

UNIVERSITY OF GHANA - LEGON



College of Basic and Applied Sciences (CBAS)  
Institute for Environment and Sanitation Studies (IESS)  
Legon - Accra

**An Annotated Bibliography on the Ecosystem Approaches in Africa  
(2015 – 2018)**

2018

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(2015 – 2018)**

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## INTRODUCTION

Climate change has become a recurrent issue in our daily life. Unfortunately, the process of its mitigation has not matched the speed with which it has developed. Torrential rains, landslides, floods and droughts among other extreme climate events are perceived more frequently in places where they had not been seen for many years, in the local, regional and global spheres. Due to population increase and the degradation of natural ecosystems, this situation has become more dramatic, jeopardizing people's lives, cities' infrastructure and the environment's capacity for resilience. A point has been reached at which it is necessary to adapt to the negative effects of climate change.

Ecosystem-based Adaptation (EbA) appears as a possibility which brings together adaptation to climate change and management of natural areas. Ecosystem-based Approaches to climate change adaptation (EbA) also known as ecosystem based adaptation constitute a promising option for sustainable and efficient adaptation to climate change. EbA is “*the use of biodiversity and ecosystem services to help people adapt to the adverse effects of climate change.*” Ecosystem- based adaptation uses sustainable management, conservation, and restoration of ecosystems to provide services that enable people to adapt to the impacts of climate variability or change. The approach contributes to reducing vulnerability and increasing resilience to both climate and non-climate risks and provides multiple benefits to society and the environment. Ecosystems and their fundamental role in protecting the environment and populations was the starting point for seeking approaches based on local ecosystems in order to generate mechanisms for adaptation to climate change. Application of the ecosystem approach will help attain the objectives of the Convention for Biological Diversity.

This annotated bibliography is designed to give students and researchers a comprehensive overview of publications regarding the ecosystem approach. The bibliography spans cover the four-year period, from 2015 to 2018 on research articles, papers, books and reports that discuss ecosystem approach. This work summarizes 700 articles, papers, books and reports on topics ranging from general ecosystem theory, implementation and its application. It goes to support the efforts of several UNEP COP 9 decisions, i.e.:

- Global assessments suggest that the ecosystem approach is not being applied systematically to reduce the rate of biodiversity loss, but there are many examples of successful application at the regional, national and local scales which should be widely promoted and communicated. Most of these examples can be considered as positive outcomes for both biodiversity and human well-being;
- There is experience with application, at the local level, but the ecosystem approach needs to be applied much more broadly across all levels, with active participation of all relevant sectors and stakeholders. The need now is to enhance access and awareness with the transmission of straight forward messages using practical tools;
- The full application of the approach in all its ecological, social, economic, cultural and political dimensions remains a formidable task, particularly at the larger scale. There is a clear need to communicate and illustrate it more clearly in order to expedite broader application.

- There is a need for promoters and leaders for the application of the ecosystem approach that can promote wider application through demonstration of the benefits of doing so amongst their peers and at their level of operation.

This work provides for different audiences such as; researchers in academic institutions, environmentally informed public, people in international development, government environmental management agencies, non-governmental organizations and other policy makers with substantial knowledge on ecosystem approach. This work seeks to broaden the foundation and expand application of the ecosystem approach moving from research into practice. It is hoped that it will assist in filling a gap in the information available for capacity building.

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## YEAR 2015

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1	Africa	A Montpellier panel report (2015). The farms of change; African smallholders responding to an uncertain climate future. <i>Montpellier Panel</i> .	Africa is already battling against the impacts of climate change and smallholder farmers are amongst the most vulnerable. Rising temperatures signal more extreme weather events that will put lives and livelihoods at greater risk, increasing smallholders' vulnerability to drought, famine and disease. Mean temperatures in Africa will rise faster than the global average, exceed 2°C and may reach as high as 3°C to 6°C greater than 20th century levels. Agricultural losses in Africa will amount to 2% to 7% of GDP by 2100.1 Climate change affects not only yields, but also food quality and safety, and the reliability of its delivery to consumers. By 2050, hunger and child malnutrition could increase by as much as 20% as a result of climate change, reversing the gains achieved through the Millennium Development Goal (MDG) process whilst jeopardising the success of the Sustainable Development Goals (SDGs). Given the importance of agriculture as a revenue earner and as the biggest employer in most African countries, the livelihoods of millions are at stake. Achieving the United Nations Framework Convention on Climate Change (UNFCCC) goal of limiting average global temperature rise to 2°C will be hard without leveraging the potential of the agriculture sector, both in the developed and developing world. Unlocking Africa's agriculture sector in a way that captures the synergies between adaptation and mitigation and identifies and reduces trade-offs can contribute to poverty reduction and economic growth. To achieve this, adaptation efforts need to be supported through new technologies, increased financial investments, and effective institutions and regulation.
2	Sudan	Abdelmalik, M. A., El Wakeel, A. S., Ali-Babiker, I. A., & El-Hag, F. M. (2015). Agro-pastoralists' Perceptions on the Impact of Climate Change on Browse Trees and Shrubs Cover in the	A study was conducted with the objectives of assessing farmers' perceptions on climate change impact on browse trees/shrubs cover and monitoring their distribution in relation to climate change in the Butana region. A total of 150 male and female farmers from 14 villages in the central, western and southern parts of Butana region were interviewed

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		Butana Region, Sudan. <i>Sudan Academy of Sciences Journal</i> , 15, 15-23.	using a structured questionnaire. All data collected were statistically analyzed using the Statistical Package for Several Sciences software program (SPSS Ver. 20.0) and Chi-square test for mean separation. The deterioration in the quantity and quality of trees/shrubs cover was mainly attributed to the decrease in rainfall, in addition to over grazing, expansion in rainfed agriculture and tree cutting for charcoal making. This was evidenced by the disappearance of many tree species from the region such as <i>Commiphora africana</i> (Gufal), <i>Terminalia brownie</i> (Soubagh) and <i>Faidherbia albida</i> (Haraz). The trees and shrubs were mainly reported by the respondent farmers as sources for livestock browsing and firewood. New tree species such as <i>Acacia oerfota</i> (Laoat) were mentioned to have invaded the region especially the central part. <i>Acacia mellifera</i> (Kitir) followed by <i>Acacia tortilis</i> subsp. <i>raddiana</i> (Seyal) were stated as the most preferred browse trees for camels and goats, especially in the dry season
3		Abidoye, B. O., & Odusola, A. F. (2015). Climate change and economic growth in Africa: an econometric analysis. <i>Journal of African Economies</i> , 24(2), 277-301.	The economic landscape of most African countries depends essentially on the dynamics of climate change. Key sectors driving their economic performance and livelihoods such as agriculture, forestry, energy, tourism, coastal and water resources are highly vulnerable to climate change. This article examines the empirical linkage between economic growth and climate change in Africa. Using annual data for 34 countries from 1961 to 2009, we find a negative impact of climate change on economic growth. Our results show that a 1°C increase in temperature reduces gross domestic product (GDP) growth by 0.67 percentage point. Evidence from sensitivity analysis shows the two largest economies in the Sub-Saharan Africa (Nigeria and South Africa) play a significant role in ameliorating the negative economic impact of climate change in the region. In addition to impact on Africa, this article provides estimates of the impact of climate change on GDP growth of these 34 countries, which can be valuable in appraising national adaptation plans. We do not find evidence that average long-run temperature changes affect long-run economic growth as measured by 5-year averages.



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4	Ethiopia	Abiy, G., Getahun, Y., & Genene, M. (2015). Assessment of farmers' perception and adaptation mechanism to soil erosion problem in Shomba Kichib. Gimbo District, Kaffa Zone, South West Ethiopia. <i>Journal of Agricultural Research</i> , 10(24 )2608-2616	Soil erosion is one of the major problems challenging farmers in Ethiopia. Though a number of soil and water conservation methods were introduced and practiced, sustaining the application of these measures is far below expectations and soil degradation is still a persistent problem. This research was conducted with the aim of finding out the type of indigenous and introduced soil and water conservation measures, determining the farmer's adaptation mechanism to erosion and biophysical factors that influence the use of these measures in the area. For this study, a total of 35 households were interviewed and farm fields were visited. The results showed that farmers in the area were mainly annual crop producers on slope farmland with traditional as well as newly introduced conservation structures. Contour farming for maize and furrow making, gulgualo and gilalo methods for millet and pepper production are the common ones. Continuous farming, tillage on slope land with no conservation structures, deforestation and frequent tillage up to 5 times for some crops are important factors aggravating soil erosion. As a recommendation, the very sloppy nature of the study area has to be given due emphasis and priority for an appropriate designed soil and water conservation practice.
5	Eastern Africa	Adhikari, U., Nejadhashemi, A. P., & Woznicki, S. A. (2015). Climate change and eastern Africa: a review of impact on major crops. <i>Food and Energy Security</i> , 4(2), 110-132.	Global warming has become one of the major challenges in maintaining global food security. This paper reviews the impacts of climate change on fourteen strategic crops for eight sub-Saharan Africa countries. Climate change is projected to increase median temperature by 1.4–5.5°C and median precipitation by –2% to 20% by the end of the 21st century. However, large levels of uncertainty exist with temporal and spatial variability of rainfall events. The impact of climate change on crop yields in the region is largely negative. Among the grain crops, wheat is reported as the most vulnerable crop, for which up to 72% of the current yield is projected to decline. For other grain crops, such as maize, rice and soybean, up to 45% yield reductions are expected by the end of this century. Two grain crops, millet and sorghum, are more resilient to climate change for which projected impacts on crop yields are <20%. Root

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			crops, such as sweet potato, potato and cassava are projected to be less affected than the grain crops with changes to crop yields ranging from about –15% to 10%. For the two major export crops, tea and coffee, up to 40% yield loss is expected due to the reduction in suitable areas caused by temperature increase. Similar loss of suitable areas is also expected for banana and sugarcane production; however, this reduction is due to rainfall variability in lowland areas. Other crops such as cotton and sugarcane are projected to be more susceptible to precipitation variation that will vary significantly in the region. In order to mitigate the long-term impacts of climate change on agricultural sectors, the development of small-scale irrigation systems and water harvesting structures seems promising, however, affordability of such measures remains a key issue.
6	South African	Adolphsen, P. (2015). <i>Encountering "Agaat": Toward a Dramaturgical Method of Adaptation</i> . Masters Theses. 178. <a href="https://scholarworks.umass.edu/masters_theses_2/178">https://scholarworks.umass.edu/masters_theses_2/178</a>	This M.F.A. thesis in dramaturgy presents the first-ever stage adaptation of South African writer Marlene van Niekerk's 2004 novel <i>Agaat</i> . Van Niekerk is an internationally acclaimed novelist, short story writer, poet, and dramatist particularly known for her lengthy novelistic excavations of Afrikaner identity, in which sexuality, race, and gender collide in compelling but fraught ways. Covering nearly fifty-years of South African history—from the establishment of apartheid in 1948 through the nation's transition to democracy in 1994— <i>Agaat</i> investigates everyday cycles of abuse and intimacy through the story of white farmer Milla de Wet and her coloured adopted daughter-cum-maid, <i>Agaat</i> Lourier. This thesis foregrounds the interconnections between theory and practice by presenting both the adaptation itself and a prolonged engagement with theories of adaptation and dramaturgy. It is framed, then, around a simple question: How might dramaturgy and adaptation, as cultural and artistic processes and products, encounter one another? Through analysis of current discussions in the fields of Adaptation Studies and dramaturgy, and reflections on the challenges and possibilities of adapting van Niekerk's novel to the stage, the thesis argues that adaption can be understood as a mode of encounter that opens up spaces for connection

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			between people, texts, and cultures. A dramaturgical method of adaptation is concerned not with hierarchy, authority, and fidelity, but rather with viewing adaptation as a conversation between a network of resonances. The thesis begins with an overview of van Niekerk's work and context, moves to an examination of current conversations in Adaptation Studies and dramaturgy, and concludes with a prolonged reflection on the process of adapting <i>Agaat</i> to the stage.
7	Ghana	Adu-Boateng, A. (2015). Barriers to climate change policy responses for urban areas: A study of Tamale Metropolitan Assembly, Ghana. <i>Current Opinion in Environmental Sustainability</i> , 13, 49-57.	Climate change has emerged as an urgent issue around which both ideas of development and practice are crystallising both in the North and South. However, in this discourse the concern with climate change seems not to dwell much on seeking a better understanding of the barriers to climate change policy responses in different contexts. This paper explores the extent to which climate change ideas are received and converted into policy and programmes by local governments, with reference to Tamale Metropolitan Assembly in Ghana. This study highlights that limited perception of development co-benefits, and the tensions in negotiating national directives and local priorities constrain policy responses to climate change.
8	Africa	African Development Bank. (2015). The African Development Bank at the UNFCCC COP21 meeting — Africa's climate opportunity: Adapting and thriving.	Africa has vast potential in renewable energy. With the right vision, investments and political commitments, it can help lead a global energy revolution, leapfrogging to renewable technologies and improving lives through cleaner, safer energy for household use. Africa must also accelerate its efforts to provide energy for the 645 million people without electricity and the 700 million people without access to clean cooking energy. There is also potential for virtuous circles in agriculture and urban development. Climate smart development could drive major increases in Africa's agricultural output. Africa's rapidly growing cities can become powerhouses for sustainable development, while delivering better living standards for their inhabitants. For our part, the African Development Bank is committed to working closely with African countries to support their adaptation and transition towards green growth. We will lead a major

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			push to deliver cleaner, more affordable energy for all Africans by 2025. We will integrate climate-smart development across our portfolio. And we will continue to use our expertise to leverage climate finance for Africa and help African countries speak with a common voice in the international policy arena.
9	Africa	Akinagbe, O.M & Irohibe, I. J. (2015). Agricultural adaptation strategies to climate change impacts in Africa: a review. <i>Bangladesh Journal of Agricultural Research</i> , 39(3): 407-418.	Climate change is expected to intensify existing problems and create new combinations of risks, particularly in Africa. The situation is made worst due to factor such as widespread poverty, over dependence on rain fed agriculture, inequitable land distribution, limited access to capital and technology, inadequate public infrastructure, such as roads, long term weather forecasts and inadequate research and extension. By lessening the severity of key damages to the agricultural sector, adaptation is the key defensive measure. Adaptation to climate change involves changes in agricultural management practices in response to changes in climate conditions. This paper reviews agricultural adaptation strategies employed by farmers in various countries in Africa in cushioning the effects of climate change. The common agricultural adaptation strategies used by farmers were the use of drought resistant varieties of crops, crop diversification, changes in cropping pattern and calendar of planting, conserving soil moisture through appropriate tillage methods, improving irrigation efficiency, and afforestation and agro-forestry. The paper concluded that improving and strengthening human capital through education, outreach programmes, extension services at all levels will improve capacity to adapt to climate change impact.
10	Sub-Saharan Africa	Alemaw, B.F.& Simalenga, T. (2015) Climate Change Impacts and Adaptation in Rainfed Farming Systems: A Modeling Framework for Scaling-Out Climate Smart Agriculture in Sub-Saharan Africa. <i>American Journal of Climate Change</i> , 4, 313-329.	Improving agricultural water productivity, under rainfed or irrigated conditions, holds significant scope for addressing climate change vulnerability. It also offers adaptation capacity needs as well as water and food security in the southern African region. In this study, evidence for climate change impacts and adaptation strategies in rainfed agricultural systems is explored through modeling predictions of crop yield, soil moisture and excess water for potential harvesting. The study specifically

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			presents the results of climate change impacts under rainfed conditions for maize, sorghum and sunflower using soil-water-crop model simulations, integrated based on daily inputs of rainfall and evapotranspiration disaggregated from GCM scenarios. The research targets a vast farming region dominated by heavy clay soils where rainfed agriculture is a dominant practice. The potential for improving soil water productivity and improved water harvesting have been explored as ways of climate change mitigation and adaptation measures. This can be utilized to explore and design appropriate conservation agriculture and adaptation practices in similar agro-ecological environments and create opportunities for outscaling for much wider areas. The results of this study can suggest the need for possible policy refinements towards reducing vulnerability and adaptation to climate change in rainfed farming systems.
11	Cameroon	Amawa, S. G., Jude, N. K., Tata, E. S., & Azieh, E. A. (2015). The implications of climate variability on market gardening in Santa sub-division, North West Region of Cameroon. <i>Environmental and Natural Resource Research</i> , 5(2), 56-65.	Using climatic records temperature and rainfall for a 10-year period, including the output of market gardening crops (carrots, leeks, tomatoes and cabbage), complemented by field observations and the interview of 50 farmers, we established a correlation between climatic variations and variations in market gardening. Specifically, the coefficient of variation (CV) was used to establish climatic variability and trends over a 10-year period, while the Pearson's Product-Moment Correlation Coefficient was used to show the relationship between climate variability and market gardening crop production. The results showed both direct and inverse relationships between climate variability and market gardening resulting in differential implications for market gardeners. The implication derived from this result is that in the future, market gardeners could logically shift their focus to some specific crops; this could reduce the output of these crops leaving a bearing on demand and price. As a logical way forward, we suggest some adaptation options which can help farmers to "climate – proof" the market gardening sector which remains a source of livelihood for many farmers in Santa Sub-Division.

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12	Euro - Mediterranean	Anav, A., & Mariotti, A. (2015). Sensitivity of natural vegetation to climate change in the Euro-Mediterranean area. <i>Climate Research</i> , 46(3), 277-292.	The study explores the sensitivity to future climate change of natural vegetation patterns in the Euro-Mediterranean area under the IPCC-A1B emission scenario, using a dynamic vegetation model forced by fully coupled high resolution regional ocean–atmosphere model simulations. Our results indicate that a future warmer climate could not only affect the regional terrestrial carbon cycle, but also significantly impact vegetation dynamics. Specifically, by 2021–2050, temperate deciduous vegetation is projected to replace boreal and grass vegetation in parts of northeastern Europe, while in North Africa, simulations show a progressive desertification. The changes in dominant vegetation are mainly related to the increased drought stress on vegetation and the enhanced fire frequency. As for the carbon cycle, large increases in net primary production (NPP) are found in northern Europe resulting from higher temperature and precipitation, as well as higher atmospheric CO2 levels. In contrast, smaller NPP increases are found in the Mediterranean region, where reduced precipitation and increased temperature leads to an increase in drought years and, hence, water stress for vegetation
13	Zambia	Arslan, A., McCarthy, N., Lipper, L., Asfaw, S., Cattaneo, A., & Kokwe, M. (2015). Climate smart agriculture? Assessing the adaptation implications in Zambia. <i>Journal of Agricultural Economics</i> , 66(3), 753-780.	The study examines a set of potentially climate smart agricultural practices, including reduced tillage, crop rotation and legume intercropping, combined with the use of improved seeds and inorganic fertiliser, for their effects on maize yields in Zambia. We use panel data from the Rural Incomes and Livelihoods Surveys merged with a novel set of climatic variables based on geo-referenced historical rainfall and temperature data to explore the changing effects of these practices with climatic conditions. We estimate the impacts on maize yields, and on the exhibition of very low yields and yield shortfalls from average levels, as indicators of resilience, while controlling for household characteristics. We find that minimum soil disturbance and crop rotation have no significant impact on these yield outcomes, but that legume intercropping significantly increases yields and reduces the probability of low yields even under critical weather stress during the growing season. We also find

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			that the average positive impacts of modern input use (seeds and fertilisers) are significantly conditioned by climatic variables. Timely access to fertiliser emerges as one of the most robust determinants of yields and their resilience. These results have policy implications for targeted interventions to improve the productivity and the resilience of smallholder agriculture in Zambia in the face of climate change.
14	Zambia	Arslan, A., McCarthy, N., Lipper, L., Asfaw, S., Cattaneo, A., & Kokwe, M. (2015). <i>Food security and adaptation impacts of potential climate smart agricultural practices in Zambia</i> . Agricultural Development Economics Division. Retrieved from <a href="http://www.fao.org/3/a-i4305e.pdf">http://www.fao.org/3/a-i4305e.pdf</a>	This paper analyzes how a set of widely promoted agricultural practices, including reduced tillage, crop rotations, legume intercropping as well as the use of modern inputs, affect crop yields and their resilience (i.e. probability of disastrously low yields) in Zambia using panel data from the Rural Incomes and Livelihoods Surveys (RILS). The RILS data are merged with a novel set of climatic variables based on geo-referenced historical rainfall and temperature data to understand whether and how the effects of the practices analyzed here change with climatic conditions. We estimate the impacts on the level of maize yields and the probability of very low yields controlling for time-invariant unobservable household characteristics. We find no significant impact of minimum soil disturbance, positive impact of legume intercropping and a negative impact of crop rotation on maize yields, which is off-set by a significantly positive impact under highly variable rainfall conditions. We also find that the average positive impacts of modern input use are conditioned by climatic variables, whereas that of legume intercropping is robust to shocks. Timely access to fertilizer is the most robust determinant of yields and resilience. This paper provides important insights into the interplay between food security outcomes and climatic variables, and provides policy implications for targeted interventions to improve the productivity and the resilience of smallholder agriculture in Zambia in the face of climate change
15	Ghana, Burkina Faso, Benin	Asare-Kyei, D. K., Kloos, J., & Renaud, F. G. (2015). Multi-scale participatory indicator development	The authors used a step-wise procedure to develop Indicator Reference Sheet based on conceptual risk assessment framework and combined with knowledge of local experts iteratively selected through snowball



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		approaches for climate change risk assessment in West Africa. <i>International Journal of Disaster Risk Reduction</i> , 11, 13-34.	approach. Local experts including at risk populations were constituted into technical working groups to elicit important processes shaping risks at multiple spatial scales. The results showed that more than half of the designated local level indicators and over two-third of macro scale indicators are rarely used in present risk assessments in the region. An important output of the study is the identification of locally and nationally evaluated indicator sets for assessing the risk to natural hazards.
16	Ethiopia	Asmamaw, M., Ambellu, A., & Tiku, S. (2015). Resilience of Ecosystems to climate change. <i>American Journal of Environmental Protection</i> , 4(6), 325-333.	Ethiopia is an agrarian country where agriculture is both the cause and victim to extreme climate variability like elevated temperature and precipitation fluctuation. These have resulted recurrent drought, flooding and reduction in agricultural productivity. The occurrence and spatial distribution of drought is projected to continue in the upcoming future. The effects of climate variability significantly reduced farmers' adaptive capacity while exacerbating their vulnerability to further weather events. The current trends of ecosystem degradation could not be controlled only through protection of parks. Instead, it involves a large-scale and integrated approach addressing the whole land and sea-escapes. This large scale and integrated ecosystem management approach conserves biodiversity builds system resilience as well as to ensures the sustainable production of ecosystem services from which the majorities of the rural poor depend on. Resilient ecosystems have a wide range of biodiversity and ecosystem services, resist and recover from extreme events more quickly and are potential to mitigate and adapt to climate change while sustaining livelihoods. Thus, ecosystem-based approach through adaptation and mitigation is instrumental to maintain ecosystem health so as to sustain system resilience in the face of climate change.
17	Nigeria	Atedhor, G. (2015). Agricultural Vulnerability to Climate Change. <i>Africa Journal of Food Agriculture, Nutrition and Development</i> , 15(2), 9855-9871.	In Nigeria, while the impacts of climate cut across diverse sectors, agriculture remains the most susceptible due to the predominance of rain fed agriculture. This paper examines agricultural vulnerability to climate change in eight selected rural settlements in Sokoto State, Nigeria adopting the integrated approach which combines environmental and



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			socio-economic determinants. Monthly rainfall, rain days and temperatures (minimum and maximum) data for Sokoto (1951-2010) were sourced from the archives of the Nigerian Meteorological Agency, Lagos. The annual rainfall, total of rain days and mean temperature were computed and used for the trend's analyses of the climatic variables while the annual drought intensities for Sokoto synoptic weather station were computed from the annual rainfall data. Data on the environmental and socio-economic determinants of agricultural vulnerability to climate change were collected from 234 selected farmers using structured questionnaire. Multiple linear regression was used to examine the relationship between the agricultural vulnerability of the sampled farmers and the determinants. Stepwise regression was used to resolve the issue of multi-collinearity in the independent variables and consequently enhance the strength of the model. Results show that while there were downward trends of annual rainfall and rain days in Sokoto, annual mean temperatures show upward trend. Annual droughts were of slight and moderate intensities during the period under review. The results also revealed that unreliable rainfall, desertification, increasing temperatures, scarcity of pastures and inaccessibility to credit facilities accounted for 86% of the variation of agricultural vulnerability to climate change in the selected settlements in Sokoto State. The paper concludes that the determinants of agricultural vulnerability to climate change in the selected settlements in Sokoto State connote environmental and socio-economical stressors. The paper, therefore, recommends development of irrigation projects and planned grazing as well as provision of soft and accessible loan facilities to local farmers on a sustainable basis.
18	Ethiopia	Ayal, D. Y., Desta, S., Gebru, G., Kinyangi, J., Recha, J., & Radeny, M. (2015). Opportunities and challenges of indigenous biotic weather forecasting	The study shows the extent how public confidence in the accuracy of indigenous weather forecasting skills has been gradually eroded overtime due to faulty forecasts. The precision and credibility of the traditional weather forecast steadily declined and led to repeated faulty predictions. Poor documentation, oral based knowledge transfer system, influence of

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		among the Borena herders of southern Ethiopia. <i>SpringerPlus</i> , 4(1), 617.	religion and modern education, aging and extinction of traditional experts were identified as the major causes undermining the vitality of traditional climate forecast. Traditional weather forecasting knowledge and skill could have some utility and also serve as a starting point to scientifically study the relationship between various signs and implied climatic events. This article recommends before traditional Borana weather forecasting system completely disappears, a remedial action should be carried out to rescue this long-established wisdom, knowledge and skill and maximize the benefits from what works well. The forecast needs of herders could be rendered by a combination of modern and traditional weather forecasting services. Further research is required to explore possible area of complementarity between the modern and traditional forecasting systems for improved efficiency and effectiveness in predictability, dissemination and advice.
19	Ghana	Badmos, B. K., Villamor, G. B., Agodzo, S. K., & Odai, S. N. (2015). <i>Heterogeneous farm household perception about climate change: a case study of semi-arid region of Ghana</i> . Masters Theses. Kwame Nkrumah University of Science and Technology, Kumasi.	Climate change is a serious challenge for the future development of Africa, particularly the drier regions. Knowledge and awareness about climatic patterns are important for adaptation planning. Although there are many studies on farmers' perceptions about climate change, the views of heterogeneous farm households also need to be addressed. This paper investigates the variations and similarities in the views of heterogeneous farm households about climate change. We employed a household survey (186) and interviews for data collection. Using principal component analysis and K-mean cluster analysis, we identified two household types that differ in terms of assets (human, natural and financial) and we compared their perceptions about climate change. Household-1 farmers are better off than household- 2 in terms of land area cultivated and income generated from rain fed rice. On the other hand, household-2 farmers are better off than household-1 in terms of area cultivated for maize and income generated from maize. In addition, household-2 farmers are better off than household-1 in terms of land area cultivated and income generated from irrigated rice. The findings from this study show that the two

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			household types shared similar views with respect to rainfall and temperature patterns, as well as in the ranking of climate change drivers. However, variation was observed in the perceptions of the household types of adaptation constraints. More household-1 farmers (60%) compared to household-2 (43%) saw access to dry season farmland as a barrier for adaptation. This may be due to the fact that household-2 farmers are better off with respect to irrigated farming. Heterogeneous household perceptions about climate change reveal similarities, but differences still exist in some aspects. From a similar environment, we can see that farm household heterogeneity shows a relationship with climate change perception. Therefore, it will be important to account for diversities within our local environments when planning for climate change adaptation.
20	Cameroon	Balgah, R. A., Buchenrieder, G., & Mbue, I. N. (2015). When nature frowns: a comprehensive impact assessment of the 2012 Babessi floods on people's livelihoods in rural Cameroon. <i>Jàmbá: Journal of Disaster Risk Studies</i> , 7(1), 1-8.	Floods are the most common natural disasters worldwide. Much of the growing literature on the impact of floods, especially in developed countries, and to a lesser extent in rural areas of developing countries, concentrates on economic rather than a comprehensive assessment of combined effects on people's livelihoods. Holistic floods impact assessments are often done long after the shock, raising problems of data reliability following long recall periods, although post-disaster needs assessments when carried out earlier can facilitate appropriate disaster recovery, relief and reconstruction activities. We applied the sustainable livelihoods framework as a comprehensive approach to assess the impacts of the Babessi floods in 2012 on livelihoods in rural (north western region) of Cameroon 6 weeks after the floods. Using a structured questionnaire, data was collected from victims before and after the floods, using recall methods. A matched sample of non-victims randomly selected from the same village as the victims was used to assess vulnerability to the floods by household type. Floods were found to have serious economic, social, human and food security impacts on victims. Both government and nongovernmental support were jointly crucial for household recovery.

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			Comparatively observed high levels of recovery were attributed to the low loss of human lives. The article concludes with the need for comprehensive approaches to floods impact assessments.
21	Africa	Barnard, J., Manyire, H., Tambi, E., & Bangali, S. (2015). <i>Barriers to scaling up/out climate smart agriculture and strategies to enhance adoption in Africa</i> . Forum for Agricultural Research in Africa. Retrieved from <a href="https://faraafrica.org/wp-content/uploads/2015/10/Barriers-to-scaling-up-out-CSA-in-Africa.pdf">https://faraafrica.org/wp-content/uploads/2015/10/Barriers-to-scaling-up-out-CSA-in-Africa.pdf</a>	Many actors are promoting key agro-ecological farming technologies and practices that are highly suited to enable farmers to adapt to climate change. These include agro-forestry, crop rotation, intercropping, minimum tillage, soil cover maintenance, residue retention, water conservation, rice systems that reduce methane emissions, improved management of livestock and soil carbon as well as breeding plants and animals adapted for future climate conditions. These practices have been documented to generate higher and more stable crop yields and incomes and enhance resilience to climate change in some countries compared to conventional agricultural production methods. Although these practices are not necessarily new, when used in the context of climatic change, they have been proved to be innovative for farmers, herders and fishermen. Such practices are dubbed Climate Smart Agriculture (CSA). Wide-scale adoption of CSA practices however, remains a challenge especially amongst smallholder farmers in Africa. There are several barriers that prevent smallholder farmers in Africa from adopting CSA practices and technologies and so far, existing policies and actions to remove these barriers remain inadequate. A good understanding of what these barriers are and how they impinge on adoption of CSA practices is essential. Equally essential are actions that favour the removal of these barriers, while at the same time promote adoption of CSA practices. These barriers can be classified under two broad categories. The first relates to the physical means or resources required to practice CSA. These can be considered as the hardware barriers and include physical inputs such as land, human resources, equipment, infrastructure and finances. The second, referred to as the non-physical or software barriers, relates to the institutional, cultural, policy and regulatory environments; information, knowledge and skills; technologies and innovations; and governance

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			among others. For farmers to take up a particular CSA practice and for public and private sector individuals to invest in a given CSA practice, the barriers must be seen not to exist. An identification and critical analysis of the factors that limit adoption of CSA practices and actions that will enable policy makers to come up with concrete actions to scale up/out adoption of CSA practices in Africa is what this report has addressed. This report has also outlined policy recommendations to promote the adoption of CSA practices in Africa.
22	Southern Africa	Bauer, S., & Scholz, I. (2015). Adaptation to climate change in Southern Africa: New boundaries for development. Retrieved from <a href="https://faraafrica.org/wp-content/uploads/2015/10/Barriers-to-scaling-up-out-CSA-in-Africa.pdf">https://faraafrica.org/wp-content/uploads/2015/10/Barriers-to-scaling-up-out-CSA-in-Africa.pdf</a>	Adverse climate impacts are already evident across Southern Africa and pose a serious threat to the development prospects of the region's societies. Sustainable development in this region will depend on the rapid development and implementation of effective adaptation measures. This volume identifies the new socioeconomic and political boundaries to development that result from ongoing climate change in Southern Africa. The collected papers explore the region's potential for a transition to development strategies that combine meaningful socioeconomic investment and adaptation measures while also improving livelihoods in the region. The chapters are backed up by detailed case studies which underscore the urgent need for national governments and multilateral agencies to develop strategies to support Southern Africa's societies in adapting to climate change.
23	Ethiopia	Belachew, O., & Zuberi, M. I. (2015). Perception of climate change and livelihood of a farming community of Maruf Kebele, Central Oromia, Ethiopia. <i>American Journal of Climate Change</i> , 4(03), 269.	The farmers' perception of climate change and their response was documented in Maruf Kebele of Central Oromia, Ethiopia with questionnaire survey, focus group discussion and field observation. Over hundred randomly selected households were included; the community typically includes a large proportion of small holder farmers from poorly equipped, land scarce households with low education and economic status. The results indicated that farmers had a good understanding and perception of the impacts of climate change at the local level; many negative impacts of the climate irregularity had been identified by the community, like reduced crop yield, heating/drying up of environment and

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			soil loss affecting natural plant regeneration from the forest soil seed bank, drying up of streams and springs, disappearance of trees and plants, rarity of wild animals and increasing pests/diseases. Farmers were observed to diversify their livelihood options as part of responding to irregularities in the local weather and adopting a number of steps to change agricultural practices. The results indicate the importance of understanding of community perception in designing policies and projects for effective adaptation strategies allowing local participation to cope with the impacts of climate change.
24	Congo	Bele, M.Y., Sonwa, D.J., Tiani, A.M. (2015). Adapting the Congo Basin forests management to climate change: linkages among biodiversity, forest loss, and human well-being. <i>Forest Policy and Economics</i> 50: 1-10	Tropical forests are at the center of any global debate on climate change and sustainable forest management because of their twin roles in climate change adaptation and mitigation and for resilient development. However, in the countries of the Congo Basin forests receive very little attention in national planning and policies. Climate change is not currently considered in decisions and long-term forest management plans in these countries. This paper demonstrates that: (1) Congo Basin forests are needed for adaptation because they can help to decrease human vulnerability to climate change; and (2) Congo Basin forest management practices need to be adapted to accommodate climate change because these forests are vulnerable to climate change. A framework for facilitating adaptation in forestry is discussed and a review of adaptive actions presented. The paper recommends the adoption of sustainable forest management approach that includes a climate change focus. Such management should not only avoid any adverse effects on the forest resources and conservation of biodiversity, but also provides opportunities for greater, more sustainable rural development and poverty alleviation through income generation and employment opportunities.
25	Ethiopia	Belete, G. A. (2015). <i>Evaluating the sustainability of communal land rehabilitation practices as a disaster risk reduction strategy and adaptation</i>	The study examined relevance and appropriateness of conservation measures and identified factors affecting sustainability of biophysical soil and water conservation on communal land. Findings show that population growth is high and crop production is the major source of income for all

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		<i>measures to climate change: a case study from Legambo District, Northern Ethiopia</i> . Masters' Thesis, University of South Africa.	households in the study area. Droughts, floods, crop diseases and frost are hazards that frequently occur in the area. Low community participation, poor planning and unclear objectives and use rights, weak enforcement of by-laws and lack of maintenance of structures are the major challenges. Integrating family planning, enhancing participation of women, clarifying responsibilities and benefit sharing arrangements, enforcement of rules and building capacity are suggested to improve effectiveness and sustainability of conservation measures
26	Tanzania	Bell, P., Kimaro, D., & Lal, R. (2015). Agricultural drought analysis for sustainable smallholder maize production in semi-arid areas: a case study of the Lower Moshi Irrigation Scheme, Tanzania. <i>Tanzania Journal of Agricultural Sciences</i> , 14(1).	Rainfed maize ( <i>Zea mays</i> ) in semi-arid Sub-Saharan Africa is subject to many climate-related risks—including agricultural dry spells and droughts. Effectively selecting appropriate agricultural water management strategies must first begin with evaluation of the potential climate-related risks. This article evaluates dry spell occurrence in the Mabogini Village—located within a semi-arid area in Tanzania—using a water balance approach with nineteen years of historical daily precipitation data. The water balance equation was related to crop water requirements to evaluate both the prevalence of agricultural dry spells as well as estimate the water deficits throughout the same time period. Only four of the nineteen seasons did not experience a dry spell of at least five consecutive days. 37% of the seasons had at least one dry spell of 6-10 days while 63% had at least one dry spell of greater than 15 days. Soil water deficit in relation to crop production ranged from 0-140 mm. This study concludes that dry spells lasting greater than 15 days throughout 63% of the past 19 growing seasons represent a high risk to smallholder farmers in the area. The high prevalence of long dry spells suggests that rainfed maize production is not sustainable in the region without interventions. However, relatively small water deficits suggest that proper water capture, storage, and supplemental irrigation methods could help to bridge the gap between dry spells. It is therefore recommended that water



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			management practices be put in place immediately to support productive and sustainable maize production in the area.
27	Tanzania	Below, T. B., Schmid, J. C., & Sieber, S. (2015). Farmers' knowledge and perception of climatic risks and options for climate change adaptation: a case study from two Tanzanian villages. <i>Regional environmental change</i> , 15(7), 1169-1180.	This study analyzes the agricultural adaptation context in two Tanzanian villages building on a newly developed agricultural adaptation and perception model (AAP). The AAP contains five dimensions as a frame of reference for empirical adaptation models: non-climatic determinants of vulnerability (1), general trends in livelihood strategies (2), perception of climatic trends (3), climate impacts in agriculture (4) and potentials and obstacles for adaptation (5). Empirical data were collected by applying various tools of rapid rural appraisal, a stakeholder workshop and supplementary interviews. The qualitative data were coded along the dimensions of the AAP and analyzed by means of qualitative content analysis. The results show that adaptation levels, sensitivities of the farming systems as well as perception and narratives about climatic and yield dynamics differ considerably among the two farming communities. Furthermore, farmers' adaptation responses are influenced by both their framing of climatic trends as well as the multiple benefits that the local agricultural systems provide. Thus, for improving food security in the face of climate change, farmers' perceptions and the multi-functionality of agricultural systems need to be explicitly recognized by agronomic adaptation research, and adaptation policy making should involve detailed vulnerability assessments.
28	Rwanda	Bendito, A., & Twomlow, S. (2015). Promoting climate smart approaches to post-harvest challenges in Rwanda. <i>International journal of agricultural sustainability</i> , 13(3), 222-239.	In this study, a review of the current status of post-harvest structures in Rwanda is done and basic design guidelines for greater adaptation to emerging environmental and climate change challenges were suggested. According to the authors, the recognition of the value of local expertise and experience in judging the expected behaviour and degrees of vulnerability of post-harvest facilities to environmental threats demanded a systematic knowledge sharing approach. The authors mentioned that their study may serve as a reference to be repeated in other countries, especially in Africa, where the economic



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			growth is increasing and where there is a growing need for improved rural structures. The study concluded that, In order to save the existing and future post-harvest facilities from impacts related to floods, droughts, high temperatures and other weather-related disasters due to climate change and from earthquakes, a holistic approach is called for consisting of creation of public awareness, education and training, research and development about safety from natural hazards
29	Uganda	Berman, R. J., Quinn, C. H., & Paavola, J. (2015). Identifying drivers of household coping strategies to multiple climatic hazards in Western Uganda: implications for adapting to future climate change. <i>Climate and Development</i> , 7(1), 71-84.	This paper investigates what drives household coping strategies in rural Uganda under different climatic hazards. Rural households in sub-Saharan Africa draw on various coping strategies to reduce the impact of climatic hazards on their livelihoods. Research to date provides only limited understanding of how the coping strategy portfolio of household's changes depending on the climatic stress. Using empirical data from Uganda, this research contributes to this gap by (1) exploring how household coping strategy relates to household characteristics and livelihood activity and (2) how these coping strategies vary depending on the hazard. Coping strategy is found to be hazard specific for households that lack market-orientated activities, whereas those with market access rely on economic activities regardless of hazard. To maintain and improve the livelihoods and coping strategies of those most vulnerable to climatic variability and This paper investigates what drives household coping strategies in rural Uganda under different climatic hazards. Rural households in sub-Saharan Africa draw on various coping strategies to reduce the impact of climatic hazards on their livelihoods. Research to date provides only limited understanding of how the coping strategy portfolio of household's changes depending on the climatic stress. Using empirical data from Uganda, this research contributes to this gap by (1) exploring how household coping strategy relates to household characteristics and livelihood activity and (2) how these coping strategies vary depending on the hazard. Coping strategy is found to be hazard specific for households that lack market-orientated activities, whereas

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			those with market access rely on economic activities regardless of hazard. To maintain and improve the livelihoods and coping strategies of those most vulnerable to climatic variability and change, policies that advocate diversification away from a sole reliance on customary activities need to recognize the level and opportunity for market-based activities. These interventions must account for different sensitivities to different hazards as well as the homogeneity of the community in order to effectively support rural communities to cope with climate variability.
30	Ethiopia	Beyene, F. (2015). Determinants of food security under changing land-use systems among pastoral and agro-pastoral households in eastern Ethiopia. <i>Environment, development and sustainability</i> , 17(5), 1163-1182.	A number of previous studies have emphasized the determinants of land-use change, as well as the management of communal lands in the pastoral systems, without assessing the effects of such changes on pastoralists/agro-pastoralists' food security. Therefore, the objective of this paper was to assess the determinants of food security under changing land use and land management systems—from communal to private investment—using household survey data collected from pastoral and agro-pastoral communities. The data were analyzed using ordinary least-square econometric analysis. The results showed that having sufficient land for crop farming, competition over land for private use, number of plots, use of improved seeds, access to infrastructure, and distance from main markets have a negative impact on food security. However, conflict with neighbors and use of crop residue as livestock feed have a positive impact on food security; impacts were also shown to affect geographically distributed pastoral and agro-pastoral communities differently. There are a number of constraints associated with such land-use changes in order to improve land productivity on privately held land, including unstable market prices, reducing the benefits from irrigated farming, moisture stress where pastoral land classified as arable suffers from water unavailability and expansion of gullies resulting in abandonment of farmland. In conclusion, land conversion to encourage pastoralists to take up sedentary farming to ensure food security will only accelerate rangeland degradation. Therefore, it is imperative that investment in land

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			management be complemented with other interventions, which can thereby increase land productivity, for example, adoption of drought tolerant crops, water harvesting, enhancing pastoralists/agro-pastoralists' technical knowledge and improved marketing infrastructure.
31	South Africa	Biggs, R., Rhode, C., Archibald, S., Kunene, L. M., Mutanga, S. S., Nkuna, N., ... & Phadima, L. J. (2015). Strategies for managing complex social-ecological systems in the face of uncertainty: examples from South Africa and beyond. <i>Ecology and Society</i> , 20(1), 52.	Improving our ability to manage complex, rapidly changing social-ecological systems is one of the defining challenges of the 21st century. This is particularly crucial if large-scale poverty alleviation is to be secured without undermining the capacity of the environment to support future generations. To address this challenge, strategies that enable judicious management of socialecological systems in the face of substantive uncertainty are needed. Several such strategies are emerging from the developing body of work on complexity and resilience. We identify and discuss four strategies, providing practical examples of how each strategy has been applied in innovative ways to manage turbulent social-ecological change in South Africa and the broader region: (1) employ adaptive management or comanagement, (2) engage and integrate different perspectives, (3) facilitate self-organization, and (4) set safe boundaries to avoid system thresholds. Through these examples we aim to contribute a basis for further theoretical development, new teaching examples, and inspiration for developing innovative new management strategies in other regions that can help address the considerable sustainability challenges facing society globally
32	Africa	Bizikova, L., Parry, JE., Karami, J. et al. (2015). Review of key initiatives and approaches to adaptation planning at the national level in semi-arid Change. <i>Regional Environmental Change</i> 15: 837.	Semi-arid regions of Africa and South and Central Asia are vulnerable to climate change and they display considerable adaptation needs. This review paper looked at the priorities and goals presented in adaptation planning documents at country-level and multi-country projects supported by international agencies. They also compared the adaptation need with current trends in national, regional and global projects. In total, 101 multi-country and 201 national projects were reviewed. They found that initiative supported my international agencies played considerable role in achieving natural adaption projects. Especially in Agriculture and water

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			management. However, compared with specific adaptation options such as drought-resistant species and irrigation, they realized that there were challenges in agriculture more in the contexts of food security, livestock and rural development. The authors also found out that priorities listed in the national documents such as human health, pastoralism, security and migration, were not in initiatives implemented at the time of the review. They finally concluded that global, national and regional initiatives were not distributed equally. Central and west Africa and central Asia exhibited low participation in national projects.
33	North Africa	Bonfils, C., de Noblet-Ducoudré, N., Braconnot, P., & Joussaume, S. (2015). Hot desert albedo and climate change: Mid-Holocene monsoon in North Africa. <i>Journal of Climate</i> , 14(17), 3724-3737.	Many models in the framework of the Paleoclimate Modelling Intercomparison Project have undertaken simulations of the mid-Holocene (6 kyr ago) climate change. Analysis of the results have mainly focused on the North African summer monsoon that was enhanced 6 kyr ago, in all models, in response to the prescribed enhanced summer insolation. The magnitude of the simulated increase in total rainfall is very different, however, among the models, and so is the prescribed mean hot desert albedo, which varies from 19% to 38%. There is yet no consensus, however, on the albedo climatological values to be used by climate modelers. Using the Laboratoire de Mé'téorologie Dynamique atmospheric general circulation model, two sets of simulations, with a mean hot desert albedo of respectively 35% and 28%, have been carried out. The simulated mid-Holocene summer monsoon change in northern Africa is significantly larger when the background hot desert albedo is the lowest (i.e., 28%). The associated increased northward penetration of monsoon rains allows a greater reduction of hot desert area that is in better agreement with paleodata. The implication of such the study is rapid response to climatic events including the use of ecosystems approaches to mitigate climate effects.
34	Algeria	Boughedir, S. (2015). Case study: disaster risk management and climate change adaptation in Greater Algiers:	The study assesses the vulnerabilities of Algiers when dealing with climate change and natural disasters up to 2030 and proposes a set of recommendations to improve risk management capacities of the Wilaya

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		overview on a study assessing urban vulnerabilities to disaster risk and proposing measures for adaptation. <i>Current Opinion in Environmental Sustainability</i> , 13, 103-108.	of Algiers. The study results show actions that have been identified as a priority, given their expected benefits (compared to their costs), are essentially within the institutional and the urban planning spheres. These actions cover all types of disaster risks, are low cost and ‘no regrets’ (useful even in the absence of climate change), and reversible. The priority actions can be classified into five broad categories: (i) integrating risk management into urban planning; (ii) increasing awareness of risk issues among policy makers, professionals and inhabitants; (iii) strengthening institutional arrangements for risk management; (iv) developing risk knowledge tools and (vi) developing flood prevention infrastructures.
35	Mozambique	Broto, V. C., Boyd, E., & Ensor, J. (2015). Participatory urban planning for climate change adaptation in coastal cities: lessons from a pilot experience in Maputo, Mozambique. <i>Current opinion in environmental sustainability</i> , 13, 11-18.	This paper offers an appraisal of participatory urban planning for adaptation in practice, building upon a participatory experience in the neighbourhood of Chamanculo C, in Maputo (Mozambique) between 2011 and 2013. The paper is divided into three parts. The first section explores the concept of participation in environmental and climate change planning, with a focus on underserved areas and informal settlements in coastal cities. The second section explains our proposal for participatory urban planning in practice, following our experiences in Maputo. Finally, the third section exposes some of the challenges that emerge to deliver a rights-based process of participatory urban planning. Overall, this assessment suggests that participatory urban planning can lead to effective action for climate change adaptation but there are challenges that can only be addressed within the specific context of communities and places
36	Mozambique	Broto, V. C., Macucule, D. A., Boyd, E., Ensor, J., & Allen, C. (2015). Building collaborative partnerships for climate change action in Maputo, Mozambique. <i>Environment and Planning</i> , 47(3), 571-587.	The authors examine partnerships as a policy strategy for climate change governance in cities in the Global South. Partnerships offer the opportunity to link the actions of diverse actors operating at different scales and, thus, they may be flexible enough to deal with uncertain futures and changing development demands. However, simultaneously, partnerships may lack effectiveness in delivering action at the local level and may constitute a strategy for some actors to legitimate their objectives in spite of the interests of other partners. Engaging with the specific

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			example of urban governance in Maputo, Mozambique, the authors present an analysis of potential partnerships in this context, in relation to the actors that are willing and able to intervene to deliver climate change action. What, they ask, are the challenges to achieving common objectives in partnerships from the perspective of local residents in informal settlements? The analysis describes a changing context of climate change governance in the city, in which the prospects of access to international finance for climate change adaptation are moving institutional actors towards engaging with participatory processes at the local level. However, the analysis suggests a question about the extent to which local communities are perceived as actors with legitimate interests who can intervene in partnerships, and whether their interests are recognized.
37	Cameroon	Brown, H. C. P., & Sonwa, D. J. (2015). Rural local institutions and climate change adaptation in forest communities in Cameroon. <i>Ecology and Society</i> , 20(2).6	Surveys and interviews were used to understand community resilience in forest-dependent communities facing climate change in Cameroon. Surveys of 232 individuals showed a diversity of formal and informal institutions that relate to most aspects of rural life. Although direct activities related to climate change adaptation were limited, the activities and density of membership in rural local institutions could increase the community's adaptive capacity. Twenty-six semi structured interviews were also conducted with representatives of diverse local institutions who had some responsibility for agriculture, forests, conservation, or development. Local
38	Madagascar	Brown, K.A., Parks, K.E., Bethell, C.A., Johnson, S.E., Mulligan, M. (2015) Predicting Plant Diversity Patterns in Madagascar: Understanding the Effects of Climate and Land Cover Change in a Biodiversity Hotspot. <i>Plos one</i> 10(4): e0122721.doi:10.1371	Climate and land cover change are driving the reorganization of terrestrial biotic communities in terrestrial ecosystem. In an effort to understand how biodiversity efforts in the tropics will understand the effect and combined effect of these drivers of environmental change, this paper used species distribution model calibrated for recent climate and land cover variables and projected future scenarios to predict future change in patterns of diversity in Madagascar. The paper showed that the regional plant diversity in Madagascar will continue to decrease in response to the combined effect of climate and land cover change. The paper

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			recommended that future gains in plant diversity will depend on the development and maintenance of dispersal pathways that connect current and future suitable habits.
39	East Africa	Adhikari, U., Nejadhashemi, A. P., & Herman, M. R. (2015). A review of climate change impacts on water resources in East Africa. <i>Transactions of the ASABE</i> , 58(6), 1493-1507.	This article reviews the impacts of population growth and climate change on water resources across eight East African countries, namely, Ethiopia, Kenya, Malawi, Mozambique, Rwanda, Uganda, Tanzania, and Zambia. Total population in the region is projected to exceed 800 million by 2060 and 1,150 million by 2090, compared to 286 million in 2012. Based on per capita water availability, six of the eight countries are either already water stressed or close to it. By the end of this century, per capita water availability will drop to water scarcity level in all the countries reviewed except Mozambique. ENSO is currently a dominant force that drives the climate in the region; however, future changes in this phenomenon are not well understood. Temperature projections show a 0.9°C to 3.4°C increase by the 2060s and 1.3°C to 5.5°C increase by the 2090s. However, precipitation projections are less certain in both the direction and magnitude of change, although the projections are more inclined toward positive change. For example, findings from an ensemble of models under the A2, A1B, and B1 scenarios projected a 15% reduction to a 48% increase in precipitation by 2090 in the countries studied. Projected runoff trends are largely dependent on precipitation variability and short-term rainfall distribution, which are highly uncertain in future climate scenarios. Although climate models are uncertain, runoff is generally predicted to increase in the eastern part of the region and decrease in the southern part. Glaciers and ice covers in the region are projected to disappear in next few decades; however, the impact of this disappearance on water resources in the region is predicted to be minimal. Evaporative demand is projected to increase with the increase in temperature and may reach as much as 53%, increasing water demand and moisture stress. Groundwater resources are more resilient than surface water resources; however, there is an overall lack of knowledge on how groundwater



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			responds to climate change at the local scale. In order to mitigate the impact of climate change on water resources, water conservation and development of irrigation facilities have been recommended.
40	Africa	Cervigni, R., Liden, R., Neumann, J. E., & Strzepek, K. M. (Eds.). (2015). <i>Enhancing the climate resilience of Africa's infrastructure: the power and water sectors</i> . The World Bank.	In 2010, the Africa Infrastructure Country Diagnostic found that to enable Africa to fill its infrastructure gap, some US\$ 93 billion per year for the next decade will need to be invested. The Program for Infrastructure Development in Africa (PIDA), endorsed in 2012 by the continent's Heads of State and Government, lays out an ambitious long-term plan for closing Africa's infrastructure including through step increases in hydroelectric power generation and water storage capacity. Much of this investment will support the construction of long-lived infrastructure (e.g. dams, power stations, irrigation canals), which may be vulnerable to changes in climatic patterns, the direction and magnitude of which remain significantly uncertain. Enhancing the Climate Resilience of Africa's Infrastructure evaluates -using for the first time a single consistent methodology and the state-of-the-art climate scenarios-, the impacts of climate change on hydro-power and irrigation expansion plans in Africa's main rivers basins (Niger, Senegal, Volta, Congo, Nile, Zambezi, Orange); and outlines an approach to reduce climate risks through suitable adjustments to the planning and design process.
41	Kenya	Chesterman, S., & Neely, C. (2015). <i>Evidence and policy implications of climate-smart agriculture in Kenya</i> . Retrieved from <a href="https://cgspace.cgiar.org/handle/10568/65098">https://cgspace.cgiar.org/handle/10568/65098</a>	This technical paper details findings and outcomes from the workshop hosted by the Climate Change Unit of Ministry of Agriculture, Livestock and Fisheries of Kenya, along with the FAO, ICRAF and CCAFS. The process engaged stakeholders from research, practice and policy and to interactively share and analyze scientific evidence and field experience from over 40 projects related to climate-smart agriculture (CSA) within integrated farming systems in Kenya. A current state of knowledge on how CSA serves to simultaneously achieve Kenya's development goals and climate change targets and relevant policy linkages is presented. Overarching recommendations for out scaling CSA in Kenya consider that: integration is required at all different levels; access to productive



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			inputs and markets is essential; knowledge generation and sharing are critical for evidence based decision making; inclusiveness and contextualization promote ownership and uptake; and the importance of building synergy and addressing potential inconsistencies between policies, regulations and implementation. Lastly, evidence-based and jointly agreed upon messaging regarding CSA is presented, as a contribution to the policy dialogues of the UNFCCC (COP 20, December, Peru [1]), Paris 2015 and other international efforts and fora, including the Alliance for CSA in Africa. The key policy recommendations elaborate upon: the consideration of development priorities; connection of interdisciplinary research, practice and policy; integration of farm and landscape systems; inclusion of women and youth; connection of policy and regulations and the filling of identified knowledge gaps.
42	Africa	Cobbinah, P. B., Erdiaw-Kwasie, M. O., & Amoateng, P. (2015). Rethinking sustainable development within the framework of poverty and urbanisation in developing countries. <i>Environmental Development</i> , 13, 18-32.	Since its emergence in the 1980s, the ideology underpinning sustainable development has become a metaphor for describing human welfare and environmental management. However, previous studies have overly focused on environmental aspects with little known about poverty–urbanisation implications on sustainable development. Given the magnitude of urbanisation and the pervasiveness of poverty in developing countries, this paper advocates for a poverty–urbanisation analytical approach to sustainable development in developing countries. First, the article provides an overview of sustainable development discourse. Second, the paper looks at the concepts of poverty and urbanisation and their ramifications on sustainable development. Third, examples of sustainable development policy initiatives and their associated poverty–urbanisation threats are presented. Fourth, the paper discusses the policy implications of these two phenomena on sustainable development. The paper concludes with some key issues necessary to make sustainable development a reality in developing countries.
43	South Africa	Colvin, C., Cartwright, A., Maherry, A., & Mhlongo, T. (2015). <i>Enhancing</i>	The Government of South Africa, through the Department of Environmental Affairs, has set up the Green Fund to support the transition

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		<i>ecological infrastructure in the uMngeni catchment through private sector action and engagement. Green Fund Research Report.</i>	to a low-carbon, resource-efficient and pro-employment development path. The Green Fund supports green economy initiatives, including research, which could advance South Africa's green economy transition. In February 2013, the Green Fund released a request for proposals (RFP), 'Research and Policy Development to Advance a Green Economy in South Africa', inviting interested parties with relevant green economy research projects to apply for research funding support. The RFP sought to strengthen the science-policy interface on the green economy by providing an opportunity for researchers in the public and private sectors to conduct research which would support green economy policy and practice in South Africa. Sixteen research and policy development grants were awarded in 2013. This peer-reviewed research report series presents the findings and policy messages emerging from the research projects.
44	Sub-Saharan Africa	Connolly-Boutin, L., & Smit, B. (2015). Climate change, food security, and livelihoods in sub-Saharan Africa. <i>Regional Environmental Change</i> , 16(2), 385-399.	Sub-Saharan Africa is particularly vulnerable to climate change. Multiple biophysical, political, and socioeconomic stresses interact to increase the region's susceptibility and constrain its adaptive capacity. Climate change is commonly recognized as a major issue likely to have negative consequences on food security and livelihoods in the region. This paper reviews three bodies of scholarship that have evolved somewhat separately, yet are inherently interconnected: climate change impacts, vulnerability and adaptation, food security, and sustainable livelihoods. The paper develops a conceptualization of the relationships among the three themes and shows how food security's vulnerabilities are related to multiple stresses and adaptive capacities, reflecting access to assets. Food security represents one of several livelihood outcomes. The framework shows how several research paradigms relate to the issue of food security and climate change and provides a guide for empirical investigations. Recognizing these interconnections can help in the development of more effective policies and programs. The framework is applied here to synthesize findings from an array of studies in sub-Saharan Africa dealing with vulnerability to climate change, food security, and livelihoods.

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45	South Africa	CSA (Conservation South Africa). (2015). <i>Alfred Nzo District Municipality Climate Change Response Strategy</i> . Technical report. Retrieved from <a href="https://www.conservation.org/publications/Documents/CI_ANDM-Climate-Change-Response-Strategy-Technical-Report.pdf">https://www.conservation.org/publications/Documents/CI_ANDM-Climate-Change-Response-Strategy-Technical-Report.pdf</a>	The impacts of climate change are recognised globally and present a significant challenge to economic development and human well-being. Local managers and decision makers require a holistic approach when responding to climate change. This includes the need understand the vulnerability of rural communities in the Alfred Nzo District Municipality (ANDM) in the context of the interactions that exist between social and ecological systems, as well as how climate change response is intimately linked to core municipal mandates. This report is a full technical assessment on adaptation and mitigation risks, opportunities, and response actions, supported by several annexes, which includes the science and analysis underpinning the shorter ANDM climate change strategy document
46	Ethiopia	Daie, G. F., & Woldtsadik, M. (2015). Household resilience to seasonal food insecurity: Dimensions and magnitudes in the “green famine” belt of Ethiopia. <i>Applied Sciences Report</i> , 11(3), 125-143.	In this paper, resilience to green famine in the green famine belt of Ethiopia was examined based on a case study area (i.e. Belo-jiganfoy district) using a resilience approach that analyzes the present characteristics of household’s ability to recover from shock and transform into another regime of behavior by absorbing the food insecurity shock. The main objective of the study was to analyze household’s resilience to seasonal food insecurity and identify resilience building blocks in the study area. Cross-sectional survey was conducted immediately after seasonal food insecurity shock based on 220 sample households. Factor analysis and regression models were employed to analyze the data using SPSS version 19. The results indicate that 34.75% of households were resilient at different levels. More non-indigenous (19.72%) than Indigenous (15.03%) ethno-culture groups were resilient to green famine condition. As indicated by the factor loadings and Beta coefficients, aspiration to change, social safety net and cultural bond were the most important dimensions of household resilience to food insecurity. These are followed by income and food access, asset possession and stability, which played an intermediate role, and then by adaptive capacity and access to basic services, which also played considerable role and would play

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			important role in long-term in enhancing household's resilience capacity. Therefore, interventions must target at strategies that address the different levels of resilience between the two ethno-culture groups by building each factors of resilience in accordance with their relative importance
47	South Africa	Daron, J. (2015). Challenges in using a Robust Decision-Making approach to guide climate change adaptation in South Africa. <i>Climatic Change</i> , 132(3), 459-473.	Conventional forecast driven approaches to climate change adaptation create a cascade of uncertainties that can overwhelm decision makers and delay proactive adaptation responses. Robust Decision-Making inverts the analytical steps associated with forecast-led methodologies, reframing adaptation in the context of a specific decision maker's capacities and vulnerabilities. In adopting this bottom-up approach, the aim is to determine adaptation solutions which are insensitive to uncertainty. Yet despite the increased use of the approach in large-scale adaptation projects in developed countries, there is little empirical evidence to test whether it can be successfully applied in developing countries. The complex realities of decision-making processes, the need to combine quantitative data with qualitative understanding and competing environmental, socio-economic and political factors all pose significant obstacles to adaptation. In this paper, Challenges and opportunities associated with Robust Decision Making, as a heuristic decision framework, are discussed with insights from a case study of adapting coastal infrastructure to changing environmental risks in South Africa. Lessons are extracted about the ability of this framework to improve the handling of uncertainty in adaptation decisions in developing countries.
48	South Africa	Daron, J. D., Sutherland, K., Jack, C., & Hewitson, B. C. (2015). The role of regional climate projections in managing complex socio-ecological systems. <i>Regional Environmental Change</i> , 15(1), 1-12.	Climate is one of many factors to be considered in adapting systems to environmental and societal change and often it is not the most important factor. Moreover, given considerable model inadequacies, irreducible uncertainties, and poor accessibility to model output, we may legitimately ask whether or not regional climate projections ought to have a central role in guiding climate change adaptation decisions. This question is addressed by analysing the value of regional downscaled climate model output in the management of complex socio-ecological systems (SESs) vulnerable to

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			climate change. We demonstrate, using the example of the Dwesa–Cwebe region in South Africa, that the management of such systems under changing environmental and socio-economic conditions requires a nuanced and holistic approach that addresses cross-scale system interdependencies and incorporates “complexity thinking”. We argue that the persistent focus on increasing precision and skill in regional climate projections is misguided and does not adequately address the needs of society. However, this does not imply that decision makers should exclude current and future generations of regional climate projections in their management processes. On the contrary, ignoring such information, however uncertain and incomplete, risks the implementation of maladaptive policies and practices. By using regional climate projections to further explore uncertainties and investigate cross-scale system dependencies, such information can be used to aid understanding of how SESs might evolve under alternative future societal and environmental scenarios.
49	Africa	De Souza, K., Kituyi, E., Harvey, B., Leone, M., Murali, K. S., & Ford, J. D. (2015). Vulnerability to climate change in three hot spots in Africa and Asia: key issues for policy-relevant adaptation and resilience-building research. <i>Regional Environmental Change</i> .15:747–753	Providing sound evidence to inform decision-making that considers the needs of the most vulnerable to climate change will help both adaptation and development efforts. Such evidence is particularly important in climate change “hot spots”, where strong climate signal and high concentrations of vulnerable people are present. These hot spots include semiarid regions and deltas of Africa and Asia, and glacier- and snowpack-dependent river basins of South Asia. In advance of a major research effort focusing on these three hot spots, studies were commissioned to identify and characterize the current status of knowledge in each on biophysical impacts, social vulnerability, and adaptation policy and practice. The resulting seven papers are brought together in this special edition, with this editorial introduction providing background on these hot spots, the program through which the studies were commissioned, and an overview of the papers that follow.

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50	Sub-Saharan Africa	<p>De Trincheria, J., Craufurd, P., Harris, D., Mannke, F., Nyamangara, J., Rao, K. P. C., &amp; Leal Filho, W. (2015). Adapting agriculture to climate change by developing promising strategies using analogue locations in eastern and southern Africa: a systematic approach to develop practical solutions. In <i>Adapting African Agriculture to Climate Change</i> (pp. 1-23). Springer, Cham.</p>	<p>From 2011 to 2014, the CALESA project was a research-for-development project which coupled integrated climate risk analyses, crop growth simulation modelling and field-based research both on-station and on-the-ground with participatory research with farmers. It comprised research-oriented activities for knowledge and technology creation, and development-oriented activities for information sharing and capacity building. The main purpose of the CALESA project was to develop sound adaptation strategies for future temperature increases associated with greenhouse gas emissions using “analogue locations”, both as learning- and technology-testing sites. This was meant to improve the ability of rainfed farmers in the semi-arid tropics of sub-Saharan Africa, Kenya and Zimbabwe, to adapt to progressive climate change through crop, soil and water management innovation, and appropriate crop genotype choices. Another key feature of the CALESA project was the development and implementation of tailor-made capacity-building activities specifically designed to fulfil the needs of local scientists in the field of climate change adaptation and climate-smart agriculture. To achieve its objectives, the CALESA project used a combination of model-based ex ante analyses and iterative field-based research on station and in farmers’ fields. This facilitated the evaluation of potential agricultural adaptation strategies for rainfed agriculture in the semi-arid and dry sub-humid tropics. In this line, four important crop production zones (two in Kenya and two in Zimbabwe) were identified. Subsequently, the corresponding ‘spatial analogue locations’ for each production zone, providing eight study locations in all, were identified. A strong element of participatory research with small-scale farmers ensured that the perceptions of current and future climate risk and their preferred climate change adaptation strategies was effectively considered. In addition, this also ensured that the project activities and outputs remained relevant to their needs and expectations. The main outputs of the CALESA project are as it follows. Firstly, the identification and fully characterisation of four important crop growing</p>

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			areas in Kenya and Zimbabwe which comprise cool/dry, cool/wet, warm/dry and warm/wet growing conditions, and their temperature analogue locations. Secondly, through the combined use of long-term daily climate data, crop growth simulation models and participatory surveys with farmers, the identification and quantification of the implications of both current and future climate change production risk at the study locations. Thirdly, through iterative field research both on station and in farmers' fields over more than 2 years, the evaluation of potential crop, soil and water management, and crop genotype adaptation options. This was followed by the formulation of adaptation strategies for the target locations.
51	South Africa	DEA (Department of Environment). (2015). Long-Term Adaptation Scenarios Flagship Research Programme (LTAS) for South Africa. Factsheet: Climate Change Adaptation: Scenarios, Pretoria, South Africa. Retrieved from <a href="https://www.sanbi.org/wp-content/uploads/2018/03/ltasclimate-trends-and-scenarios-tech-report2013low-res.pdf">https://www.sanbi.org/wp-content/uploads/2018/03/ltasclimate-trends-and-scenarios-tech-report2013low-res.pdf</a>	This technical report presents the LTAS Phase 1 findings for the agriculture and forestry sectors. It references existing South African research combined with insights from global projections to develop a preliminary picture of the potential effects of climate change on key agricultural and forestry activities. Specifically, it summarises climate change impacts as well as adaptation response options and future research needs for the agriculture and forestry sectors, based on the results of relevant past and current research, including the Climate Change Adaptation and Mitigation Plan for the South African Agricultural and Forestry Sectors (DAFF, 2013); the Department of Agriculture, Fisheries and Forestry (DAFF) funded Atlas of Climate Change and the South African Agricultural Sector (Schulze, 2010); and new simulations from recent modelling work from the Treasury and the National Planning Commission study (Treasury and NPC, 2013).
52	Sub-Saharan Africa	Dixon, J. L., & Stringer, L. C. (2015). Towards a theoretical grounding of climate resilience assessments for smallholder farming systems in Sub-Saharan Africa. <i>Resources</i> , 4(1), 128-154.	Resilience assessments are increasingly used to inform management decisions and development interventions across sub-Saharan Africa (SSA). In light of current and future climate change and variability, there is growing interest in applying such tools and frameworks to assess and strengthen the climate resilience of smallholder farming systems. However, these assessments are often undertaken without explicit



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			consideration of the resilience thinking in which they are grounded. This makes it difficult to understand how the conceptual aspects of resilience are translating into resilience assessment practice. This paper provides an important first step in tackling this gap, by identifying and using key characteristics of resilience thinking to evaluate existing resilience assessment tools and frameworks and drawing insights for assessing the climate resilience of smallholder farming systems. We find that power, politics, and agency, identified as important in the resilience literature, are not fully incorporated within current tools and frameworks. This leads to inadequate consideration of spatial and temporal trade-offs. We propose six recommendations for assessing the climate resilience of smallholder farming systems in SSA in order to enhance the linkages between resilience theory and practice. These are: (1) better integrate vulnerability and resilience; (2) recognize that resilience does not equal development or poverty reduction; (3) recognize the benefits and limitations of adopting flexible, participatory approaches; (4) integrate issues of power into assessment tools; (5) target specific systems; and (6) encourage knowledge sharing, empirical studies, and critical evaluation. Our findings contribute to improved understanding of applications of resilience thinking to enhance natural resource management.
53	Zimbabwe	Dodman, D., & Mitlin, D. (2015). The national and local politics of climate change adaptation in Zimbabwe. <i>Climate and Development</i> , 7(3), 223-234.	The description and analysis of climate change adaptation programmes in low- and middle-income countries rarely examines the political conditions and contexts in which these take place, or the way in which these activities may themselves shape local and national politics. This paper uses a case study of Zimbabwe to examine how the discourse and practice of climate change has been incorporated in, and has the potential to influence, national politics in a context marked by high levels of contestation. It identifies the ways in which climate change is framed within national political discourses and describes the structures for governing climate change adaptation and how these are influenced by global priorities and policies. The paper then raises specific questions that are fundamental to



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			understanding the broader political implications of work related to climate change in low-income countries and argues that these must be engaged with if climate change adaptation is to generate sustainable long-term improvements in livelihoods and well-being for citizens in these contexts.
54	Ghana	Dumenu, W.K., Obeng, A.E. (2015). Climate change and rural communities in Ghana: Social vulnerability, impacts, adaptations and policy implications. <i>Environmental Science &amp; Policy</i> , Volume 55, Part 1.	This study assessed social vulnerability level, impacts and adaptation strategies to climate change in rural communities in four ecological zones in Ghana. Primary data were collected through questionnaires and interviews from 196 households in 14 rural communities. Using six demographic, social and economic indicators in assessing social vulnerability to climate change, the Sudan and Guinea Savanna zones were ranked the most vulnerable to climate change. vulnerability factors such as high illiteracy level, heavy dependence on climate sensitive occupation, less diversified sources of income and limited access to climate change information contributed to the high vulnerability level of the zones. Frequently experienced climate change impacts in the four ecological zones were erratic rainfall, reduction in crop yield, prolonged drought and shift in cropping season. Most engaged adaptation strategies included crop diversification, engagement in non-farm secondary jobs, rural–urban migration and increasing farm size. The results highlight the importance of local-level climate change vulnerability assessment and demonstrated the need for local area-specific actions/policies to reducing vulnerability and enhancing adaptation in rural communities.
55	Burkina Faso	Eguavoen, I., & Wahren, J. (2015). <i>Climate change adaptation in Burkina Faso: aid dependency and obstacles to political participation</i> (No. 140). ZEF Working Paper Series.	This study analyses the climate change discourses and political dynamics in south-western Burkina Faso from three empirical entry points: (a) the production of the National Adaptation Programmes of Action; (b) climate change discourses in the Ioba province; and (c) the role of the public media. Climate change is not a popular discourse in Burkina Faso and seems limited to the national and international levels. Farmers in the Ioba province have experienced environmental degradation and changes in precipitation patterns but have not linked these to climate change, except for extreme events. Local discourses mostly focus on deforestation and

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			express disappointment in the degree of support that the government and non-governmental organizations (NGOs) offer to producers of food crops. External support is characterized by a good knowledge base of climate change among government officials and NGO staff but also insufficient funds, a lack of coordination, shifting donor interest in development themes and little responsiveness to farmers' concerns and needs, leading to a lack of political interest. Farmers' low levels of understanding of elections, voting power and political accountability have resulted in little political representation of their interests. Climate change and adaptation options are disseminated via radio, drama groups, mobile cinema and trainings. These participatory formats allow top-down information flow and opportunities for farmers to publicly discuss their views, concerns and questions beyond climate change. The popularity of these formats show that farmers are eager to communicate, become informed and get active in environmental change and resources management.
56	Africa	Eguavoen, I., Schulz, K., de Wit, S., Weisser, F., & Müller-Mahn, D. (2015). Political dimensions of climate change adaptation: conceptual reflections and African examples. <i>In Handbook of climate change adaptation</i> (pp. 1183-1199). Springer, Berlin, Heidelberg.	This chapter supports the argument that social science research should focus on adaptation to climate change as a social and political process, by analyzing the politics and interests of actors in climate change adaptation arenas and by acknowledging the active role of those people who are expected to adapt. Most conventional climate research depoliticizes vulnerability and adaptation by removing dominant global economic and policy conditions from the discussion. Social science disciplines, if given appropriate weight in multidisciplinary projects, contribute important analyses by relying on established concepts from political science, human geography, and social anthropology. This chapter explains relevant disciplinary concepts (climate change adaptation arena, governance, politics, perception, mental models, culture, weather discourses, risk, blame, traveling ideas) and relates them to each other to facilitate the use of a common terminology and conceptual framework for research in a developmental context.

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57	Nigeria	Elias, P., & Omojola, A. (2015). Case study: The challenges of climate change for Lagos, Nigeria. <i>Current Opinion in Environmental Sustainability</i> , 13, 74-78.	This case study paper considers some of the main climate change challenges for Lagos. Emerging adaptation and mitigation responses are considered in the context of Lagos urbanization trends, as well as development and transformation agendas. Insights are based on a synthesis of key literature, technical reports and policy documents. The paper reports that although Lagos authorities have started to respond to the stresses and risks from climate change, these efforts are haphazard, largely top-down, uncoordinated and fragmented. To be sustainable, there is an urgent need to rally political will, recognize local action through popular participation, identify and build capacities, and institutionalize adaptation frameworks in all agencies and planning levels.
58	Africa	Engelbrecht, F., Adegoke, J., Bopape, M. J., Naidoo, M., Garland, R., Thatcher, M., ... & Gatebe, C. (2015). Projections of rapidly rising surface temperatures over Africa under low mitigation. <i>Environmental Research Letters</i> , 10(8), 085004.	An analysis of observed trends in African annual-average near-surface temperatures over the last five decades reveals drastic increases, particularly over parts of the subtropics and central tropical Africa. Over these regions, temperatures have been rising at more than twice the global rate of temperature increase. An ensemble of high-resolution downscalings, obtained using a single regional climate model forced with the sea-surface temperatures and sea-ice fields of an ensemble of global circulation model (GCM) simulations, is shown to realistically represent the relatively strong temperature increases observed in subtropical southern and northern Africa. The amplitudes of warming are generally underestimated, however. Further warming is projected to occur during the 21st century, with plausible increases of 4–6 °C over the subtropics and 3–5 °C over the tropics by the end of the century relative to present-day climate under the A2 (a low mitigation) scenario of the Special Report on Emission Scenarios. High impact climate events such as heat-wave days and high fire-danger days are consistently projected to increase drastically in their frequency of occurrence. General decreases in soil-moisture availability are projected, even for regions where increases in rainfall are plausible, due to enhanced levels of evaporation. The regional downscalings presented here, and recent GCM projections obtained for

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			Africa, indicate that African annual-averaged temperatures may plausibly rise at about 1.5 times the global rate of temperature increase in the subtropics, and at a somewhat lower rate in the tropics. These projected increases although drastic, may be conservative given the model underestimations of observed temperature trends. The relatively strong rate of warming over Africa, in combination with the associated increases in extreme temperature events, may be key factors to consider when interpreting the suitability of global mitigation targets in terms of African climate change and climate change adaptation in Africa.
59	Africa	Ensor, J., & Harvey, B. (2015). Social learning and climate change adaptation: evidence for international development practice. Wiley Interdisciplinary Reviews: <i>Climate Change</i> , 6(5), 509-522	This paper draws out lessons for international development practice, through the review of literature on social learning, to draw out lessons for international development practice. The purpose is to support those looking to design social learning interventions for eco system-based adaptation approaches. The review thus sought to look within the current practice of social learning to better understand what is emerging in terms of approaches, lessons, tools and impacts. The major findings of the study was in relation to adaptation practice. However, attention was drawn to three central issues that emerged. These are developing a shared vision for change, facilitation and social differentiation.
60	Africa	Eriksen, S. H., Nightingale, A. J., & Eakin, H. (2015). Reframing adaptation: The political nature of climate change adaptation. <i>Global Environmental Change</i> , 35, 523-533.	This paper is motivated by a concern that adaptation and vulnerability research suffer from an under-theorization of the political mechanisms of social change and the processes that serve to reproduce vulnerability over time and space. We argue that adaptation is a socio-political process that mediates how individuals and collectives deal with multiple and concurrent environmental and social changes. We propose that applying concepts of subjectivity, knowledge and authority to the analysis of adaptation focuses attention on this socio-political process. Drawing from vulnerability, adaptation, political ecology and social theory literatures, we explain how power is reproduced or contested in adaptation practice through these three concepts. We assert that climate change adaptation processes have the potential to constitute as well as contest authority,

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			subjectivity and knowledge, thereby opening up or closing down space for transformational adaptation. We expand on this assertion through four key propositions about how adaptation processes can be understood and outline an emergent empirical research agenda, which aims to explicitly examine these propositions in specific social and environmental contexts. We describe how the articles in this special issue are contributing to this nascent research agenda, providing an empirical basis from which to theorize the politics of adaptation. The final section concludes by describing the need for a reframing of adaptation policy, practice and analysis to engage with multiple adaptation knowledges, to question subjectivities inherent in discourses and problem understandings, and to identify how emancipatory subjectivities – and thus the potential for transformational adaptation – can be supported
61	Ghana	Essegbey, G.O., Nutsukpo D, Karbo N, Zougmore R. (2015). National Climate-Smart Agriculture and Food Security Action Plan of Ghana (2016-2020). Working Paper No. 139. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).	National Climate-Smart Agriculture and Food Security Action Plan of Ghana (2016-2020) – provides the implementation framework for an effective development of climate-smart agriculture in the ground. It formulates specific strategies that will contribute developing climate-resilient agriculture and food systems for all agro-ecological zones, as well as the human resource capacity required for a climate-resilient agriculture promotion in Ghana. The action plan is therefore an effort to translate to the ground level the broad national goals and objectives in climate-smart agriculture.
62	East Africa	Few, R., Satyal, P., McGahey, D., Leavy, J., Budds, J., Assen, M., ... & Bewket, W. (2015). <i>Vulnerability and adaptation to climate change in semi-arid regions of East Africa</i> . ASSAR working paper, ASSAR PMU, South Africa. <a href="http://www.assar.uct.ac">http://www.assar.uct.ac</a> .	The Adaptation at Scale in Semi-Arid Regions (ASSAR) Consortium seeks to deepen understanding of climate vulnerability and adaptation in semi-arid regions and help transform current adaptation practice to a mode that achieves proactive, widespread adaptation embedded in development activities. The project works at multiple scales, but with a central focus on advancing adaptive livelihoods for vulnerable groups. As part of the ASSAR project, the East Africa team's work concentrates especially on dryland zones of Ethiopia, Kenya and Uganda. This report summarises key findings from the regional diagnostic study (RDS) of the ASSAR East

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			Africa team, and identifies major gaps in the existing literature on areas of vulnerability and adaptation in East Africa. The discussion provides the foundation for detailed case study work planned for the major phase of research, the Regional Research Programme (RRP), as well as an underpinning guide to develop a dialogue on adaptation options.
63	Uganda	Fisher, M., & Carr, E. R. (2015). The influence of gendered roles and responsibilities on the adoption of technologies that mitigate drought risk: The case of drought-tolerant maize seed in eastern Uganda. <i>Global Environmental Change</i> , 35, 82-92.	Gender-disaggregated, household survey data for Uganda are used to examine how gendered roles and responsibilities influence adoption of drought-tolerant (DT) maize, a new technology that can help smallholder farmers in sub-Saharan Africa adapt to drought risk. Multinomial logit (MNL) regression results indicate that, compared to men farmers, women farmers have much lower adoption of DT maize, mainly due to differences in resource access, notably land, agricultural information, and credit. Differentiation of women and men farmers by various characteristics reveals that whether a male farmer was younger or older, or poor or non-poor has no significant influence on DT maize adoption; but important differences among different categories of women farmers are identified. For example, the farmer group found least likely to adopt DT maize is young, poor women household heads. MNL results also show that wives strongly influence adoption of DT maize on plots controlled by their husbands. We discuss the implications of study findings for the development of well-targeted and socially-inclusive adaptation policies.
64	Sub Saharan Africa	Fisher, M., Abate, T., Lunduka, R. W., Asnake, W., Alemayehu, Y., & Madulu, R. B. (2015). Drought tolerant maize for farmer adaptation to drought in sub-Saharan Africa: Determinants of adoption in eastern and southern Africa. <i>Climatic Change</i> , 133(2), 283-299.	In sub-Saharan Africa (SSA), “maize is life,” due to its importance to food security and economic wellbeing. Around 40 % of Africa’s maize-growing area faces occasional drought stress, resulting in yield losses of 10–25 %. Around 25 % of the maize crop suffers frequent drought, with losses of up to half the harvest. To reduce vulnerability and improve food security, the Drought Tolerant Maize for Africa (DTMA) project has made releases of 160 drought tolerant (DT) maize varieties between 2007 and 2013. These have been tested in experimental and farmers’ fields and disseminated to farmers in 13 African countries through national agricultural research systems and private seed companies. Yields of the

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			new varieties are superior to those of currently available commercial maize varieties under both stress and optimum growing conditions. Although the benefits of DT maize for African farmers have been repeatedly predicted, realization of those benefits depends on farmer uptake, which has received limited empirical study. We use new plot-level data from surveys of 3,700 farm households in six countries (Ethiopia, Tanzania, Uganda, Malawi, Zambia, and Zimbabwe) to measure DT maize adoption rates and their determinants. The data reveal considerable inter-country variation in farmer uptake of DT maize, from 9 % of maize plots in Zimbabwe to 61 % in Malawi. The major barriers to adoption include unavailability of improved seed, inadequate information, lack of resources, high seed price, and perceived attributes of different varieties. Based on the results, we recommend that seed companies and agro-dealers ensure adequate supply of DT maize seed in local markets and sell seed in affordable micro-packs (1 or 2 kg). Furthermore, the DTMA project and partners should ramp up promotional efforts to ensure widespread awareness and understanding of the benefits of the new DT maize varieties.
65	Uganda	Friis-Hansen, E., Aben, C., Okiror, J. J., Bashaasha, B., & Suubi, G. (2015). <i>Local government engagement with climate change adaptation in Uganda</i> (No. 2015: 19). DIIS Reports, Danish Institute for International Studies.	The report analyses the evolution of climate change policy in Uganda and uses the principle of subsidiarity to understand the appropriateness of the proposed implementation strategy. Recognizing the importance of political support for the outcome of climate change action, the report examines the extent to which climate change adaptation is on the political agenda of local government bodies and in what ways. A case study from Amuria provides a deeper examination of how events that lead climate change can become a contested issue during local government elections. Meso-level rural institutions are increasingly playing a key role in formulating and implementing support for climate change adaptation. The study explores the nature and extent of engagement of and interactions between meso-level rural institutions in this providing this support. By



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			means of four district case studies, the report reveals a wide spectrum of context-specific institutional changes.
66	Rwanda	Gebauer, C., & Doevenspeck, M. (2015). <i>Adaptation to climate change and resettlement in Rwanda</i> . Area, 47(1), 97-104. <a href="http://dx.doi.org/10.1111/area.12168">http://dx.doi.org/10.1111/area.12168</a>	In this paper, analysis is done to find out why forced resettlement of farmers is considered an innovative action among the climate change adaptation efforts. It also argues that the concept of adaptation to climate change is a travelling idea that is constantly translated and used politically to frame environmental and developmental interventions in concrete places that heavily impact the everyday lives of rural dwellers. The study assessed the ties that are being established between climate change, presumed regional effects and possible solutions within the political environment. The authors concluded that, their study has helped gain better understanding of the interventions and frameworks that are being designed and that, through the resettlement programme, shape the daily experience of adaptation to climate change of rural dwellers in Gishwati/Kanembwe.
67	Africa	Gemeda, D. O., & Sima, A. D. (2015). The impacts of climate change on African continent and the way forward. <i>Journal of Ecology and the Natural environment</i> , 7(10), 256-262.	This paper reviews several studies on the impacts of climate change on developing countries in Africa, one of the most vulnerable continents due to lack of financial, technical and institutional capacity to cope with the impacts of climate change. Due to various anthropogenic activities, greenhouse gases are increasing in the atmosphere at an alarming rate which leads to extreme temperature and flooding, loss of soil fertility, low agricultural productions (both crops and livestock's), biodiversity loss, risk of water stress, and prevalence of various diseases. It is predicted that the temperature in Africa continent will rise by 2 to 6°C over the next 100 years. In terms of economic, the Sub-Saharan Africa will lose a total of US\$26 million by 2060 due to climate change. The increasing occurrence of flooding and drought is also another predicted problem for Africa. Climate change can set back development of nations. Even though African countries are working on adaptation and mitigation options to minimize the adverse effects, climate change is expected to cause large damage to their economy. Thus, climate change adaptation and mitigation options



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			require greater attention to ensure future food security and well-being of African peoples.
68	Ethiopia	Getu, A. (2015). The effects of climate change on livestock production, current situation and future consideration. <i>International Journal of Agricultural Science</i> , 5(3), 494-499.	Review work was conducted to assess the climatic effect on livestock productions. Worldwide reviewers stated that the performances of animals are strongly correlated to environments. Currently climate change is a great challenge in the world. Intergovernmental panel meeting on climate change underlined that the poorest vulnerable groups are the worst and affected groups. Indirectly climate change has significant impact on feed resources on livestock productivity, carrying capacity of rangelands, and feeds, feeding options and grazing managements. Changed temperature increases the lignifications of plant tissues and reduces the digestibility and rates of degradations. Livestock is also directly exposed to tresses of the mortality, growth, reproduction and maintenances. Climatic change aggravates the water scarcity and accelerates the poverty level. The response of changing environments is increased. Water intake of Bos Indicus cattle was increased from about 3 kg DM intake at 10 °C to 5 kg at 30°C and to about 10 kg at 35°C. Climate change influenced other factors associated with vector populations and their distributions. Awareness creation on the consumption of livestock products related to environmental effects is important mitigation measures. The future directions of livestock production will be increased for the production of foods for the efficient transformation of livestock production to the international markets.
69	Africa	Groner, V., Claussen, M., & Reick, C. H. (2015). Palaeo plant diversity in subtropical Africa—ecological assessment of a conceptual model of climate–vegetation interaction. <i>Climate of the Past</i> , 11, 1361-1374.	We critically reassess a conceptual model here, dealing with the potential effect of plant diversity on climate– vegetation feedback, and we provide an improved version adjusted to plant types that prevailed during the African Humid Period (AHP). The work contributes to the understanding of the timing and abruptness of vegetation decline at the end of the AHP, investigated by various working groups during the past 2 decades using a wide range of model and palaeoproxy reconstruction approaches.

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70	Botswana	Hambira, W. L., & Saarinen, J. (2015). Policy-makers' perceptions of the tourism–climate change nexus: Policy needs and constraints in Botswana. <i>Development Southern Africa</i> , 32(3), 350-362.	Tourism is a key sector for most southern African economies endowed with unique natural capital, and the industry is increasingly being used for socio-economic development and diversification of national economies in the region. However, it has become clearly evident that the natural capital upon which the sector depends is highly vulnerable to climate change. This has created urgent governmental needs to take action through policy formulation and implementation. The paper uses in-depth interviews to determine Botswana policy-makers' perceptions of climate change and tourism with the aim of determining policy needs and constraints. The results reveal that the policy-makers do see climate change as a concern requiring urgent establishment of relevant policy. However, they foresee inadequate information as well as uncertainties surrounding the impacts of climate change on the natural capital. This may hamper the formulation and effective implementation of such a policy.
71	Ghana, Kenya and Zimbabwe	Hengsdijk, H., Conijn, J. G., & Verhagen, A. (2015). Climate Smart Agriculture: Synthesis of case studies in Ghana, Kenya and Zimbabwe (No. 624). <i>Plant Research International</i> , 624 – 26.	This study contributes to the current debate on climate smart agriculture and development in Africa, specifically in relation to farm size, food security and intensification in rain fed farming areas. Although the different analyses are rough, because of a combination of incomplete knowledge and limited data sets, the results place the prevailing development discussions in the context of CSA: Provides intensification a way out of poverty and contributes intensification to food security under climate change? How affects climate change crop yields and household income? Conflicts intensification with climate mitigation goals? These are some of the questions addressed for diverging case study areas in this study.
72	Kenya	Hohenthal, J., Owidi E., Minoia, P. and Pellikka, P. (2015). Local assessment of changes in water-related ecosystem services and their management: DPASER conceptual model and its application in Taita Hills, Kenya.	This study was conducted in semi-arid East Africa, where fresh water provisioning, regulation and purification services provided by aquatic forests and wetlands are among the most crucial types of ecosystems. The study area was the Taita Hills in south-eastern Kenya. The overuse of natural resources and environmental degradation in this area have and continue to place pressure on water-related ecosystem services (ES). The

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		<i>International Journal of Biodiversity Science, Ecosystem Services &amp; Management</i> , 11:3, 225-238, DOI: 10.1080/21513732.2014.985256	authors of this study used historical to trace changes undergone by water related ES during the last few decades and assess the factors that have created a situation of unsustainable management. They also evaluated the applicability of the ES based approach to water resource management in the study area. Moreover, the study first of all evaluated how the ES approach has been adopted in Kenya. The study further sought answers through analysis of the institutional acts and legislation influencing the local governance of natural resources, as well as the responsibilities and tasks undertaken by either individual, collective or governmental actors. The study analysed the main drivers, pressures and human actions affecting the ecosystems of Taita hills using the conceptual DPASER framework adapted from the DPSIR model. The response undertaken by local institutions and community groups was also examined. It was concluded that technical restoration and sectoral responses to environmental protection cannot provide durable solutions to problems of endangered ES. However, the authors' suggested that current development trajectories using the ES based approach can be reversed by enhancing multi sectoral cooperation and reconsidering the conditions of private ownership of land and resources.
73	Ghana	Institute of Green Growth Solutions (2015). Climate Change Learning Strategy in Ghana: Background Report. Retrieved from <a href="http://www.gh.undp.org/content/dam/ghana/docs/Doc/Susdev/UNDP_GH_SU SDEV_CCLEARN">http://www.gh.undp.org/content/dam/ghana/docs/Doc/Susdev/UNDP_GH_SU SDEV_CCLEARN</a>	In response to the global call for more action to be taken by governments to address the negative impacts of climate change and the growth of climate science both globally and locally, the Government of Ghana (GoG) has taken various steps to mainstream climate change into the developmental agenda of the country. The National Environment policy (NEP) has capacity building as one of its key cardinal points. The NEP acknowledges capacity building as a major step towards the realization of a desired environment. Approaches highlighted to address climate change and its impact were; Develop climate-resilient agriculture and food security systems; Build climate-resilient infrastructure · Increase resilience of vulnerable Communities to climate-related Risks; Increase Carbon Sinks; Improve management and resilience of Terrestrial, Aquatic

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			and Marine Ecosystems; Address impacts of climate change on human health; Minimize impacts of Climate Change on access to water and sanitation; Address gender issues in Climate Change; Address Climate Change and Migration Energy and minimize green gas emission.
74	Zimbabwe	Jiri, O., Mafongoya, P. L., & Chivenge, P. (2015b). Indigenous knowledge systems, seasonal 'quality' and climate change adaptation in Zimbabwe. <i>Climate Research</i> , 66(2), 103-111.	Farmers use a variety of local indicators for weather forecasting and climate prediction, in order to adapt to climate variability and change. Integrating indigenous knowledge systems (IKS) with the efforts of climate scientists can contribute to effective on-farm adaptation initiatives. The objective of this research was to identify IKS used by Zimbabwean farmers to predict seasonal weather patterns, and their adaptation strategies in response to these predictions. The information was collected using focus group discussions, household surveys, and ethnographic interviews. Most farmers (72.2%) indicated that low rainfall is the major limitation to agricultural production. Without access to reliable local scientific weather forecasts, the farmers use tree phenology, animal behaviour and atmospheric circulation as sources of local knowledge to predict the onset and 'quality' of the season. These forecasts are then used for designing crop choices, planting dates and agronomic practices. Our results show that the use of IKS in local farming communities is an effective way of building coping and adaptation strategies. The results also revealed that indigenous knowledge is being eroded and is becoming less accurate in seasonal weather prediction. Therefore, future studies on IKS could explore the use of multiple methods that combine indigenous knowledge and scientific weather data in order to obtain more complete and accurate information for the prediction of local area seasonal characteristics.
75	Zimbabwe	Jiri, O., Mafongoya, P., & Chivenge, P. (2015a). Smallholder farmer perceptions on climate change and variability: A predisposition for their subsequent adaptation strategies.	Smallholder farmers are facing several climate-related challenges. Projected changes in climate are expected to aggravate the existing challenges. This study was conducted in Chiredzi district, Masvingo, Zimbabwe. The study objective was to examine farmer perceptions on climate variability, current adaptive strategies and establish factors

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		<i>Journal of Earth Science &amp; Climatic Change</i> , 6(5), 1-7.	influencing smallholder farmers' adaptation to climate change. A survey was conducted with 100 randomly selected respondents from four wards. Additionally, data was collected through focus group discussions and key informant interviews. The results showed that farmers perceived that there has been a decrease in annual rainfall and an increase in average temperatures. A linear trend analysis of rainfall and temperature data from 1980 to 2011 corroborated the farmers' perceptions. Farmers' adaptation options included adjusting planting dates and crop diversification. Off-farm income has reduced the dependence of the farmers on agriculture. A multinomial regression analysis showed that socioeconomic factors such as gender, age, number of cattle owned, land size and average crop yields influenced farmer adaptation strategies. The study concludes that although farmers are diverse in their socio-economic attributes, they exhibit homogeneous perceptions on changes in climate, which are consistent with observations of empirical climate data. These perceptions help to shape smallholder farmer coping and adaptation strategies
76	Sub Saharan Africa	Jones, L., Dougill, A., Jones, R. G., Steynor, A., Watkiss, P., Kane, C. & Roux, J. P. (2015). Ensuring climate information guides long-term development. <i>Nature Climate Change</i> , 5(9), 812.	Many sub-Saharan countries are failing to include climate information in long-term development planning. Ensuring climate-resilient development requires a step change in how medium- to long-term climate information is produced, communicated and utilized in sub-Saharan Africa and elsewhere. Factoring medium-to long-term climate information usually associated with interannual, decadal and multi-decadal timescales into investments and planning decisions can therefore play an important role in guiding climate-resilient development and helping to safeguard economic development across the region.
77	Rwanda	Kabirigi, M., Musana, B., Kipchirchir, F. and Mugwe, J.N. (2015) Applicability of conservation agriculture for climate change adaptation in Rwanda's situation. <i>Journal of Soil Science and</i>	Improving food security and environmental conservation has been the main targets of innovative farming systems. Conservation agriculture (CA), based on minimum tillage, crop residue retention and crop rotations has been proposed against poor agricultural productivity and soil degradation. This paper discusses the applicability and potential benefits of CA in Rwanda under the unfolding climate change scenario. The

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		<i>Environmental Management</i> . Vol. 6(9), pp. 241-248.	potential and benefits from CA may vary with rainfall regime. In high rainfall areas (For example North and West of Rwanda), the soils are susceptible to soil erosion and face fertility decline while in low rainfall areas (For example East of Rwanda) crops fail due to sub-optimal water use efficiency. Furthermore, low organic carbon content lower fertilisers response and government targets of increasing production through Crop Intensification Program, is limited. It has been shown that CA can: Reduce soil loss from 35.5 to 14.5 t/ha/year, have 50-70% greater infiltration and increase 42% of organic carbon. Long term analysis using Agricultural Production System Simulator showed that CA can increase yield from 3.6 to 4.4t/ha in areas having >770 mm. Based on the evidence from regional research, CA has a good potential for climate change adaptation in both high and low rainfall areas of Rwanda. However, decreased yield observed in high rainfall areas, increased labour requirements when herbicides are not used and lack of mulch due to priority given to feeding of livestock constrained CA adoption. We conclude that there is a need for critical assessment under which ecological and socio-economic conditions CA is suited for smallholder farming in Rwanda.
78	Tanzania	Kahimba, F. C., Sife, A. S., Maliondo, S. M. S., Mpeta, E. J., & Olson, J. (2015). Climate change and food security in Tanzania: Analysis of current knowledge and research gaps. <i>Tanzania Journal of Agricultural Sciences</i> , <b>14</b> (1), 21-33.	A review of literature was conducted in order to identify knowledge gaps in climate change and food security research in Tanzania. The review focused on published literature covering the past 20 years addressing climate change effects on various components of the food security. The review of literature reveals, among other things, that the current agricultural practices cannot ensure food security since they heavily rely on the increasingly erratic and unreliable rainfall. Food systems in Tanzania are highly vulnerable to climate change and variability due to poor adaptive capacity of the socio-economic systems and limited community resilience to cope with climate variability and change. Response to climate change impacts is affected by multiple factors at different scales, ranging from the individual to the household and landscape, which in turn affects food security. Quality climate change

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			science research in Tanzania is limited by few, scattered, unevenly distributed, and ill-equipped meteorological stations. This calls for research that is geared towards combining mitigation and adaptation strategies against the impacts of climate change, focusing on adaptation strategies that build climate resilience, reduce greenhouse gas emissions, and increase food security. Multidisciplinary research is required to provide a sciencebased analysis of potential coping and adaptation strategies and their economic and social effects.
79	Morocco	Karmaoui, A., Messouli, M., Ifaadassan, I., Khebiza, M.Y (2015). A Multidisciplinary Approach to Assess the Environmental Vulnerability at Local Scale in Context of Climate Change (Pilot Study in Upper Draa Valley, South Morocco). <i>Global Journal of Technology &amp; Optimization</i> , 1-11.	This assess how climate change and anthropogenic has affected biodiversity, ecosystems, and ecosystem services and what is the human behavior to response (reaction) of these changes in Upper Draa Valley (pre-Sahara of Morocco). Qualitative analysis based on calculations of 50 indicators of the environmental vulnerability index (EVI) was used. Models such as Water Evaluation and planning system WEAP) and Statistical Downscaling Model (SDSM) were used to address the linkages between ecosystem services (ES) and human outcomes and behavior, and how they influence each other in arid ecosystem. Other relevant data were obtained from documents and data provided by governments and agencies. EVI results classified the region as a vulnerable area to climate change and anthropogenic impacts. This results also showed that water and population indicators influencing the existence of their oasean ecosystems. Effectively the climate conditions and their trends, impact the water resources, which are the support of all ecosystem services and human activities.
80	Mali	Kelly, V., Diakité, L., & Teme, B. (2015). Sorghum Productivity in Mali: Past, Present, and Future (No. 207024). Michigan State University, Department of Agricultural, Food, and Resource Economics.	Mali has a long history of focusing agricultural research and policies on the cereal sector, as cereals are the major staples providing food security. Despite the overall success of Malian cereal research and market reforms, recent production and productivity trends for traditional coarse grains (millet and sorghum) have grown at a much slower pace than rice and maize. This literature review describes how Mali is currently performing



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			in terms of sorghum productivity, how the sector got to where it is today, and issues that need to be addressed to further its development. Sorghum is the focus of the review because of its adaptability to a variety of climates and the role it plays in providing food security to semi-subsistent rural households.
81	Africa	Kilroy, G. (2015). A review of the biophysical impacts of climate change in three hotspot regions in Africa and Asia. <i>Regional Environmental Change</i> , 15(5), 771-782.	A systematic review was conducted of biological and physical climate change impacts in three hotspot regions in Africa and Asia. Specifically, the review focused on identifying the nature and extent of biophysical impacts in semi-arid zones, mega-deltas and glacial-fed river basins. In total 139, peer-reviewed articles were reviewed, with a steady increase in relevant articles reported since 2006. Publications on the South Asian glacial-fed river basins were the most numerous followed by semi-arid areas and then deltas, with Central Asia and some African countries being the most under represented. The nature and extent of impacts varied for each hotspot area and were largely determined by the geographical context and intrinsic characteristics of each region. River basin publications were dominated by impacts concerning hydrology, highlighting the importance of glacial-fed water resources to downstream populations. Semi-arid regions were dominated by impacts to climate processes and impacts to livestock and vegetation highlighting the importance of rainfall to the ecosystems and the livelihoods of communities in these regions. In contrast, delta studies were dominated by a focus on hazards, predominantly coastal inundation, reflecting the concentration of populations and assets in these areas. Uncertainties associated with the biophysical impacts on these regions under a changing climate are documented and represent key knowledge gaps. Common information gaps for all hotspot regions were the need for improved hydro-meteorological monitoring systems. The development of climate change adaptation strategies and policies should be supported by a sound knowledge and understanding of the full range of biophysical impacts, which are characteristic to each geographical location



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82	West Africa	Kima, S. A., Okhimamhe, A. A., Kiema, A., Zampaligre, N., & Sule, I. (2015). Adapting to the impacts of climate change in the sub-humid zone of Burkina Faso, West Africa: Perceptions of agro-pastoralists. <i>Pastoralism</i> , 5(1), 16.	This study examined the impact of climate change on pastoral livestock in Boulgou Province located in the sub-humid zone of Burkina Faso. We analysed the annual rainfall and temperature data from 1980 to 2012 using both Mann-Kendall's statistical test to show the long-term annual trends and Standardised Anomaly Index (SAI) to evaluate inter-annual rainfall fluctuations. We also conducted household interviews with 248 respondents to analyse agro-pastoralists' perceptions of climate change and variability, its impacts on livestock production and their acceptance of adaptation measures. A binary regression model was employed to identify the most important factors affecting agro-pastoralists' decisions to adopt specific adaptation measures. Within the period of study, the annual rainfall showed an upward trend, with high inter-annual variability and 818.9 mm of mean annual rainfall. Additionally, the annual minimum and maximum temperatures showed a statistically significant upward trend, with a rate of change of 0.20 °C and 0.27 °C per decade. The results of the household interviews indicated that most of the respondents (73.4 %) observed temperature changes compared with rainfall amount (1.2 %). To adapt to these changes, they have already adopted some adaptation measures that include the use of crop residue and herd destocking. Other less popular but innovative adaptation measures such as haymaking and use of concentrate livestock feeds could be promoted effectively under a comprehensive climate change adaptation action plan within a reviewed National Policy for Sustainable Livestock Development. This case study is one of the platforms through which poor agro-pastoralists' perception and recommendations can be accommodated in this proposed multi-stakeholder policy review.
83	Kenya	King-Okumu, C. (2015). Inclusive green growth in Kenya: opportunities in the dryland water and rangeland sectors. Study in support of the Danish Green Growth and Employment	Inclusive green growth requires enhanced resilience to perturbations that affect the Kenyan economy. These include climatic variability and changes and a range of other economic and socially driven changes in the drylands. This report explores the challenges and potential for Danida and its selected partners in the water, rangeland and livestock enterprise

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		Programme in Kenya 2015–2020. IIED Issue Paper. <i>IIED, London.</i>	sectors. The concluding discussion highlights shared considerations across both sectors concerning the roles of the public sector, private sector and communities in providing services, tracking inclusive green growth and fostering green innovations (hard and soft). Recommendations target better nationallevel water accounting and more participatory scientific ecosystem management methods.
84	Africa	Knaepen, H., Carmen Torres, C., & Rampa, F. (2015). Making agriculture in Africa climate-smart from continental policies to local practices. ECDPM. No. 80.	There are various approaches to make agriculture “climate smart”. These can be complementary, and it is therefore an important challenge to link their best practices. African policy-makers generally promote climate-smart agriculture (CSA) and aim to mainstream this approach in agricultural policies and interventions at continental, regional and national levels. But a lack of knowledge, weak governance and insufficient financing impede smooth mainstreaming. Moreover, despite mainstreaming efforts, “climate” and “agriculture” are treated in silos. There is also a disconnect between policies and frameworks at the global, continental, regional, national and local levels. A multistakeholder, bottom-up, intersectorial approach can overcome these challenges. At the same time, top-down frameworks such as the United Nations (UN) climate debates should give “agriculture” its deserved priority, given its relevance as “victim and vector” of climate change. Investing in climate-sensitive agriculture is an opportunity for the private sector to make sustainable profits. But governments and financial partners should create an enabling environment and provide financial incentives to mitigate risks especially for small and medium-sized enterprises (SMEs). SMEs can better address opportunities in local markets and can better adapt climate smart technologies to local markets.
85	Tanzania	Komba, C & Muchapondwa, E. (2015). Adaptation to Climate Change by Smallholder Farmers in Tanzania. Environment for Development,	In Sub-Saharan Africa, climate change is set to hit the agricultural sector the most severely and cause suffering, particularly for smallholder farmers. To cushion themselves against potential welfare losses, smallholder farmers need to recognize the changes already taking place in their climate and undertake appropriate investments in adaptation. The

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		Discussion Paper Series, EfD DP 15-12.	study investigated whether these smallholder farmers in Tanzania recognized climate change and, consequently, adapt to it in their agricultural activities. The study also investigated the factors influencing their choice of adaptation methods. In order to achieve this, the study analyzed data from 534 randomly selected households in a sample of districts representing six of the seven agro-ecological regions of the country. The data shows that Tanzanian smallholder farmers have observed changes in mean and variance precipitation and temperature and have responded to it. The farmers have generally used short-season crops, drought-resistant crops, irrigation, changing planting dates and tree planting to adapt to the negative impacts of climate change on their agricultural yields. In this study, selection bias is corrected using a Heckman sample selection model. A binary probit model was used as a selection equation to investigate the factors influencing a farmer's decision to undertake any adaptation at all to climate change, while a multinomial probit model is used as an outcome equation to investigate the factors influencing farmers' choice of specific adaptation methods. The inverse Mill's ratio reported selection bias in choosing three of the adaptation methods. The findings of the study suggest that the Tanzanian government needs to help smallholder farmers overcome the constraints they face in their attempts to adapt. The government can play a significant role by promoting adaptation methods appropriate for particular circumstances, e.g., particular crops for different agro-ecological zones.
86		Konin, T. A. (2015). <i>Climate Change Adaptation Strategies: Water Resources Management in Senegal and Sierra Leone</i> (Doctoral dissertation, Johns Hopkins University).	Climate change is known to be a widespread phenomenon that is connected to how much greenhouse gases are emitted into the atmosphere, which in turn is associated with the rapid increase in the global temperature. The increase of these emissions is caused mainly by human activities such as the burning of fossil fuels, causing the massive emission of carbon dioxide and the loss of carbon storage in forests and other natural lands. This project is referencing many data found through extensive research as well as unavailable information. In fact, the project

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			will be based on least developed countries in West Africa. This intends that many necessary data and helpful information will not be available. Climate change can have very serious negative effects on the socio-economic development of a community, if the possible impacts and effects are not identified in order for the appropriate authorities to put suitable adaptive measures. In fact, this could be seen as a barrier that will be encountered while working on this project. This project purpose is answering the core questions concerning the main impacts of climate change on water resources and how to achieve a safe level of sustainability. Water is the main source of life and this sentence has more meaning in least developed countries like in West Africa. Water is a scarce resource, and this is greatly felt West Africa where it suffers from under management. This under management is noticed through diseases, lack of potable water for everyday activities, and the rapid increase in pollution rate
87	Zambia	Lawlor, K., Handa, S., Seidenfeld, D., & Zambia Cash Transfer Evaluation Team. (2015). <i>Cash Transfers and Climate-resilient Development: Evidence from Zambia's Child Grant Programme</i> . Innocenti Working Paper No.2015-03, UNICEF Office of Research, Florence.	Climate change is projected to dramatically disrupt rainfall patterns and agricultural yields in Sub-Saharan Africa, potentially stalling and even reversing gains that have been made in the region's fight against poverty. Many of the coping strategies the rural poor use to cope with failed harvests and other negative income shocks, such as reducing food consumption, selling off productive assets, and pulling children out of school, can mire households in poverty traps – the self-reinforcing conditions that cause poverty to persist. Avoiding detrimental coping strategies that degrade households' capabilities, and thus ability to escape poverty, is essential for building resilience to climate change. This study investigates whether cash transfers enable households facing weather and other negative shocks to avoid coping strategies that lead to poverty traps. We capitalize on the randomized roll-out of Zambia's Child Grant programme and a panel of 2,515 households to estimate impacts. The programme provides a monthly cash payment of 60 kwacha (U.S. \$12) to poor households with children under the age of five. We find that in the

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			face of shocks, cash empowers poor, rural households to employ coping strategies typically used by the non-poor, such as spending savings, and also enables them to substantially increase their food consumption and overall food security. This evidence demonstrates that extending relatively small cash payments unconditionally to the rural poor is a powerful policy option for fostering climate-resilient development.
88	Africa	Leal Filho, W., Esilaba, A. O., Rao, K. P., & Sridhar, G. (2015). <i>Adapting African Agriculture to Climate Change</i> . Springer International Publishing: Imprint: Springer,	Africa is one of the continents mostly severely affected by climate change, for two main reasons. The first reason is because the geographical characteristics of the African continent make it highly vulnerable to the effects of climate change, especially from the projected changes in the rainy seasons and intensivity of droughts, which in turn may affect agriculture and other human activities. The second reason for high vulnerability of African countries is related to their limited capacity to adapt. By not having access to required technological and financial resources that are needed to implement substantial adaptation programmes, many African nations are finding it difficult to handle the many challenges that climate change poses to them. Climate change is also one of the major challenges that the agricultural research community is facing in recent years. Compared to many other biophysical constraints that the smallholder farmer is facing, climate change is a difficult problem to address for various reasons. First, climate change is a future problem and there are problems in assessing the magnitude and direction of these changes accurately, especially at local level. Second, while temperature projections seem to be fairly certain, changes in rainfall both in quantity and in variability are difficult to predict and rainfall is the major factor influencing productivity and profitability of the agricultural systems. Third, our understanding of impacts of projected changes in climate on crop growth and performance, especially the role of changes in carbon dioxide concentration, is limited. Despite these limitations, significant progress has been made in understanding the impacts of climate change on smallholder agricultural systems and in identifying appropriate

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			management options to adapt. Unfortunately, much of the fieldwork carried out in many African countries remained inaccessible to the global community.
89	North Africa Region	Link, P. M., Brücher, T., Claussen, M., Link, J. S., & Scheffran, J. (2015). The nexus of climate change, land use, and conflict: complex human–environment interactions in Northern Africa. <i>Bulletin of the American Meteorological Society</i> , 96(9), 1561-1564.	Northern Africa, especially the Sahel, is particularly vulnerable to climate change because of the region’s strong exposure to increasing temperature, higher precipitation variability, and extended population growth. Primary connectors between the climate system and the human societies in this region are land use and the associated land-cover changes, which mainly affect the areas where substantial subsistence farming occurs. The study sought to answer the questions, how strongly do climate change and land-use change affect each other? And to what extent are climate-induced water, food, and wood shortages associated with land degradation, migration, and conflict?
90	Africa	Locatelli, B., Catterall, C. P., Imbach, P., Kumar, C., Lasco, R., Marín-Spiotta, E. & Uriarte, M. (2015). Tropical reforestation and climate change: beyond carbon. <i>Restoration Ecology</i> , 23(4), 337-343.	Tropical reforestation (TR) has been highlighted as an important intervention for climate change mitigation because of its carbon storage potential. TR can also play other frequently overlooked, but significant, roles in helping society and ecosystems adapt to climate variability and change. For example, reforestation can ameliorate climate-associated impacts of altered hydrological cycles in watersheds, protect coastal areas from increased storms, and provide habitat to reduce the probability of species' extinctions under a changing climate. Consequently, reforestation should be managed with both adaptation and mitigation objectives in mind, to maximize synergies among these diverse roles, and to avoid trade-offs in which the achievement of one goal is detrimental to another. Management of increased forest cover must also incorporate measures for reducing the direct and indirect impacts of changing climate on reforestation itself. Here we advocate a focus on “climate-smart reforestation,” defined as reforestation for climate change mitigation and adaptation, while ensuring that the direct and indirect impacts of climate change on reforestation are anticipated and minimized.

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91	Africa	Locatelli, B., Pavageau, C., Pramova, E., & Di Gregorio, M. (2015). Integrating climate change mitigation and adaptation in agriculture and forestry: opportunities and trade-offs. Wiley Interdisciplinary Reviews: <i>Climate Change</i> , 6(6), 585-598.	This review explores the opportunities and trade-offs when managing landscapes for both climate change mitigation and adaptation; different conceptualizations of the links between adaptation and mitigation are highlighted. After considering three different conceptualizations namely “joint outcomes”, “unintended side effects” and “joint objectives”, this study reveals a diversity of reasons for mainstreaming adaptation and mitigation separately or jointly in landscape management.
92	Africa	Lwasa, S. (2015). A systematic review of research on climate change adaptation policy and practice in Africa and South Asia deltas. <i>Regional Environmental Change</i> , 15(5), 815-824.	Recent years have witnessed a rapid increase in scholarship on adaptation to climate change. Peer-reviewed literature, governmental communiqués and reports are increasingly reporting formulated and implemented climate change adaptation policies, strategies and plans of action. A large part of this literature describes general policy strategies, while there is limited published work on adaptation interventions at the local scale. The generality of adaptation is not only limited to strategies but also in terms of coverage of regions believed to be highly vulnerable to the effects of climate change. Among such climate change “hotspots” where understanding on adaptation is limited are river deltas. Herein, this paper synthesizes selected literature on adaptation policy and practice in river deltas located in Africa and South Asia. A systematic review methodology was used to scan online knowledge portals for published papers and unpublished government documents. The review characterizes the state of adaptation policy in African and South Asian deltas and identifies future research priorities targeting climate change adaptation in large delta regions.
93	Global	Magnan, A., Ribera, T., & Treyer, S. (2015). National adaptation is also a global concern. IDDRI Policy Briefs.	Although national to subnational levels have a key role to play in adaptation, the international community dealing with climate has also a role to play, beyond raising awareness and providing funds. A central argument is that there is risk that countries will not be able to adapt to the current climate change trajectory, and so that non-adaptation will have impacts beyond national boundaries. This paper thus claims that national adaptation is also a global concern. It then argues for the development of



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			a post-2015 Global Adaptation Goal framework allowing monitoring progress and better sharing experiences and, more importantly, building both a collective understanding of what adaptation means and shared tools to capture adaptation efforts and limitations on the field.
94	Africa	Mahmoudi, H., & Knierim, A. (2015). Risk Communication for Farmers' Adaptation to Climate Change: A New Task for Agricultural Advisory Services. <i>International Journal of Performability Engineering</i> , 11(6).	Decision making in agricultural production is a complex process in which many risks such as natural, economic and social ones need to be considered. Climate change is one important example for complex risks causing ambiguities. How can farmers be supported to pro-actively deal with and adapt to climate change? A comprehensive answer to this question can create a good potential for an improved risk communication and governance within agricultural sector. The aim of this paper is to conceptually argue farmers' risk perceptions, roles and tasks that intervention agents such as agricultural advisory services may adopt in order to support farmers' risk management and adaptation to climate change. Two specific approaches namely 'risk communication' and 'social learning' in the frame of risk governance were discussed followed by conclusions drawn on cross-cutting insights and deficits in research and practice.
95	Global	Manuel, C. (2015). Investment climate reform doing it differently: What, why, and how. <i>First synthesis paper</i> .	The Legal Assistance for Economic Reform (LASER) programme (2014-17) is a DFID funded initiative implemented by The Law & Development Partnership and KPMG that supports developing countries in strengthening their investment climates. This LASER product has been written by Clare Manuel, Director of The Law & Development Partnership, with support from Ian Mills and other LASER team members. The report aims to help DFID and other donors better understand why and how to approach investment climate reform programming differently and help development practitioners better understand how best to operate on the ground.
96	Zimbabwe	Manyanhai, I. O. (2015). Integrating indigenous knowledge systems into climate change interpretation:	The theoretical paper argues for the Integration of Indigenous Knowledge Systems (IKS) with modern climate change science as a basis for sustainable comprehensive community-based response to the impacts of



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		perspectives relevant to Zimbabwe. <i>Greener Journal of educational research</i> , 5, 27-36.	climate change. Climate change is a long-term change in weather patterns resulting from natural and human activity. Human beings have a rich history of oral interpretation of climate change and variability through observing changes in behaviour of living organisms within their localities. Such knowledge could be used in determining timing of important agricultural activities, predicting disasters and in the interpretation of climate change. Climate change erodes global environmental sustainability and the repository of IKS. This paper recognizes the power of IKS and proposes a strategy to incorporate it into climate interpretation. Whilst the indicators of climate change like changes in precipitation, temperature, runoff, biodiversity and ecosystems, water resources, oceanic circulations and others are generally understood in modern climate change science literature there is limited research and integration with IKS. In the short to medium term comprehensive documentation of IKS is required as a basis for a national framework policy on climate change and its impacts
97	Uganda	Markandya, A., Cabot-Venton, C., & Beucher, O. (2015). Economic Assessment of the Impacts of Climate Change in Uganda.	This report which mainly discusses The Economic Assessment of the Impacts of Climate Change, presents information about the current “adaptation deficit” in Uganda and the negative consequences and costs that climate variability already has on the Ugandan economy and expected to have under future climate change scenarios. Economic assessments of the impacts of climate change were conducted at the national level for five sectors (agriculture and livestock, energy, water, human settlements, and transport infrastructure) and detailed case studies were carried out in five local level locations: Kampala (focusing on infrastructure), Kabale & Tororo (health), Karamoja (agriculture and livestock), Mount Elgon (coffee), and Mpanga river catchment (water and electricity). The national-level assessment was carried out under two of the latest Representative Concentration Pathways (RCPs) developed as part of the Fifth Assessment Report (AR5) under the Intergovernmental Panel on Climate Change (IPCC). The overall aim is to provide policy makers and

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			international development partners in Uganda with the evidence base on the economic impacts of climate change in order to mobilize increased investment for adaptation in climate-sensitive sectors. The study also aims to increase the capacity of government officials to use the evidence on the economic impacts of climate change in development and investment planning.
98	Swaziland	Mavuso, S. M., Manyatsi, A. M., & Vilane, B. R. (2015). Climate Change Impacts, Adaptation and Coping Strategies at Malindza, a Rural Semi-Arid Area in Swaziland. <i>American Journal of Agriculture and Forestry</i> , 3(3), 86-92.	The objective of the study was to assess the impacts of climate change faced by rural households in the lowveld of Swaziland, using Malindza as a case study area, and further identify adaptation and coping strategies employed by households. A questionnaire was developed and used to conduct interviews from 160 households randomly selected in four rural communities of the study area. Data were analysed with SPSS software, and reported in forms of tables and figures. More or less all the respondents (99%) were aware of climate change and climate change variability, Sources of information included radios (92.5%), television (5.6%) and agricultural extension officers (2%). The information was however considered inadequate and of short-term remedy as it was in the form of daily weather forecast. The perceived effects of climate change included crop failure (99%), loss of livestock (99%) and drying of surface water (99%). Only 9% of the households harvested enough maize to last for a year, and the rest (91%) had to rely on buying maize, exchanging it for labour or receiving food aid. The climate change adaptation strategies practiced included contour ploughing (49%), use of organic fertilisers (29%) and crop rotation (20%). Thirty two percent of the households planted hybrid maize seeds and 15% planted open pollinated maize seeds. Another 26% planted both hybrid maize and open pollinated maize seeds. On the other hand, coping strategies practiced included selling or consuming small livestock and chicken (97%), consuming maize left for seeds (93%) and reducing food intake (23%). It was clear that the effects of climate change in rural areas were severe and needed to be addressed before critical damages like loss of human life manifest. The government

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			should ensure that farmer's knowledge on climate change and variability is increased through education to improve their adaptive capacity.
99	Uganda	Mayanja, M. N., Rubaire-Akiiki, C., Greiner, T., & Morton, J. F. (2015). Characterising food insecurity in pastoral and agro-pastoral communities in Uganda using a consumption coping strategy index. <i>Pastoralism</i> , 5(1), 11.	The study explores the utility of a consumption coping strategy index (CSI) in characterising and assessing the factors influencing household food insecurity. We assessed 53 pastoral and 197 agro-pastoral households in Nakasongola and Nakaseke districts of Uganda, examining the use of 27 consumption coping strategies over a recall time of two 30-day periods, one at the start of a dry season in 2012 and one at the start of a rainy season in 2013. Four categorical food insecurity status measures were established - food secure (CSI 0 to 5) and mildly (CSI 6 to 20), moderately (CSI 21 to 42) and extremely (CSI >42) food insecure. For the dry season, the mean CSI was $29.4 \pm 2.59$ and 33.6 % of households were food secure, while for the rains, mean CSI was $33.1 \pm 2.30$ and 14.0 % of households were food secure. The combination of livelihood system, land holdings, number of livestock owned and belonging to a social network explained 9.4 % to 10 % of the variance in household food insecurity for agro-pastoralists, but variance for pastoralists was not explained by these factors. While the only highly significant factor associated with increasing household food insecurity in the dry season was low landholdings, in the rainy season, it was pastoral livelihood, low livestock holdings for agro-pastoralists and non-involvement in social networks.
100	Africa	Mbungu, W. B., Mahoo, H. F., Tumbo, S. D., Kahimba, F. C., Rwehumbiza, F. B., & Mbilinyi, B. P. (2015). Using climate and crop simulation models for assessing climate change impacts on agronomic practices and productivity. In <i>Sustainable intensification to advance food security and enhance climate resilience in Africa</i> (pp. 201-219). Springer, Cham.	Due to heavy dependence on rain-fed agriculture, most developing countries, particularly Sub-Saharan Africa including Tanzania, are likely to suffer negatively to the impacts of climate change. Future climate projections predict a 2–4 °C rise in temperature by 2100, and rainfall is expected to decrease especially in the interior regions. As a result, grain production is predicted to decrease, and particularly maize, which is the main cereal crop, will experience up to 33 % decrease in yield. To capture the impacts of climate change relevant to agronomic productivity, site-specific assessments are needed to inform adaptation options. This study investigated the impacts of climate change on maize production using

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			<p>outputs of Global Circulation Models (GCMs) and crop simulation models. Current conventional and recommended agronomic practices in Same District, Kilimanjaro region, Tanzania were simulated by Agricultural Production Systems sIMulator (APSIM) model using long-term and projected future climates. Four maize cultivars commonly used in the study area Situka, Kito, Sc401, and TMV1 were used. Results show a yield decline of 13 % for cultivar Situka, and an increase of 10 % and 15 % for cultivars Sc401 and TMV1, respectively, in the long rainy season (March-May) under the conventional practices. A yield increase of 10 % is projected for Sc401 and TMV1 and a decrease of 10 % for Situka and 45 % for Kito cultivars under recommended practices. The short rainy season (October–December) is projected to register yield increases of between 75 and 146 % for all cultivars under both conventional and recommended agronomic practices. Generally, the study has revealed that the yield of only some maize varieties are expected to decrease due to a 2 °C rise in temperature and only during the long rainy season. Therefore, there is a need for more site-specific climate change studies that evaluate several crop varieties grown in the area.</p>
101	Kenya	<p>Mburu, B., Biukung'u, J., &amp; Muriuki, J. N. (2015). Climate change adaptation strategies by small-scale farmers in Yatta District, Kenya. <i>African Journal of Environmental Science and Technology</i>, 9(9), 712-722.</p>	<p>In Yatta District, residents report frequent crop failures, water shortages and relief food has become a frequent feature of their life. This study examines the adaptation strategies to climate change adopted by the dry-land farming communities in Yatta District. Study participants included 510 randomly sampled small-scale farmers. Key informants were district departmental heads from the Ministries of Water, Agriculture and Environment. Questionnaires, interviews, Focus Group Discussions and field observations were used to generate the data. Quantitative data was analysed using Statistical Package for Social Sciences (SPSS) whereas qualitative data was analysed through establishing the categories and themes, relationships/patterns and conclusions drawn in line with the study objectives. Findings indicate that most farmers adopted autonomous adaptation strategies that included planting drought tolerant crops</p>

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			(76.5%), charcoal burning (52.9%) and rainwater harvesting (20.2%) among others. Chi square results indicated that age, level of education and knowledge of climate change had significant influences on adaptation strategies. Some of these strategies had serious adverse environmental impacts on social, economic and biophysical domains of the environment like putting future agricultural production at risk since farms have been converted into sand mining fields. Major limitations to climate change adaptation were financial constraints (93.4%), lack of relevant skills (74.5%) and lack of scientific and technical knowledge (71.6%). The study concludes that farmers are engaging in adaptation strategies that are fundamentally changes in livelihoods and mainly unsustainable. Livelihood activities such as charcoal burning and sand harvesting in their fragile arid and semi-arid lands ecosystem are destructive and thus, not sustainable. These livelihood changes are significantly influenced by levels of education and climate change knowledge. The study recommends that agricultural extension services be enhanced to sensitize the farmers about climate change thus improving their perception and adaptation strategies.
102	South Africa	McGregor, E. S. (2015). <i>Assessing the implementation efficacy of an Ecosystem Approach to Fisheries management in the South African sardine fishery</i> (Doctoral dissertation, University of Cape Town).	An Ecosystem Approach to Fisheries management (EAF) offers a holistic approach for sustainable fisheries management by extending the traditional target resources-orientated management (TROM) to include wider social-ecological dimensions of fisheries. An EAF requires balancing of multiple, often conflicting objectives, effectively dealing with complexity and uncertainty, and engaging with diverse groups of stakeholders. Various tools within the field of Multi-criteria Decision Analysis provide a formal approach which takes explicit account of multiple criteria, while effectively dealing with risk and uncertainty. A knowledge-based tool was developed in this thesis to assess the efficacy of EAF implementation for the ecological well-being dimension in the South Africa sardine fishery. An iterative, participatory approach was adopted for its implementation. The modelling philosophy applied a rapid

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			<p>prototyping approach, and an applied research perspective was employed to direct the research. A broad group of stakeholders participated in indicator selection, tool design, and interpretation. The knowledge-based tool provided a hierarchical framework for seven specific management objectives to which eleven ecological indicators were linked. Time series (1987-2009) were collated for each indicator, and a utility approach was used to transform indicators to a common scale. Weights for indicators and objectives were agreed to by stakeholders and combined through the objectives' hierarchy using weighted means. The resulting outputs were discussed in detail during focus group meetings to ensure that the tool was clearly presented and as intended helped improve the stakeholder's understanding of the process. It was confirmed that the 20 knowledge-based tool presents a transparent, repeatable and scientifically defensible approach, suitable to meet management requirements. The tool development process was useful in bringing diverse stakeholder groups together, and through applying the tool as a boundary object, has helped to bridge the boundary between the TROM and EAF research communities. Encouraging stakeholder interaction offers opportunities for social learning, which if carefully facilitated through the tool development process is likely to enhance the outcomes of this process and support more generally in bridging boundaries to EAF implementation. The combined focus on tool development and social processes supports effective implementation of an EAF in the South African small pelagic fishery and provide a model for other fisheries</p>
103	Ethiopia	<p>Mengistu Asmamaw, Argaw Ambellu, Seid Tiku. (2015). Resilience of Ecosystems to Climate Change <i>American Journal of Environmental Protection</i>. 325-333.</p>	<p>This is a review paper on resilience of Ecosystem to climate change. The objective of this review was to examine the potentials of ecosystems in mitigating climate change and in building resilience in Ethiopia. A review of relevant literature was employed as possible approach to compile the document. The authors explained that climate change exacerbates environmental hazards, ecosystem modification as well as loss of biological organisms. The average global temperature has risen more</p>

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			linearly for the last 100 years mainly by releases of greenhouse gases (e.g. CO <sub>2</sub> ). These have resulted in recurrent drought, flooding and reduction in agricultural productivity as a whole. They concluded that unless ecosystems become resilient enough against environmental disturbances, no life could exist on this planet. Therefore, ecosystem resilient should be built through adaptation and mitigation strategies so as to reverse current emissions as well as to adapt to live with uncertainty.
104	North Africa Region	Mentis, D., Hermann, S., Howells, M., Welsch, M., & Siyal, S. H. (2015). Assessing the technical wind energy potential in Africa a GIS-based approach. <i>Renewable Energy</i> , 83, 110-125. Retrieved December, 4 2018 from <a href="https://www.sciencedirect.com/science/article/pii/S0960148115002633">https://www.sciencedirect.com/science/article/pii/S0960148115002633</a>	The authors begun by explaining how Africa has underutilized the wind energy by which the continent is privileged with. Since the utilization of wind energy is associated with a myriad of localization criteria, they systematically addressed it by spatial assessments to guarantee its harmonization with socio-economic systems, infrastructure, and ecosystems. The study maps wind power potential at 80 m, the hub height of a modern wind turbine derived via statistical distribution of wind speed data and implementation of wind power curves, on the African continent. The theoretical, geographical and technical wind power potential are estimated in this study. The authors begun by explaining how Africa has underutilized the wind energy by which the continent is privileged with. Since the utilization of wind energy is associated with a myriad of localization criteria, they systematically addressed it by spatial assessments to guarantee its harmonization with socio-economic systems, infrastructure, and ecosystems. The study maps wind power potential at 80 m, the hub height of a modern wind turbine derived via statistical distribution of wind speed data and implementation of wind power curves, on the African continent. The theoretical, geographical and technical wind power potential are estimated in this study. The results of this work are presented and compared with similar approaches and significant conclusions are drawn. Based on the analysis most of the north Africa countries signify high yearly wind energy yield, such as Algeria, Egypt, Libya, Mauritania, Tunisia and Morocco.



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105	Africa	Midgley, G. F., & Bond, W. J. (2015). Future of African terrestrial biodiversity and ecosystems under anthropogenic climate change. <i>Nature Climate Change</i> , 5(9), 823-829.	Projections of ecosystem and biodiversity change for Africa under climate change diverge widely. More than other continents, Africa has disturbance-driven ecosystems that diversified under low Neogene CO2 levels, in which flammable fire-dependent C4 grasses suppress trees, and mega-herbivore action alters vegetation significantly. An important consequence is metastability of vegetation state, with rapid vegetation switches occurring, some driven by anthropogenic CO2-stimulated release of trees from disturbance control. These have conflicting implications for biodiversity and carbon sequestration relevant for policymakers and land managers. Biodiversity and ecosystem change projections need to account for both disturbance control and direct climate control of vegetation structure and function.
106	Ghana	Ministry of Environment, Science, Technology and Innovation. (2015). Ghana National Climate Change Master Plan Action Programmes for Implementation: 2015–2020. 978-9988-2-2631-2	National Climate Change Policy (NCCP), provides a clearly defined pathway for dealing with the challenges of climate change. The Policy takes account of the current socioeconomic context of Ghana and incorporates the opportunities and benefits of a green economy. The NCCP process identified ten Policy Focus Areas for addressing Ghana's climate change challenges and opportunities. Develop climate-resilient agriculture and food security systems; Build climate-resilient infrastructure; Increase resilience of vulnerable communities to climate-related risks; Increase carbon sinks; Improve management and resilience of terrestrial, aquatic and marine ecosystems; Address the impact of climate change on human health; Minimize the impact of climate change on access to water and sanitation; Address gender issues in climate change; Address climate change and migration; and Minimize greenhouse gas emissions.
107	Global	Molua, M. E. (2015). <i>Implementation of the Ecosystem Approach to Fisheries; an institutional solution in fisheries management. The case of the ground-fisheries IFMP, Canada</i> (Master's	Fisheries management institutions call the shots in fisheries management. Coming at a time when, global fish stocks are experiencing decline at an ever-increasing rate, sectorial single species approaches cannot be looked upon solely to provide sustainable fisheries. This is foremost because studies have revealed that, the problems associated with the management



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		thesis, UiT The Arctic University of Norway).	of stocks are manmade and have a sporadic effect on the entire aquatic ecosystem, thus management must be holistic, and comprehensive enough considering those challenges. Global entities such as, the Food and Agricultural Organisation (FAO) and Multi-lateral Agreements have adopted an Ecosystem Approach to Fisheries (EAF) to sustainably manage fisheries. The FAO, charged with the development of guidelines and frameworks for fisheries management worldwide, has developed an EAF implementation roadmap to facilitate its implementation by States and Regional Organizations. The Convention of Biodiversity and the Code of Conduct for Responsible Fisheries represents a move towards the EAF. That move, is within the framework of the Law of the Sea Convention. The duty, to implement an EAF is facultative and depends largely on States sovereign will. Be that as it may, member States of UNCLOS and other global policies such as Canada are committed and have successfully adopt an EAF in their national policies and management plans. The Integrated Fisheries Management Plan (IFMP), was developed to manage the ground-fisheries in the Pacific region of Canada due to decline of stocks and habitat degradation witnessed in the fishery. The IFMP, is consistent with the FAO implementation roadmap, global policy recommendation and has successfully achieved its objectives. Its worthy of note that, the success of the IFMP goes beyond Canada's political will to adhere to global policies and guidelines. This study explores the institutional and policy framework which underpin an EAF from a global perspective and how the EAF is implemented in the IFMP. This study focuses solely, on the implementation of the EAF from a human dimension. Keywords: Ecosystem Approach to Fisheries; Integrated Fisheries Management Plan; United Nations Law of the Sea Convention; Fisheries management institutions.
108	Tanzania	Msongaleli, B. M. (2015). <i>Assessment of the impacts of climate variability and change on rainfed cereal crop</i>	Though production of cereal crops in Tanzania could succumb to the projected climate change, research has mainly focused on maize ( <i>Zea mays</i> L), the main staple crop for the country, and just little work has been

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		<i>productivity in central Tanzania</i> (Doctoral dissertation, Sokoine University of Agriculture).	done to analyse climate change impacts specifically on sorghum [Sorghum bicolor (L) Moench]. This study analysed the nature and sources of vulnerability on sorghum production by smallholder farmers due to climate variability and change and evaluated possible farm-level adaptation options that can enhance the adaptive capacity of smallholder farmers in the face of increased climate variability and long-term change in climate. The study was conducted in Dodoma and Singida regions in central Tanzania. Local famers' management practices from databases and surveys were combined with field experimentation and simulation modelling. The Agricultural Production Systems SIMulator (APSIM) and Decision Support System for Agro-technological Transfer (DSSAT) models were calibrated and validated to predict growth and yield of sorghum under rainfed conditions in the case study regions. Three sorghum varieties: Macia, Pato and Tegemeo were used. The models were parameterized using different agronomic parameters (phenological development, dry matter accumulation and grain yield) and climatic data. Efficiency of the models were tested using model validation skill scores including d-stat, root mean square error (RMSE) and regression coefficient (R <sup>2</sup> ). To understand the nature of vulnerability, long term historical rainfall data were analysed. Simulations were conducted to evaluate the impacts and interactions of adaptation options, namely: staggered planting dates, recommended planting density, and variable fertilizer rates on sorghum and maize yields under long-term climate change towards the mid-century. The long-term rainfall analysis shows that total annual rainfall has so far not changed, but variability in the rainfall distribution within seasons has increased. Experimentation in this study demonstrated that the tested sorghum varieties had variable maturity dates and different responses to prolonged dry spells.
109	Tanzania	Msongaleli, B. M., Rwehumbiza, F., Tumbo, S. D., & Kihupi, N. (2015). <i>Impacts of climate variability and</i>	Concern about food security has increased because of a changing climate, which poses a great threat to food crop productivity. Climate change projections from the Coupled Model Inter-comparison Project phase 5

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		<i>change on rainfed sorghum and maize: implications for food security policy in Tanzania</i> (Doctoral dissertation), Sokoine University of Agriculture. Morogoro, Tanzania.	(CMIP5) and crop models were used to investigate the impacts of climate change on rain-fed cereal production. Calibrated and evaluated crop models simulated maize and sorghum yields over time periods and scenarios across central zone Tanzania with and without adaptation. Simulation outputs without adaptation showed predominant decrease and increase in maize and sorghum yields, respectively. The results showed that maize yields were predicted to decline between 1% and 25% across periods, representative concentration pathways (RCPs) and global circulation models (GCMs). However, sorghum yields were on average predicted to increase between 5% and 21%. Overall when adaptation is incorporated toward mid-century, yields are projected to increase for both crops. The yield projections variation between cereal crops highlights the importance of location and crop specific climate change impact assessments. Despite the uncertainties in predicting the impacts of climate change on rainfed crops, especially on cereals (maize and sorghum) which are important staple food crops in semi-arid Tanzania, the findings of this study enable policy makers to develop plans aimed at sustainable food security. In conclusion, the results demonstrate the presumption that sorghum productivity stands a better chance than maize under prospects of negative impacts from climate change in central zone Tanzania.
110	Uganda	Mubiru DN, Kyazze FB, Radeny M, Zziwa A, Lwasa J, Kinyangi J. (2015). Climatic trends, risk perceptions and coping strategies of smallholder farmers in rural Uganda. CCAFS Working Paper no. 121. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark.	Smallholder farmers in Uganda face a wide range of agricultural production risks, with climate change and variability presenting new risks and vulnerabilities. Climate related risks such as prolonged dry seasons have become more frequent and intense with negative impacts on agricultural livelihoods and food security. This paper assesses farmers' perceptions of climate change and variability and analyses historical trends in temperature and rainfall in two rural districts of Uganda in order to determine the major climate-related risks affecting crop and livestock production and to identify existing innovative strategies for coping with and adapting to climate-related risks, with potential for up-scaling in rural districts. The traditional coping strategies that have been developed by

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			these community's overtime provide a foundation for designing effective adaptation strategies. Drought, disease and pest epidemics, decreasing water sources, lack of pasture, bush fires, hailstorms, changes in crop flowering and fruiting times were the major climate-related risks reported across the two districts. Farmers use a wide range of agricultural technologies and strategies to cope with climate change and climate variability. Mulching, intercropping and planting of food security crops were among the most common practices used. Other strategies included water harvesting for domestic consumption, other soil and water conservation technologies and on-farm diversification. Farmers often use a combination of these technologies and practices to enhance agricultural productivity. The average maximum temperatures increased across the two districts. Trends in average annual rainfall showed mixed results with a general decline in one district and a relatively stable trend in the other district. Perceived changes in climate included erratic rainfall onset and cessation, which were either early or late, poor seasonal distribution of rainfall and little rainfall. Farmers also reported variations in temperatures. Farmers' perception of changing rainfall characteristics and increasing temperatures were consistent with the observed historical climatic trends from meteorological data.
111	kenya	Munang, R., Mgendi, R., Alverson, K., O'Brien-Onyeka, M., Ochieng, C., Molua, E. & Bekele, W. (2015). <i>Ecosystem Based Adaptation (EBA) for food security in Africa-Towards a comprehensive Strategic Framework to Upscale and Out-scale EbA-driven agriculture in Africa. United Nations Environment Programme (UNEP), Nairobi.</i> Retrieved from <a href="http://www.afsac2.aaknet.org/index">http://www.afsac2.aaknet.org/index</a> .	Africa faces a myriad of hurdles on its way to achieving the Millennium Development Goals (MDGs) and the post-2015 development agenda. Climate change, population growth, youth bulge, widespread unemployment, extreme poverty and hunger are some of the challenges that the continent is grappling with. Beyond the farm gate, this paradigm proposes value addition through food processing and the application of storage and mobile technologies to reduce postharvest losses and unlock additional income and job opportunities. Affordable storage technologies and deployment of mobile innovations to enhance market and financial access are among the propositions discussed. Cumulatively, the proposed holistic policy paradigm shift potentially brings 5 distinct benefits to

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		php/downloads/publications/item/69-towards-a-comprehensive-strategic-framework-to-upscale-and-out-scale-eba-driven-agriculture-in-africa.	Africa's food sector – enhances food and nutritional security, enhances ecosystem productivity, builds community climate resilience, enhances value chains by linking on farm production with opportunities for both demand and supply value chains, creates jobs and more incomes. A strategic framework to operationalize the new agriculture paradigm that imbeds ecosystem-based adaptation approaches is documented. This framework captures key operational aspects of institutions, financing, knowledge management and monitoring & evaluation. The case for a stronger political and financial support is made for investments in ecosystem based adaptation for food security in Africa as this provides an opportunity to pave forward a future that is not marked by conflict but by cooperation, not by human suffering, but by human progress as we seek to achieve, in the words of Nelson Mandela, “an Africa where there is work, bread, water and salt for all’.
112	Tanzania	Munishi, L. K., Lema, A. A., & Ndakidemi, P. A. (2015). Decline in maize and beans production in the face of climate change at Hai District in Kilimanjaro Region, Tanzania. <i>International Journal of Climate Change Strategies and Management</i> , 7(1), 17-26.	The purpose of this paper is to show how climatic change in Africa is expected to lead to a higher occurrence of severe droughts in semiarid and arid ecosystems. Understanding how crop productions react to such events is, thus, crucial for addressing future challenges for food security and poverty alleviation. The authors explored how temperature and rainfall patterns determined maize and beans production in Hai District in Kilimanjaro Region, Tanzania. Annual food crops were particularly sensitive to the drought and maize and beans yields were lower than perennial crops during the years of drought. The authors also report strong and significant association between maize and beans production with temperature and rainfall patterns.
113	Uganda	Munroe, R., Hicks, C., Doswald, N., Bubb, P., Epplé, C., Woroniecki, S., ... & Osti, M. (2015). Guidance on integrating ecosystem considerations into climate change vulnerability and impact assessments to inform	This Guidance provides information and advice on how to integrate consideration of ecosystems and their services into a climate change Vulnerability and Impact Assessment (VIA). It is informed by the experience of the Ecosystem-based Adaptation in Mountain Ecosystems Project focused on Nepal, Peru and Uganda where UNEP (UNEP-WCMC), in collaboration with partners IUCN and UNDP, undertook

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		ecosystem-based adaptation. <i>UNEP-WCMC, Cambridge, UK.</i>	extensive work on VIAs to build a case for better understanding of climate resilience as it relates to mountain ecosystems. The work is supported by the Federal Ministry for Environment, Nature Conservation, Building and Nuclear Safety of the Federal Republic of Germany. VIAs are conducted to inform the objectives, focus and content of adaptation interventions and strategies, and many approaches, tools and methods now exist to guide this process. However, despite this plethora of guidance, there are significant challenges to fully capturing the complexity of social-ecological systems and their vulnerabilities in VIAs. This Guidance addresses these challenges and recognizes the importance of designing assessments of social vulnerability to climate change so that they take account of potential changes in the supply of and demand for ecosystem services (the benefits that people obtain from ecosystems) that support livelihoods, the well-being of societies and their adaptation strategies. Using the steps described can provide a strong basis for identifying options for ecosystem-based adaptation to climate change (EBA), as part of wider adaptation planning.
114	Tanzania	Mutabazi, K. D., Amjath-Babu, T. S., & Sieber, S. (2015). Influence of livelihood resources on adaptive strategies to enhance climatic resilience of farm households in Morogoro, Tanzania: an indicator-based analysis. <i>Regional environmental change</i> , 15(7), 1259-1268.	The article attempts to identify a set of resilience-building adaptive strategies (intensification, diversification, alteration, migration, etc.) among farmers in Morogoro, Tanzania, and crafts a composite index of these strategies using a principal component analysis-based weighting scheme. The analysis also reveals the latent structure and internal correlations of actions intended to build resilience of the farming systems. Subsequently, the linkages of livelihood resources (natural, human, social and financial capitals) to the resilience-building strategies are examined. A multiple regression analysis is employed to link the composite index to variables representing the four capitals. The results bring quantitative evidence to the linkages and highlight the need of enhancing livelihood resources to enhance the ability to undertake adaptive strategies that denotes the ability to withstand stresses and shocks from climatic changes. Actions to improve human capital (awareness campaigns on climate

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			change impacts as well as possible adaptive strategies), social capital (strengthening social networks, improving tenure security), financial capital (increasing credit availability) and natural capital (measures to enhance agricultural potential, support for adaptive action in areas with low agricultural potential) are needed in order to impart resilience to the farming systems against the changing climate.
115	Tanzania	Mutabazi, K. D., Sieber, S., Maeda, C., & Tscherning, K. (2015). Assessing the determinants of poverty and vulnerability of smallholder farmers in a changing climate: the case of Morogoro region, Tanzania. <i>Regional environmental change</i> , 15(7), 1243-1258.	This paper analyses the determinants of poverty and vulnerability of smallholder farmers in the rural areas in the face of climate change. The data were collected through a cross-sectional survey conducted between December 2009 and January 2010 covering 240 households in six villages of Morogoro region, Tanzania. Descriptive and the econometric approaches involving three-stage least squares (3SLS) and generalized methods of moments (GMM) regressions were used to analyse poverty and vulnerability. Results indicate that income poverty was prevalent in the study area—based on a daily income per capita poverty line of US\$ 1.25. The income poverty was relatively higher in agro-climatically less-favourable area than in favoured areas. Over three quarters of the sample households were vulnerable. The pattern of future vulnerability tended to overlap with poverty rates. Ageing of the household head tended to increase the level of vulnerability. Large-sized households were more income-poor than their counterpart small-sized households. Farming experience reduced the probability of future vulnerability. Increased farm size enhanced the level of income, and further increase in farm size reduced future vulnerability. Higher income contributed to wealth formation through improved access to assets and housing amenities. Farmers who perceived that climate change is human-induced tended to have significantly higher income than otherwise. The following conclusions with policy implications are drawn from the findings: (1) addressing poverty and vulnerability of farmers is critical particularly in relatively agro-ecologically less-favoured areas that are prone to climate change impacts, (2) old-age-related vulnerability must be addressed



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			through dedicated policies and programmes, (3) increasing farm size would enhance smallholder farm income, (4) awareness creation among farmers on climate change drivers and processes by highlighting anthropogenic contribution is important in order to influence local adaptation and mitigation practices, and (5) improving rural income will advance wealth creation and foster local livelihood resilience to shocks including climate change.
116	East Africa	Naess, L. O., Newell, P., Newsham, A., Phillips, J., Quan, J., & Tanner, T. (2015). Climate policy meets national development contexts: Insights from Kenya and Mozambique. <i>Global Environmental Change</i> , 35, 534-544.	Despite the growth in work linking climate change and national level development agendas, there has been limited attention to their political economy. These processes mediate the winners, losers and potential trade-offs between different goals, and the political and institutional factors which enable or inhibit integration across different policy areas. This paper applies a political economy analysis to case studies on low carbon energy in Kenya and carbon forestry in Mozambique. In examining the intersection of climate and development policy, we demonstrate the critical importance of politics, power and interests when climate-motivated initiatives encounter wider and more complex national policy contexts, which strongly influence the prospects of achieving integrated climate policy and development goals in practice. We advance the following arguments: First, understanding both the informal nature and historical embeddedness of decision making around key issue areas and resource sectors of relevance to climate change policy is vital to engaging actually existing politics; why actors hold the positions they do and how they make decisions in practice. Second, we need to understand and engage with the interests, power relations and policy networks that will shape the prospects of realising climate policy goals; acting as barriers in some cases and as vehicles for change in others. Third, by looking at the ways in which common global drivers have very different impacts upon climate change policy once refracted through national levels institutions and policy processes, it is easier to understand the potential and limits of translating global policy into local practice. And fourth, climate change



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			and development outcomes, and the associated trade-offs, look very different depending on how they are framed, who frames them and in which actor coalitions. Understanding these can inform the levers of change and power to be navigated, and with whom to engage in order to address climate change and development goals.
117	Africa	NASAC. (2015). Climate Change Adaptation and Resilience in Africa Recommendations to Policymakers. Network of African Science Academies.	As a consequence of Africa's diversity, climate change impacts will depend on the peculiar climate, environmental and socio-economic set-up of particular sub-regions. For example, Central, and more so, Eastern Africa are expected to experience major impacts that will be driven by changes in seasonal rainfall and extreme rainfall and drought events, while large parts of Western, Northern and Southern Africa will likely experience significant reductions in overall rainfall amounts, becoming hotter and drier. Warming of fresh and marine waters is impacting on fisheries productivity: warming in freshwaters tends to reduce fisheries production, but in the marine system there may be some short-term benefits. In coastal zones and Small Island Developing States (SIDS), flood risks resulting from sea-level rise and sporadic storm surges will increase. All these changes will have severe attendant impacts on the socio-economic fabric of Africa's nations, including declines in water availability, reduced agricultural production, heightened risk of diseases, and destruction of infrastructure, ecosystem changes and biodiversity loss. Adaptation to these expected changes is key, if the Africa region is to continue on the path of growth and sustainable development even in light of the projected negative impacts of climate change on the natural and socio-economic fabric of the continent. This particular booklet focuses on providing concise assessments of the effects or impacts of climate change in the water, agriculture and fisheries, and health sectors, as well as coastal/urban zones where a significant proportion of Africa's population dwells, and provides adaptation options that are specific to each of these sectors or zones.

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118	Uganda	NatureUganda (2015). <i>Ecosystem-based approaches to Climate Change Adaptation, Local guidance</i> . NatureUganda, Kampala, Uganda.	The EbA is presented as a way of using biodiversity and ecosystem services as part of an overall strategy to help people adapt to the adverse impacts of climate change. It takes into account anticipated climate change impacts and reduces the vulnerability of communities to these impacts by using sustainable management, conservation and restoration of ecosystems. EbA approaches are helping people adapt to the impacts of climate change at local levels. In response to growing climate change pressures, Ecosystem-based approaches have emerged as a promising strategy to increase the resilience of ecosystems and support sustainable livelihoods. Other development organisations prefer to use Community-based Approaches that considers community led processes, based on community's priorities, needs, knowledge and capacities, which should empower people to plan for and cope with the impacts of climate change. These two approaches are complementary and should be integrated for greater impact.
119	Uganda	NatureUganda (2015). <i>Ecosystem-based approaches to Climate Change Adaptation, National guidance</i> . NatureUganda, Kampala, Uganda.	These national guidance on Ecosystem-based Approaches to climate change Adaptation (EbA) document and analyse good practice examples of EbA approaches in Uganda. The guidance aim to strengthen the capacity of stakeholders at national level to achieve the mainstreaming of ecosystem-based approaches in the national climate adaptation policy framework, and to ensure their sustained implementation on the ground. Uganda's economy is highly dependent on climate-sensitive natural resources, which are already negatively impacted on by adverse effects of climate change. Many of Uganda's water bodies are shrinking in volume. The rains are becoming more unpredictable and unreliable and some parts of the country are experiencing water stress conditions that traditionally did not experience these conditions. The increasing climate change related negative impacts are a big threat to all the drivers of Uganda's economic development especially the agricultural, water, and forestry and energy sectors among others. Adaptation to climate change impacts is urgently needed. In Uganda, EbA have been demonstrated through the following

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			scenarios: (a) building resilience through Vulnerability Impact Assessments (VIA) and Community Environment Conservation Fund (CECF); (b) making EbA work through Public-Private-Partnerships (PPP) in ecosystem/ landscape restoration approach; (c) linking EbA to Payment for Ecosystems Services (d) landscape restoration taking actions through local adaptation actions; (e) zones and villages adaptation actions, as an approach to building community resilience and (f) building resilience through Community Conservation Groups and on-farm interventions. In order to support the future for EbA, policy makers and leaders at all levels will need to take lessons from examples of the EbA projects implemented in Uganda and described here.
120	Sub-Saharan Africa	Ngoran, S. D., Dogah, K. E., & Xue, X. (2015). Assessing the impacts of climate change on water resources: The Sub-Saharan Africa perspective. <i>Journal of Economics and Sustainable Development</i> , 6(1), 185-193.	This work paints a clear picture of the impacts of climate change on water resources in Sub-Saharan Africa (SSA) and showcases that the population in this section of the continent value water as much as they value life. Deteriorating water resources in SSA due to climate change have numerous negative ramifications, such as increasing food insecurity, transboundary conflicts and rising health problems among other socioeconomic consequences. While SSA countries have contributed little to the magnitude of the global problem, they stand to bear some of the serious consequences. It is imperative that the most affected vulnerable communities with climate change be given assistance and the means to diversify their economies and develop adaptive measures to climate change. Looking beyond command and control policy and regulatory measures, emphasizing on market-based approaches falls within proactive measures that can mitigate the adverse effects of climate change. Despite the number of strategies that have been identified to help SSA countries cope with the impacts of climate change on water resources, no single approach is adequate to address the problems. Since many of the impacts are subjective in nature, the holistic approach via the application of integrated methods is much solicited in addressing the challenges of climate change in SSA. Therefore, shedding more light into the SSA-

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			climate change-water resources interconnection will provide great insight to proactively address the situation and pave the way for sustainable water resource management in SSA.
121	Kenya	Ngugi, L. W., Rao, K. P. C., Oyoo, A., & Kweni, K. (2015). Opportunities for coping with climate change and variability through adoption of soil and water conservation technologies in semi-arid Eastern Kenya. <i>In Adapting African Agriculture to Climate Change</i> (pp. 149-157). Springer, Cham.	Scenario analysis using data generated from APSIM model was conducted to investigate the effect of soil and water conservation practices (tied ridges and mulching) on grain yield of improved maize varieties (Katumani and Makueni) generated with and without N fertilizers under below normal (<250 mm), normal ( $\geq 250 < 350$ mm) and above normal seasons ( $\geq 350$ mm) in two sites, Katumani and Makindu in Machakos and Makueni counties Eastern Kenya. Results indicate that the yields were significant (<0.01) under the different seasons and treatments with the magnitude of the yields response varied. Highest yields in Katumani (3,370 kg/ha) were obtained during below normal seasons and when both fertilizer and tied ridges were used. In Makindu, however, under all treatments, highest yields were obtained during above normal seasons with 3,708 kg/ha yield when 40 kg N/ha fertilizer was applied. Lowest yields on the other hand, were obtained during normal seasons in both sites with 507 kg/ha in Katumani and 552 kg/ha under tied ridges and mulching + fertilizers in Makindu. Compared with farmers practice (control), the yield increment obtained was 4 kg/ha (0.6 %) and 5 kg/ha (0.7 %) in Katumani; 32 kg/ha (4.6 %) and 33 kg/ha (4.7 %) in Makindu under mulching and tied ridges respectively during below normal seasons otherwise the yield decreased during normal and above normal seasons with up to 19 % in Makindu when tied ridges was practised. Fertilization increased the yields of maize by as high as 2,552 kg/ha (433 %) and 2,319 kg/ha (166 %) in Katumani and Makindu respectively during above normal seasons. However, during normal seasons, there was yield decrease in Makindu by 42 %. When both fertilization and soil and water conservation practices was done, yield increase was 2,335 kg/ha (456 %) and 2,382 kg/ha (465 %) in Katumani during normal seasons under mulching +40 kg N/ha and tied ridges +40 kg N/ha respectively. In

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			Makindu, yields declined during normal seasons, however, increase was by 2,229 kg/ha (160 %) and 2,108 kg/ha (152 %) during above normal seasons under mulching +40 kg N/ha and tied ridges +40 kg N/ha respectively. The results indicate that the use of fertilizers and soil and water conservation are indispensable for ensuring food security in semi-arids where rainfall is very variable.
122	East Africa	Nicol, A.; Langan, S.; Victor, M.; Gonsalves, J. (Eds.) (2015). <i>Water-smart agriculture in East Africa</i> . Colombo, Sri Lanka: International Water Management Institute (IWMI). CGIAR Research Program on Water, Land and Ecosystems (WLE); Kampala, Uganda: Global Water Initiative East Africa (GWIEA)	Continental impacts vary significantly due to the diversity of environments across Africa, and there are many places and people with a high degree of adaptability and resilience to a range of climatic conditions. The differing impacts result from a variety of interconnected factors, including socio-economic conditions, agricultural technologies, and the natural resource base. Therefore, a variety of options and opportunities exists for countries to increase their resilience. Meeting the challenges posed by climate change requires a holistic response comprising assessment, use of appropriate technologies and interventions, diversified livelihoods, and sustainable policies.
123	Nigeria	Nwajiuba, C., Emmanuel, T. N., & Bangali Solomon, F. A. R. A. (2015). State of Knowledge on CSA in Africa: Case Studies from Nigeria, Cameroun and the Democratic Republic of Congo. In <i>Forum for Agricultural Research in Africa, Accra, Ghana</i> ISBN (pp. 978-9988).	The niche offered by Climate Smart Agriculture (CSA) is the triple possibility of simultaneously raising productivity, enhancing resilience and mitigating carbon emission. These three possibilities address existing challenges to agriculture in the African continent, which include in the least, the urgency of food insecurity, climate change, and related carbon emission. To effectively address these at the African level requires innovations, technologies and policy interventions that are knowledgebased. The Forum for Agricultural Research in Africa (FARA), with support from the Norwegian Agency for Development (NORAD) is facilitating research, policy and advocacy on CSA. However, in order to effectively do this there is need to understand the state of knowledge on CSA in Africa and possibly learn best practices that may be extended to various regions and farming systems in the continent. This study focused on three countries in the West and Central African regions – Nigeria,

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			Cameroun, and the Democratic Republic of the Congo - is a component of an Africa– wide effort.
124	Ghana	Nyantakyi-Frimpong, H., & Bezner-Kerr, R. (2015). The relative importance of climate change in the context of multiple stressors in semi-arid Ghana. <i>Global Environmental Change</i> , 32, 40-56.	This paper investigates the relative importance of climate change in the context of multiple stressors in semi-arid Ghana. It draws upon ethnographic research in two agrarian villages, and integrates theories from resilience, vulnerability and feminist political ecology. The findings empirically demonstrate that many farmers do not worry about climate change, even in situations where local perceptions and the climate data show a clear pattern of variability. Additionally, the paper provides evidence of a ‘gendered double exposure,’ whereby patriarchy and local culture shape how different social groups are impacted by climate change. Overall, the emerging findings suggest that an overemphasis on scenario-based climate change impacts may detract attention from equally important non-climatic factors that loom large in people's lives. The article's central argument is not meant to downplay the ongoing impacts of climate change in Africa. It rather suggests that climate change should be addressed as one problem among many socio-ecological challenges facing smallholder farmers.
125	Kenya	Nyberg, G., Knutsson, P., Ostwald, M., Öborn, I., Wredle, E., Otieno, D. J. & Grönvall, A. (2015). Enclosures in West Pokot, Kenya: Transforming land, livestock and livelihoods in drylands. <i>Pastoralism</i> , 5(1), 25.	Dryland livestock production systems are changing in many parts of the world, as a result of growing human populations and associated pressure on water and land. Based on a combination of social and natural science methods, we studied a 30-year transformation process from pastoralism to a livestock-based agro-pastoral system in northwestern Kenya, with the overall aim to increase the understanding of the ongoing transition towards intensified agro-pastoralist production systems in dryland East Africa. Key to this transformation was the use of enclosures for land rehabilitation, fodder production, and land and livestock management. Enclosures have more soil carbon and a higher vegetation cover than adjacent areas with open grazing. The level of adoption of enclosures as a management tool has been very high, and their use has enabled agricultural diversification, e.g. increased crop agriculture, poultry

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			production and the inclusion of improved livestock. Following the use of enclosures, livelihoods have become less dependent on livestock migration, are increasingly directed towards agribusinesses and present new opportunities and constraints for women. These livelihood changes are closely associated with, and depend on, an ongoing privatization of land under different tenure regimes. The results indicate that the observed transformation provides opportunities for a pathway towards a sustainable livestock-based agro-pastoral system that could be valid in many dryland areas in East Africa. However, we also show that emergent risks of conflicts and inequalities in relation to land, triggered by the weakening of collective property rights, pose a threat to the sustainability of this pathway.
126	Global	OECD (2015b), The economic consequences of climate change, OECD Publishing, Paris, <a href="http://dx.doi.org/10.1787/9789264235410-en">http://dx.doi.org/10.1787/9789264235410-en</a> .	Climate risks, and the measures to address them, are inherently linked with other policy measures. The efficiency and effectiveness of adaptation planning can be increased by integrating it with the relevant policy processes and decision cycles, for instance regarding land use planning and resource management. By recognizing that adaptation is one of many policy objectives, not necessarily the dominant one, mainstreaming ensures that adaptation priorities are aligned with policy priorities. This avoids some potential misalignments with climate adaptation, such as: regulatory regimes for infrastructure that deter investment in resilience; planning policies that encourage development in vulnerable areas; and under-pricing of natural resources
127	Africa	Ojea, E. (2015). Challenges for mainstreaming ecosystem-based adaptation into the international climate agenda. <i>Current Opinion in Environmental Sustainability</i> , 14, 41-48.	Ecosystem-based Adaptation promotes the sustainable use of biodiversity and ecosystem services to adapt to climate change and has been defended as an effective and cost-efficient way of reducing climate change impacts. In fact, there is a growing recognition of the role that healthy ecosystems play in helping people to adapt to climate change, but Ecosystem-based Adaptation is only starting to be incorporated to policy and its role is so far limited to complement (not substitute) more traditional adaptation measures. This paper reviews recent literature on Ecosystem-based



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			Adaptation and looks for the main reasons for this delay by identifying key areas that need more attention from scientists and policymakers in order to incorporate Ecosystem-based Adaptation into the international climate policy agenda. Main challenges relate to governance structures and participation, how to measure effectiveness, the incorporation of longer-term scales for management, appropriate financial mechanisms, and dealing with climate change and ecosystem science inherent uncertainties
128	Tanzania	Ojoyi, M. M., & Mwenge Kahinda, J. M. (2015). An analysis of climatic impacts and adaptation strategies in Tanzania. <i>International Journal of Climate Change Strategies and Management</i> , 7(1), 97-115.	The study investigates smallholder farmers' views regarding major drivers of change, assessing main factors leading to changes in climate experienced and identifying potential coping strategies against climate change, was conducted in East Africa, Tanzania between 2009 and 2010. This paper identifies potential resilient practices intended to minimize destruction and maximize opportunities likely to benefit Morogoro region.
129	Nigeria	Okpe, B. E., & Aye, G. C. (2015). Adaptation to Climate Change by Farmers in Makurdi, Nigeria. <i>Journal of Agriculture and Ecology Research International</i> , 2(1), 46-57.	The increasing trend of climate change has led to growing concern on its impact on different sectors of the economy particularly on agriculture. Coping with the vulnerability and negative effects of climate change on agriculture requires mitigation at the policy level and adaptation at the farm level. However, the ability of farmers to adopt the various adaptation strategies may be constrained by several factors. Therefore, this study identified the climate adaptation strategies adopted by farmers in Makurdi, Nigeria and subsequently examined the determinants of farmers' adaptation strategies to climate change. The primary data used in this study were collected through structured questionnaires administered to 120 randomly selected farmers. Both descriptive and inferential statistics were used in analyzing the data. Results shows that about 58% of the farmers adopted at least one of the following climate change adaptation strategies: cultivating diff type of crop, shortening growing season, changing extent of land put in crop production, use of irrigation as water source, use of chemical fertilizer, mulching, planting of cover crops, planting of resistant crop varieties, changing of planting dates, adoption



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			of new techniques and use of drainage system. Logit regression was used to identify factors that influence the strategies employed by famers for adaptation to climate change. The result of the logit model showed that annual farm income, farming experience, knowledge of climate information, education and extension access variables are significant determinants of climate change adaptation strategies. The study recommends the promulgation of policies to ensure that farmers have access to physical, human and social capital will enhance farmers' ability to respond effectively to changing climate conditions.
130	The Gambia	Olaniyan, O. F. (2015). Sustaining N'Dama cattle for the resource-poor farmers in The Gambia. <i>Bulletin of Animal Production and Health in Africa</i> , 63(1), 83-92.	N'Dama cattle which is endemic to West and Central African countries is a part of global livestock biodiversity that needs to be sustainably conserved in order not to lose its unique genetic characteristics which are important for meeting the challenges of insufficient animal protein production, food insecurity, rural poverty and climate change. This study assesses the genetic improvement, sustainable production, utilization and conservation of this breed of cattle in order to strengthen them through relevant technical strategies and policy measures. Review of relevant literature and policy documents, participatory group discussions were used while the information gathered was analysed through content analysis. Efforts to sustainably improve, utilize and conserve the adaptive traits of N'Dama cattle which are able to tolerate trypanosomosis and survive on low-quality feed will serve as impetus for the farmers. Particularly, strengthening of open nucleus breeding scheme, institutional support of the multipliers, financial and technical support of the extension services, and favourable policy environments are the packages that would maximize the potentials of N'Dama cattle in terms of food production and reliable income generation for the resource poor farmers in a country such as The Gambia.
131	Nigeria	Olujobi, O. J. (2015). Perception and Adaptation Strategies of Agroforest Farmers to Climate Change in Ekiti	Perceptions and understanding of rural agroforest farmers about climate change, the possible consequences of cli-mate change and available adaptation options for its mitigation in the tropics have been noted to be

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		State. <i>American Journal of Human Ecology</i> , 4(1), 1-8.	abysmally low. This study examines the perception and adaptation strategies of agroforest farmers towards climate change mitigation in Ekiti State. The study area was stratified into two vegetation zones (rainforest and derived savannah). Pre-tested interview schedule was administered to eighty randomly selected agroforest farmers for collection of data in the two zones. Field observations revealed that majority of the respondents are married (96.25 %) male (93.75 %) of over 40 years old (81.25 %) with 50 % of them having more than 10 years of farming experience. The study revealed that farmers perceived that there are changes in climatic parameters (temperature, rainfall and wind intensity) with its attendant consequences on their production. Measures such as mulching, adjustment in planting period and planting of different crop were employed by respondents to mitigate the effect of climate change on their livelihood. The study also identified among others; lack of water for irrigation and lack of information on weather forecast as some of the problems militating against their adaptation to climate change.
132	Nigeria	Onu, F.M. Ikehi, M. E. (2015) Mitigation and adaptation strategies to the effects of climate change on the environment and agriculture in Nigeria.	Climate change has been threatening the global environment and agricultural sustainability in Nigeria and other vulnerable regions of the world. Climate change affects not only agricultural production and prices, trade and food sufficiency but also environmental conditions like water resources, land use and coastal infrastructure, among others. Addressing climate change issues and promote sustainability in agricultural sector and the environment requires tangible progress on implementation of mitigation and adaptation strategies in the environment and agricultural sector. This paper relied heavily on literature and participant observation to highlight the various efforts combat the effects of climate change on the environment and agriculture.
133	Nigeria	Oruonye, E. D., & Adebayo, A. A. (2015). An Assessment of the level of Farmers Awareness and Adaptation to Climate Change in Northern Taraba	This paper investigated the extent of awareness of climate change by local farmers in northern part of Taraba State, Nigeria. The study explores the choice of adaptation measures employed by the local farmers and the constraints to such measures. Descriptive statistics was used to analyze

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		State, Nigeria. <i>The Journal of Social Sciences Research</i> , 1(7), 79-85.	data obtained from a survey of 248 farmers from 31 villages in six local government areas of northern Taraba State. The finding of the study reveals that about 88% of the farmers are aware of climate change in the study area, however, only 48% of the respondents claimed they know the causes of climate change. 90% of the farmers claimed that they have been affected by recent changes in climate in the study area through low rainfall, excess rainfall, flooding and extreme high temperature. The study findings show that most of the farmers' opinion, observations and adaptation measures to climate change agrees with expert's report. The study findings show that the common adaptation measures applied by the local farmer's in the study area include altering of planting season, use of different tillage system, use of tolerant seed variety, planting early maturing variety and crop diversification/mixing. Despite the peoples' awareness and adaptation to climate change in the study area, lack of finance hinders farmers from getting the necessary resources and technologies that facilitate adapting to climate change. The study recommends the need to increase farmers' accessibility to information on adaptive research findings on early maturing, insect/pest tolerant, and high yielding varieties through increase extension service and soft loans to the farmers.
134	East Africa	Osima, S. E. (2015). <i>Understanding a high-resolution regional climate model's ability in simulating tropical East Africa climate variability and change</i> (Doctoral dissertation) University of Cape Town, South Africa.	The main aim of this thesis is to investigate the potential benefits of increasing resolution in regional climate models in the simulation of climate variability and change over East Africa. This study utilizes reanalysis and observational datasets: a hindcast of HIRHAM5 forced with ERA Interim, as well as two observation datasets for temperature and rainfall. Since reanalyses aim to make "best use" of all available observations by making a physically consistent representation continuous in time and space, and since there is a paucity of observations over many parts of Africa, the ERAI reanalysis is also used as a best estimate for model evaluation. Additionally, for evaluation of the bimodal nature of East Africa's rainfall, especially over Tanzania, three stations run by the

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			<p>Tanzania Meteorological Agency were used. The model data used in th is evaluation ranges from 1980 to 2006 iv HIRHAM5 demonstrates reasonable skill in the reproduction of observed patterns of mean climatology of rainfall, surface temperature and winds over East Africa. Moreover, the patterns of annual cycles of rainfall and surface temperature in the bimodal nature of East Africa are well represented. Furthermore, the model showed reasonable skill in the representation of the inter-annual variability and ENSO signals as suggested by the observation. Despite these strengths, HIRHAM5 shows some shortcomings. One weakness of the model is the simulation of the magnitude of a given variable over a specific region. For example, HIRHAM5 driven by ERAI underestimates rainfall and overestimates surface temperature over the entire domain of East Africa. The higher resolution HIRHAM5 (10km resolution) overestimates rainfall over high ground. The model bias could be due in part to the inadequacy of the observation networks in East Africa, represented in this thesis by the CRU and FEWS datasets. However, these two datasets draw on some different sources and neither do they have the same resolution. FEWS is a high-resolution data (0.1 o) gridded satellite-derived precipitation estimate covering the entire African continent while CRU datasets is a relatively low resolution (0.5 o) dataset based on rain gauge monthly precipitation only; in addition, near surface temperature is also available. As no reliable wind observations exist, wind data was taken from the ERA-Interim reanalysis. The different observational datasets do not agree particularly well, which impedes evaluating the quality of the HIRHAM5 simulations, in particular the high resolution one. So, while the higher resolution HIRHAM5 appears to be generally reliable, caution must be exercised in formulating conclusions from the results, especially over high ground and remote areas without adequate observation data. Under these constraints, the results suggest HIRHAM5 may be useful for assessing climate variability and change over East Africa. A weakness of the analysis presented here is that only</p>

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			<p>one combination of GCM and RCM could be investigated in depth due to computer and time constraints. Therefore, the results presented here, if used in application for climate change adaptation, should be considered in conjunction with a broader suite of data, such from the CORDEX programme. This has potential to increase the reliability of information about climate variability and change at a regional to local level necessary for impact assessment.</p> <p>Includes bibliographical references</p>
135	Africa	<p>Otto, F. E., Boyd, E., Jones, R. G., Cornforth, R. J., James, R., Parker, H. R., &amp; Allen, M. R. (2015). Attribution of extreme weather events in Africa: a preliminary exploration of the science and policy implications. <i>Climatic Change</i>, 132(4), 531-543.</p>	<p>Extreme weather events are a significant cause of loss of life and livelihoods, particularly in vulnerable countries and communities in Africa. Such events or their probability of occurring may be, or are, changing due to climate change with consequent changes in the associated risks. To adapt to, or to address loss and damage from, this changing risk we need to understand the effects of climate change on extreme weather events and their impacts. The emerging science of probabilistic event attribution can provide scientific evidence about the contribution of anthropogenic climate change to changes in risk of extreme events. This research has the potential to be useful for climate change adaptation, but there is a need to explore its application in vulnerable developing countries, particularly those in Africa, since the majority of existing event attribution studies have focused on mid-latitude events. Here we explain the methods of, and implications of, different approaches to attributing extreme weather events in an African context. The analysis demonstrates that different ways of framing attribution questions can lead to very different assessments of change in risk. Crucially, defining the most appropriate attribution question to ask is not a science decision but one that needs to be made in dialogue with those stakeholders who will use the answers. This is true of all attribution studies but may be particularly relevant in a tropical context, suggesting that collaboration between scientists and policy-makers is a priority for Africa.</p>

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136	Africa	Panel, A. P. (2015). Power people planet: seizing Africa's energy and climate opportunities: Africa progress report 2015.	For Sub-Saharan Africa, 2015 is a turning point. The summits on sustainable development, financing and climate change are swinging the spotlight not only onto Africa's needs to accelerate development and adapt to global warming, but also onto the region's urgent energy crisis. Two in three Africans lack access to electricity. But this crisis is also a moment of great opportunity, as we demonstrate in the Africa Progress Report 2015, Power People Planet: Seizing Africa's Energy and Climate Opportunities. Demand for modern energy is set to surge, fuelled by economic growth, demographic change and urbanisation. As the costs of low-carbon energy fall, Africa could leapfrog into a new era of power generation. Utility reform, new technologies and new business models could be as transformative in energy as the mobile phone has been in telecommunications. Renewable energy is at the forefront of the changes sweeping Africa, which is registering some of the most remarkable advances in solar, geothermal and wind power. With world leaders due to meet in Paris in December to settle on a new global climate change deal, Africa has a chance to show the way to a low-carbon future - while putting in place the policies needed to reduce its vulnerability to the effects of climate change. A 'triple win' is within the region's grasp, as renewable technologies create opportunities to increase agricultural productivity, improve resilience to climate change, and contribute to long-term reductions in dangerous carbon emissions. The Africa Progress Report 2015 explains the bold steps that leaders globally and in Africa must take to achieve this vision. Above all, the report shows that the global climate moment is also Africa's moment - Africa's moment to lead the world.
137	South Africa	Pasquini, L., & Cowling, R. M. (2015). Opportunities and challenges for mainstreaming ecosystem-based adaptation in local government: evidence from the Western Cape, South	Ecosystem-based adaptation can reduce social vulnerability to climate hazards and can be more sustainable in the long term than hard technical solutions to adaptation. Thus, it can provide a strong argument for the conservation of natural ecosystems. As the entities most directly responsible for local-level planning and management, municipalities represent a potentially key site for implementing ecosystem-based climate

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		Africa. <i>Environment, development and sustainability</i> , 17(5), 1121-1140.	adaptation. This paper presents the results of a study that investigated the extent of eight local municipalities' knowledge and mainstreaming of ecosystem-based adaptation issues in the Western Cape, South Africa. Most municipalities had little understanding of ecosystem-based adaptation issues and limited implementation of relevant actions. Our findings suggest that ecosystem-based adaptation mainstreaming in local governments will be assisted by increasing learning and networking opportunities for municipalities and by increasing the "profile" of the concept of ecosystem-based adaptation, as well as by conducting research on barriers and enablers to collaborative governance.
138	South Africa	Pasquini, L., Ziervogel, G., Cowling, R. M., & Shearing, C. (2015). What enables local governments to mainstream climate change adaptation? Lessons learned from two municipal case studies in the Western Cape, South Africa. <i>Climate and Development</i> , 7(1), 60-70.	Municipalities represent a key opportunity for implementing local adaptation to the impacts of climate change. Most research has focused on the barriers to climate change adaptation, and little research exists that considers the conditions under which a municipality is able to initiate the process of mainstreaming climate adaptation. Through a case study of two municipalities in the Western Cape of South Africa, this paper identifies the factors that enable action to be taken at the local government level. The presence of dedicated environmental champions is key, particularly within political leadership. Experiencing the costs of climate change often provides the strongest initial catalyst for action and is aided by the recognition that the local environment has value. Access to a knowledge base, the availability of resources, political stability and the presence of dense social networks all positively affect adaptation mainstreaming. It is these enabling factors that other government levels and stakeholders need to support with different interventions. We draw attention to two under-researched topics, the effect of political instability on municipal functioning and the effects of social network characteristics on facilitating institutional change.
139	Africa	Pérez, C., Jones, E. M., Kristjanson, P., Cramer, L., Thornton, P. K., Förch, W., & Barahona, C. A. (2015). How	In this paper we examine conditions that underlie vulnerability and resilience possibilities for households and communities that face and respond to climate- and other changes, in nine East and West African



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		resilient are farming households and communities to a changing climate in Africa? A gender-based perspective. <i>Global Environmental Change</i> , 34, 95-107.	countries. We base our analysis on a unique integrated qualitative and quantitative dataset composed of household surveys and village focus group studies carried out across a wide range of environments and agricultural systems. We identify human population growth, commercialization of the economy, and natural resource use policies, in addition to weather, as key drivers of change. We compare the agricultural and livelihood systems of male and female respondents, as well as their productive resources, organization and access to services. Women have less access than men to common property resources, as well as to cash to obtain goods or services. Women control less land than men, the land they control is often of poorer quality, and their tenure is insecure. Women engage in mutual insurance and risk-sharing networks, and benefit from non-agricultural services provided by social support institutions external to the village. Formally registered, public and private external organizations that foster agriculture and livestock production have tremendous anti-women biases and tend to provide support primarily to men. Policies and strategies are needed to eliminate those prejudices so that men and women increase their resilience and manage well their changing environments.
140	South Africa	Petersen, S., Duncan, J. A., Omdien, A., Betts, M., & Johnson, A. (Eds.). (2015). A decade of implementing an Ecosystem Approach to Fisheries for Southern African fisheries. <i>WWF South Africa Report Series–2015/Marine/001</i> .	This is the third publication produced by WWF describing the progress made towards implementing an Ecosystem Approach to Fisheries (EAF) in the Benguela Current Large Marine Ecosystem (BCLME) region over the last decade. This publication builds on the two previous reports by Nel et al. in 2007 and Petersen et al. in 2010 and reviews those earlier assessments and updates them, presenting the reports of all the ecological risk assessments (ERAs) undertaken in Namibia and South Africa between 2010 and 2013, as well as the report of a training workshop held in Luanda, Angola on 18-19 May 2011. The report also tracks the history of EAF implementation and reviews the tools developed through the BCLME project. It includes a practical guide to facilitating ERAs and Review workshops and provides



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			a set of recommendations to guide the future implementation of an EAF in the region. During this third phase of the on-going assessment and review programme, ERAs were completed for 10 fisheries in South Africa and three in Namibia, encompassing a range of fisheries including the Patagonian toothfish fishery around South Africa's Prince Edward Islands, the prawn trawl fishery on the east coast of South Africa, the demersal hake fishery in Namibia and a lot more in-between. Overall, in these three series WWF has reported on ERAs conducted on 29 fisheries, to which can also be added those undertaken on three Angolan fisheries under the BCLME-FAO project that ran from 2004-2006 (Cochrane et al.,2007). These reports provide an important window for the Benguela Current Commission, the governments of Namibia and South Africa in particular, and a range of stakeholders on progress being made in the implementation of an ecosystem approach to fisheries (EAF) in the region and the remaining priority threats and challenges.
141	Africa	Pettengell, C. (2015). <i>Africa's Smallholders Adapting to Climate Change: The need for national governments and international climate finance to support women producers</i> . Retrieved December 5, 2018 from <a href="https://www.oxfam.org/sites/www.oxfam.org/files/file_attachments/bn-african-smallholders-climate-change-141015-en.pdf">https://www.oxfam.org/sites/www.oxfam.org/files/file_attachments/bn-african-smallholders-climate-change-141015-en.pdf</a>	Climate change is undermining the ability of African nations to feed themselves. Women smallholder producers are on the front line of dealing with the impacts but are not first in line for international climate finance. Wealthy countries have committed to helping countries in Africa to adapt to climate change, but few women producers are feeling the benefit. National governments are stepping up despite limited resources and multiple development priorities. New analysis shows that whilst international climate finance overall is on the rise, wealthy countries are still failing to deliver public finance for adaptation in Africa.
142	North Africa Region	Quéfélec, S., & Allal, S. (2015). Development, water and energy in the context of climate change in North	This article adopts a holistic approach to explore and quantify interactions between water and energy in the context of climate change in North Africa. It brings together results from different research areas to describe the physical interactions and to shortly discuss governance issues in the

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		Africa. <i>Regional environmental change</i> , 15(8), 1611-1625.	sectors of water and energy. We use the IPAT formula approach to compute scenarios for quantifying the magnitudes of advantages to expect from water demand side management actions coupled with energy efficiency options. Depending on the scenario and assumptions, the expected cumulated benefit in terms of energy bill over the period 2005–2025 could range between 30 and 48 billion US Dollar, which is comparable to the GDP of Tunisia in 2011 (46 billion US Dollar).
143	Africa	Rakgase, M. A., & Norris, D. (2015). Determinants of livestock farmers' perception of future droughts and adoption of mitigating plans. <i>International Journal of Climate Change Strategies and Management</i> , 7(2), 191-205.	The purpose of this paper was to determine if there is an association between farmers' socio-economic profile and their perception of climate change and related events (drought). Understanding of farmers' perceptions of drought and climate change may assist in informing policy decisions and development of appropriate intervention strategies.
144	Africa	Ramirez-Villegas J, Thornton PK. (2015). Climate change impacts on African crop production. CCAFS Working Paper no. 119. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).	According to the most recent IPCC report, changes in climates over the last 30 years have already reduced global agricultural production in the range 1-5 % per decade globally, with particularly negative effects for tropical cereal crops such as maize and rice (Porter et al., 2014). In addition, there is now mounting evidence suggesting that even at low (+2 °C) levels of warming, agricultural productivity is likely to decline across the globe, but particularly across tropical areas (Challinor et al., 2014). This Working Paper provides an overview of projected climate change impacts on crop production and suitability across Africa, using a combination of literature review, models and new data analysis.
145	Morocco	Rankovic, A. C. (2017). Implementing nature-based solutions in climate policies: What's in it for biodiversity? First lessons from Morocco and Tunisia. France: IDDRI.	In this report the Authors indicated that the naturally based solutions (NBS) to biodiversity protection in climate change policies are always in the minority. It is important to identify and support actors and stakeholders who will be capable of delivering intersectoral implementation, in both the public services and civil society, in order to ensure biodiversity challenges are considered. For efficient implementation of NBS to climate change the authors recommended 5 guiding principles: (1) Prioritising

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			NBS measures relying on policies that already explicitly integrate ecosystem protection or restoration targets (2) Analysing NDCs in order to identify the NBS they contain and classify these according to their level of ambition and the guarantees they provide for biodiversity protection (3) Integrating biodiversity targets into climate NBS that do not give them explicit attention (4) Evaluating the additional resources required to implement biodiversity-friendly climate NBS. (5) Identifying and supporting project leaders capable of intersectoral implementation of NBS.
146	Nigeria	Raufu, M. O., Kibirige, D., & Singh, A. S. (2015). Perceived effect of climate change on cocoa production in south western Nigeria. <i>International Journal of Development and Sustainability</i> , 4(5), 529-536.	The study examines the perceived effect of climate change on cocoa production in South Western Nigeria. Information collected from 270 respondents residing in Ondo, Osun and Oyo states of Nigeria using well-structure questionnaires forms the primary data used in the analysis. Descriptive statistics, weighted means score, and multiple regression analysis were the analytical techniques used. The result shows that more than 70 percent of the respondents were male, majority of them were 50years of age and 57.4 percent had no formal education. The major means of awareness about climate change are radio and co-farmers in Ondo State and Osun State while its radio and television in Oyo State. Livestock farming systems, weeding options, mixed cropping, remover of chupons, and pruning of old cocoa trees are the main preventive strategies adopted by farmers in the states under study. Applications of pesticides on cocoa and determining damage threshold for use of insecticides are part of the mitigating strategies used by the farmers in the study area. The inferential statistics shows that farmers' age, level of education, extension services, farming experience, farm and family size are significantly related to the farmers' perceived effect of climate change on cocoa production in the three States under study.
147	Botswana	Reed, M., Stringer, L., Dougill, A., Perkins, J., Atlhopheng, J., Mulale, K.,	This paper identifies new mechanisms to tackle land degradation based on retaining critical levels of natural capital whilst basing livelihoods on a

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		et al. (2015). Reorienting land degradation towards sustainable land management: Linking sustainable livelihoods with ecosystem services in rangeland systems. <i>Journal of Environmental Management</i> , 472-485.	wider range of ecosystem services. The study was achieved through a case study analysis of the Kalahari rangelands in southwest Botswana. The paper first describes the socio-economic and ecological characteristics of the Kalahari rangelands and the types of land degradation taking place. It then focuses on bush encroachment as a way of exploring new economic instruments designed to enhance the flow of ecosystem services that support livelihoods in rangeland systems. It does this by evaluating the likely impacts of bush encroachment, one of the key forms of rangeland degradation, on a range of ecosystem services in three land tenure types namely; private fenced ranches, communal grazing areas and Wildlife Management Areas), before considering options for more sustainable land management in these systems. Adequate policy support, economic mechanisms could help reorient degraded rangelands towards more sustainable land management.
148	West Africa	Ricci, L., Sanou, B., & Baguian, H. (2015). Climate risks in West Africa: Bobo-Dioulasso local actors' participatory risks management framework. <i>Current Opinion in Environmental Sustainability</i> , 13, 42-48.	The paper focuses on the role of multilevel governance in climate change adaptation and risk management and draws out lessons from the implementation of the UN Habitat Cities and Climate Change Initiatives (CCCI) in Bobo-Dioulasso, Burkina Faso. It describes the process for the formulation of a participatory risk management framework for local actors drawing from empirical investigations undertaken in Bobo-Dioulasso. The paper argues that adaptation needs to be mainstreamed and implemented at local level and to include risk management. Moreover, regulatory capacity of public authorities and balance of power and resources play a major role in this process. After presenting the specific knowledge on climate and environmental challenges and CCCI implementation in Bobo-Dioulasso, the paper describes challenges and opportunities in the implementation of the participatory risk and management framework.
149	East Africa	Richard, K., Mwayafu, D. M., & Kairu, G. (2015). REDD+ and other sectors in East Africa; opportunities for cross-	REDD+ processes and initiatives are gaining popularity internationally and are gaining momentum in East Africa as one of the 'hot topics' of climate change discussions, though a formal international framework for

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		sectoral implementation. Retrieved from <a href="http://www.ugandacoalition.or.ug/sites/default/files/REDD">http://www.ugandacoalition.or.ug/sites/default/files/REDD</a>	REDD+ is yet to be fully defined. As REDD+ implementation will affect many actors, it is important that a multi-stakeholder process is initiated including governments and the people. Ownership, transparency, dissemination and implementation of activities by all relevant stakeholders are key to the success of REDD+ programmes. Also, REDD+ 's proposed holistic approach where different sectors are actively involved in implementation will be important in future. This analytical paper outlines the status of REDD+ processes, opportunities and challenges in Uganda, Kenya, and Tanzania, and points out current and potential synergies between REDD+ and key economic sectors: agriculture and food security; energy for rural development; and to water resources management.
150	Tanzania	Rizvi, A. R., Baig, S., & Verdone, M. (2015). <i>Ecosystems based adaptation: knowledge gaps in making an economic case for investing in nature-based solutions for climate change</i> . Gland, Switzerland: IUCN, 48.	Changes in global climate are increasingly having adverse impacts on human populations and natural systems. This has resulted in increased efforts to come up with options that can mitigate the impacts, as well as help to adapt to already occurring changes. Ecosystem based adaptation is used by several organisations and in many developed and developing countries as a means for climate adaptation, especially at the community level. It is also applied for disaster risk reduction. Still, there is a propensity of policy makers to implement traditional engineering solutions for adaptation rather than investing in EbA. There is, therefore, a need to raise further awareness on the use of nature-based solutions. An important approach to promote investment in EbA is to identify its economic costs and benefits. This study therefore reviewed a number of projects in Costa Rica, India, Mexico, Peru, Philippines and Tanzania, to assess existing data and knowledge gaps regarding the economic values of EbA projects. The literature review showed that climate change is likely to change the productivity and benefits from the agriculture, fisheries and forestry sectors. These sectors are important economic contributors to these countries and provide extensively to the national exchequer. Already, impacts are being observed in terms of lower yields and

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			<p>productivity as well as loss of livelihoods and security. Cost-benefit analyses (CBA) of projects in these countries showed that EbA projects provided many benefits and in general helped to increase resilience and decrease vulnerabilities. However, it was clear that there were extensive knowledge gaps and detailed economic valuation/ CBA studies need to be undertaken to make a stronger case for ecosystems-based adaptation. Currently, the studies are context specific, do not include opportunity costs and much of the benefits are in qualitative terms. Detailed assessments will help to establish the importance of EbA, if they are based on robust methodologies that are developed with appropriate guidance; differentiate between different costs and sectors; incorporate biodiversity and species; are based on gender (and other groups) disaggregated data; and account for co-benefits. This can be undertaken at two scales: undertaking CBA before project initiation, to help stakeholders decide on investment options and actions. More importantly however, there is a need to undertake analyses of ongoing and completed projects in the studied countries, to understand and gather the evidence for the effectiveness of EbA projects as compared to other solutions.</p>
151		Robards, M. D., & Hillmer-Pegram, K. (2015). Ecosystem stewardship: a resilience framework for arctic conservation. <i>Global Environmental Change</i> , 34, 207-217	<p>Ecosystem stewardship is a framework for actively shaping trajectories of ecological and social change to foster a more sustainable future for species, ecosystems, and society. We apply this framework to conservation challenges and opportunities in the Arctic, where the rapid pace of human-induced changes and their interactions force us now to consider a new relationship between people and the rest of nature. Biodiversity, which has traditionally been the target of conservation efforts, is increasingly affected by human impacts such as energy demand and industrial development that are motivated more by short-term profits than by concerns for societal consequences of long-term arctic biodiversity change. We posit that effective approaches to conservation must (a) foster both ecosystem resilience and human wellbeing, (b) integrate ecological and social processes across scales, and (c) take actions</p>

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			that shape the future rather than seeking only to restore the past. To this end, we identify progress through actions that have been or could be taken at local, national, and international scales to promote arctic resilience and conservation. A stewardship approach to conservation aims to prevent undesirable changes and prepares for adaptation to rapid and uncertain changes that cannot be avoided and for transformation to avoid or escape undesirable states. The greatest opportunity for arctic stewardship at the local scale may lie in building upon culturally engrained (often indigenous) respect for nature and reliance on local environment, empowering it through knowledge and power sharing with national regulatory frameworks. This, in turn, allows connection of drivers with impacts across scales and raises awareness of the value of human–environment relationships. At national and international scales stewardship provides rules for coordinated action to reconcile local and regional conservation actions with those that are motivated by constraints at the global level, to foster ecosystem integrity and human wellbeing in the face of transformative changes in environment, landscapes, species, and society.
152	Sahel	Rose, R. M. (2015). The Impact of Climate Change on Human Security in the Sahel Region of Africa. <i>Donnish Journal of African Studies and Development</i> 1(2), 9–14	The Sahel known as the semi-arid transition zone between humid tropical Africa and the arid Sahara Desert, characterised by a high degree of temporal and spatial unpredictability in rainfall. The people in this region practice agriculture and cattle-herding, and their livelihoods mostly suffer the effects of climate change because of their reliance on rainfall. Changes in rainfall and temperature had the capacity to reshape the productive landscape of this region and exacerbate food, water and energy scarcities. Also, natural disasters like drought could make the entire area uninhabitable for the people and this could contribute to destabilising and unregulated population movements which could force previously separate groups to compete for the same dwindling resources thereby leading to conflicts eventually. Using the environmentalist’s perspective to explain how natural and human activities had impacted negatively on this region,



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			thereby making it uncondusive for human sustenance. This paper explored the consequences of climate change on human well-being in the Sahel region; and the capacity of the population to adapt to the expected changes. It also recommended that there is the need to adopt new technologies and varieties in order to boost food production particularly.
153		Rudolph, L., Gould, S., & Berko, J. (2015). <i>Climate change, health, and equity: opportunities for action</i> . Public Health Institute. Oakland, CA	Climate change and health inequities are the greatest global health threats of the 21st century. <sup>3,4</sup> In this report, we explore the many ways in which climate change, health, and equity are connected. With input from more than a hundred public health professionals and community health, equity, and environmental justice advocates and support from The Kresge Foundation, we developed a conceptual framework to help us see how these issues are linked, and to identify opportunities and recommendations for action.
154	Madagascar	Secretariat of the Convention on Biological Diversity (2015). <i>Ecosystem-based Adaptation &amp; Disaster Risk Reduction: A compilation of country experiences &amp; synthesis of information</i> . Retrieved May, 27 2018 from <a href="https://www.cbd.int/sbstta/sbstta-20/sbstta-20-inf-cc-eba.pdf">https://www.cbd.int/sbstta/sbstta-20/sbstta-20-inf-cc-eba.pdf</a>	While mitigation efforts had generally been the focus of climate change negotiations, the UNFCCC Cancun Agreements promoted discussion on the need for adaptation to climate change impacts that are unavoidable. The Cancun Adaptation Framework defined several principles for prioritizing and implementing adaptation actions, including transparency, stakeholder participation, gender sensitivity, consideration of vulnerable groups, communities and ecosystems, use of indigenous knowledge and best available science, and integration of adaptation into relevant social economic and environmental policies and plans
155	sub-Saharan Africa	Shackleton, S., Ziervogel, G., Sallu, S., Gill, T., & Tschakert, P. (2015). Why is socially-just climate change adaptation in sub-Saharan Africa so challenging? A review of barriers identified from empirical cases. <i>Wiley Interdisciplinary Reviews: Climate Change</i> , 6(3), 321-344.	The study seeks to enhance understanding of the process of climate change adaptation and to facilitate the planning and implementation of socially-just adaptation strategies, deeper consideration of the factors that impede adaptation is required. In response, scholars have increasingly identified barriers to adaptation in the literature. But, despite this progress, knowledge of barriers that hamper adaptation in developing countries remains limited, especially in relation to underlying causes of vulnerability and low adaptive capacity. To further improve understanding of barriers to adaptation and identify gaps in the state-of-the-art



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			knowledge, we undertook a synthesis of empirical literature from sub-Saharan Africa focusing on vulnerable, natural resource-dependent communities and livelihoods. Our review illustrates that: (1) local-level studies that reveal barriers to adaptation are diverse, although there is a propensity for studies on small-holder farmers; (2) many of the studies identify several barriers to adaptation, but appreciation of their interactions and compounded impacts remains scarce; and (3) most of the barriers uncovered relate broadly to biophysical, knowledge, and financial constraints on agricultural production and rural development. More hidden and under-acknowledged political, social, and psychological barriers are rarely mentioned, unless captured in studies that specifically set out to investigate these. We finish our review by highlighting gaps in understanding and by suggesting future research directions, focusing on issues of social justice. We argue that research on barriers needs to start asking why these barriers emerge, how they work together to shape adaptation processes, who they affect most, and what is needed to overcome them.
156	South Africa	Sharaunga, S., Mudhara, M., & Bogale, A. (2015). The impact of 'Women's Empowerment in Agriculture' on household vulnerability to food insecurity in the KwaZulu-Natal Province. <i>In Forum for Development Studies</i> (Vol. 42, No. 2, pp. 195-223). Routledge.	It is argued that empowering women in smallholder agriculture is very crucial in reducing vulnerability to food insecurity among rural households. This study contributes to this literature by adapting the vulnerability as expected poverty approach to determine which dimensions of 'women's empowerment in agriculture' reduces household's vulnerability to food insecurity based on cross-section data collected from 300 randomly selected primary female heads-of-households in Msinga rural areas of KwaZulu-Natal. It was found that empowering women in socio-cultural aspects that creates hindrances in agriculture reduces the probability of their households being vulnerable to food insecurity. Surprisingly, access to irrigation and improved water-use security did not significantly influence household vulnerability to food insecurity. However, other forms of women's empowerment including economic agency and physical capital empowerment were found to reduce

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			the likelihood of a household being vulnerable to food insecurity. Women with high levels of financial capital empowerment invested less in other capital assets and were more vulnerable to food insecurity in the future. In addition to women's empowerment, demographic characteristics of a household influence its vulnerability status. A household's vulnerability to food insecurity reduces as the husband's income increases but increases with increased dependency ratio. It was concluded that empowerment in agriculture alone is not a panacea to reduce household vulnerability to food insecurity. Efforts should be made to improve physical assets that determine the off-farm income earning and agricultural production capacity of households.
157	Tanzania	Shemdoe, R., Kassenga, G., & Mbuligwe, S. (2015). Implementing climate change adaptation and mitigation interventions at the local government levels in Tanzania: where do we start? <i>Current Opinion in Environmental Sustainability</i> , 13, 32-41.	Climate change adaptation and mitigation interventions have traditionally been planned at the national and policy levels, but their implementation is done predominantly at the local government authority level. The general mandate of local governments is to work for their communities. At these levels, in both rural and urban contexts, local government technical cadres are required to be equipped with knowledge and skills to address existing problems effectively, including climate change-induced impacts. A study conducted in the urban local government authorities of Dar es Salaam, Tanzania, revealed low levels of knowledge and skills related to policies, plans and strategies pertinent to climate change and vulnerability assessments. As an entry point for climate change adaptation and mitigation interventions to be included in the local authority plans and budgets, there is a need to build capacity of the technical cadres. Short courses, workshops and seminars, training workshops, on-job training, conferences and postgraduate training are recommended to ensure that capacity of the local government authorities regarding climate change aspects is improved.
158	Tanzania	Sieber, S., Jha, S., Shereef, A. B. T., Bringe, F., Crewett, W., Uckert, G., ... & Mueller, K. (2015). Integrated	This article reports the application of a tool “ScalA” that generates information on a multitude of aspects and assesses the local suitability of CRSA practices among sub-Saharan smallholders. It also briefly presents

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		assessment of sustainable agricultural practices to enhance climate resilience in Morogoro, Tanzania. <i>Regional environmental change</i> , 15(7), 1281-1292	other state-of-the-art tools that can be used for similar purposes. In the first case study, the tool is used to assess appropriateness of agroforestry, biochar application, and rainwater harvesting in Fulwe village of Morogoro, Tanzania, for enhancing resilience capacity. In another case study, the potential of fertilizer management is assessed for two different villages, i.e., Fulwe and Mlali. Analytically, appropriateness of interventions is assessed by the deviation of the actual factor constellation of the scaling-up process with an optimal constellation that will foster the wider adoption of the given practice.
159	Tanzania	Smucker, T. A., Wisner, B., Mascarenhas, A., Munishi, P., Wangui, E. E., Sinha, G. & Lovell, E. (2015). Differentiated livelihoods, local institutions, and the adaptation imperative: Assessing climate change adaptation policy in Tanzania. <i>Geoforum</i> , 59, 39-50.	This paper interrogates the framings and priorities of adaptation in Tanzania's climate policy and examines the implications for the role of local institutions and differentiated rural populations in climate change adaptation. Although Tanzania lacks a "stand alone" climate policy, Tanzania's National Adaptation Programme of Action (NAPA) and National Climate Change Strategy (NCCS) provide the most comprehensive statements of the central government's framing of adaptation and its priorities with regard to adaptation. In assessing discursive framings of adaptation, we find that the dominant policy discourse constructs an anti-politics of adaptation through its framing of climate change as an urgent and generalized threat to development while failing sufficiently to address the complex governance and social equity dimensions of climate change adaptation. The technocratic prescriptions of Tanzania's NAPA and NCCS converge with similar prescriptions found in Tanzania's national development policies, such as the major agricultural development initiative Kilimo Kwanza. Adaptation challenges identified by communities in Mwanga District demonstrate complex local institutional and resource tenure questions that are not addressed in climate policy, but which require policy attention if social equity in climate change adaptation is to be achieved.
160	Zimbabwe	Soropa, G., Gwatibaya, S., Musiyiwa, K., Rusere, F., Mavima, G. A., &	The smallholder sector is vulnerable to climate change due to its reliance on rainfed agriculture and has the least ability to adapt. Based on

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		Kasasa, P. (2015). Indigenous knowledge system weather forecasts as a climate change adaptation strategy in smallholder farming systems of Zimbabwe: Case study of Murehwa, Tsholotsho and Chiredzi districts. <i>African Journal of Agricultural Research</i> , 10(10), 1067-1075.	appropriate weather forecasts, farmers can mitigate and adapt to climate change through sound crop management decisions. A study was conducted to explore indigenous knowledge system (IKS) weather forecasts as a climate change adaptation strategy in smallholder farming systems of Zimbabwe. Eighty-six farmers from three agro-ecological regions with different agricultural potential and cultural backgrounds were involved in the study. Questionnaires and focus group discussions were used to collect data on climate change perceptions, access and interpretation of meteorological forecasts and IKS weather indicators and their use in crop production. Most farmers (93%) believed that there is climate change, citing low rainfall, late rains and rising temperatures as some of the indicators. Sixty five percent of farmers had access to and can interpret the meteorological forecasts disseminated through print and electronic media, though arguing that the forecasts are not timely disseminated. Sixty seven percent of the respondents were using IKS weather indicators such as wild fruits, trees, worms and wind for predicting seasonal quality in addition to meteorological forecasts. Basing on IKS forecasts, farmers are changing varieties, staggering planting dates, varying fertilizer rates and cropping land area. The study showed that IKS forecasts indicators are different in the three agro-ecological regions, are being used by farmers in making farming decisions and if properly documented, disseminated and integrated with scientific seasonal climate forecasts can be used as a climate change adaptation strategy.
161	Uganda	Cooper, S. J., & Wheeler, T. (2015). Adaptive governance: Livelihood innovation for climate resilience in Uganda. <i>Geoforum</i> , 65, 96-107.	Adaptive governance is the use of novel approaches within policy to support experimentation and learning. Social learning reflects the engagement of interdependent stakeholders within this learning. Much attention has focused on these concepts as a solution for resilience in governing institutions in an uncertain climate; resilience representing the ability of a system to absorb shock and to retain its function and form through reorganisation. However, there are still many questions to how these concepts enable resilience, particularly in vulnerable, developing

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			contexts. A case study from Uganda presents how these concepts promote resilient livelihood outcomes among rural subsistence farmers within a decentralised governing framework. This approach has the potential to highlight the dynamics and characteristics of a governance system which may manage change. The paper draws from the enabling characteristics of adaptive governance, including lower scale dynamics of bonding and bridging ties and strong leadership. Central to these processes were learning platforms promoting knowledge transfer leading to improved self-efficacy, innovation and livelihood skills. However even though aspects of adaptive governance were identified as contributing to resilience in livelihoods, some barriers were identified.
162	Sub-Saharan Africa	Spires, M. H. (2015). <i>Barriers to and enablers of climate change adaptation in four South African municipalities, and implications for community-based adaptation</i> (Doctoral dissertation). Rhodes University.	Municipalities struggle to implement climate change adaptation and community-based adaptation within contexts of significant social, economic and ecological challenges. These contextual barriers, when combined with certain cognitive barriers, lead to reactive responses. Existing municipal systems and structures make it difficult to enable climate change adaptation, which is inherently cross-sectoral and messy, and especially community-based adaptation that is bottom-up and participatory. Lack of locally applicable knowledge, funding and human resources were found to be significant resource barriers and were often underlain by social barriers relating to perceptions, norms, discourses and governance challenges. Enablers of engaged officials, operating within enabling organisational environments and drawing on partnerships and networks, were able to overcome or circumvent these barriers. When these enablers coincided with windows of opportunity that increased the prioritisation of climate change within the municipality, projects with ancillary benefits were often implemented.
163	Sub-Saharan Africa	Suckall, N., Stringer, L. C., & Tompkins, E. L. (2015). Presenting triple-wins? assessing projects that deliver adaptation, mitigation and	The concept of climate compatible development (CCD) is increasingly employed by donors and policy makers seeking 'triple-wins' for development, adaptation and mitigation. While CCD rhetoric is becoming more widespread, analyses drawing on empirical cases that present triple-

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		development co-benefits in rural Sub-Saharan Africa. <i>Ambio</i> , 44(1), 34-41.	wins are sorely lacking. We address this knowledge gap. Drawing on examples in rural sub-Saharan Africa, we provide the first glimpse into how projects that demonstrate triple-win potential are framed and presented within the scientific literature. We identify that development projects are still commonly evaluated in terms of adaptation or mitigation benefits. Few are framed according to their benefits across all three dimensions. Consequently, where triple-wins are occurring, they are likely to be under-reported. This has important implications, which underestimates the co-benefits that projects can deliver. A more robust academic evidence base for the delivery of triple-wins is necessary to encourage continued donor investment in activities offering the potential to deliver CCD
164	South Africa	Sweijd, N. A., Wright, C. Y., Westwood, A., Rouault, M., Landman, W. A., MacKenzie, M. L. & Berhoozi, F. (2015). Climate change is catchy—but when will it really hurt. <i>South African Medical Journal</i> , 105(12), 1018-1023.	Concern and general awareness about the impacts of climate change in all sectors of the social- ecological-economic system is growing as a result of improved climate science products and information, as well as increased media coverage of the apparent manifestations of the phenomenon in our society. However, scales of climate variability and change, in space and time, are often confused and so attribution of impacts on various sectors, including the health sector, can be misunderstood and misrepresented. In this review, we assess the mechanistic links between climate and infectious diseases, and consider how this relationship varies, and may vary according to different time scales, especially for aetiologically climate-linked diseases. While climate varies in the medium (inter-annual) time frame, this variability itself may be oscillating and/or trending on cyclical and long-term (climate change) scales because of regional and global scale climate phenomena such as the El-Niño southern oscillation coupled with global-warming drivers of climate change. As several studies have shown, quantifying and modelling these linkages and associations at appropriate time and space scales is both necessary and increasingly feasible with improved climate science products and better epidemiological data. The application of this approach is considered for

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			South Africa, and the need for a more concerted effort in this regard is supported.
165	Tanzania	Synnevåg, G., Kabote, S. J., Nombo, C. I., Mamiro, D., & Mattee, A. Z. (2015). Smallholder adaptation to climate change in semi-arid areas of Tanzania: experiences from Iramba and Meatu districts. In <i>Sustainable intensification to advance food security and enhance climate resilience in Africa</i> (pp. 467-485). Springer, Cham.	A study of the impact over the past 30 years of climate variability and change on smallholders' farming systems and adaptation strategies was conducted in three villages of Iramba and Meatu Districts, Tanzania. Both districts involved in the study lie within a semi-arid zone. Crop failure and food insecurity are common characteristics to all three villages in the study. Personal descriptions of climate change and meteorological data confirmed that rainfall patterns have become increasingly inconsistent and unpredictable and that the length of dry spells has increased. Crop growing seasons have been shortened by 1 month or more. The availability of ground water, particularly from rivers, has increasingly become seasonal, compared to the situation in the 1970s and 1980s. These results have all impacted negatively on rain-fed agriculture and livestock production systems and increased the vulnerability of smallholder livelihoods, because of their high dependency on natural resources. Almost 80 % of the households in both study areas were characterized as poor. Households are becoming increasingly vulnerable to multiple factors including drought, price fluctuations, increased population pressure, loss of soil fertility and decreased productivity, scarcity of farm and grazing land, water and fuel wood shortages, loss of 'ngitiri', increased conflicts over pastures, crop and livestock diseases, male out-migration, and increased labor burdens on women. Responses to climate change impacts varied by the socioeconomic condition of households and gender. Coping and adaptation mechanisms to which farmers have resorted include selling labor, land leasing, shifts in crop and livestock systems, use of early maturing, drought and disease resistant varieties, small scale irrigation systems, gardening, increased use of crop residues as animal feed, diversification to off farm activities, and petty trade.
166	Kenya	Syomiti, M., Maranga, E., Obwoyere, G., Getachew, G., Dana, H., Beatrice,	Production of pasture and fodder grasses is low in the Kenya's rangelands as a result of unreliable and low rainfall regimes. A sustainable livelihood



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		M., & Duyu, J. (2015). The adaptive and coping strategies of pastoralists to climate change in Baringo, Laikipia and Nyeri Counties of Kenya. <i>Livestock Research for Rural Development</i> . Volume 27, Article, 248.	in the region is threatened by climate change due to frequent droughts and erratic rainfall. Technologies aimed at increasing rural communities' resilience are necessary to support their capacity to adapt and respond to new hazards. In view of this, a baseline survey was conducted to identify and document local climate change adaptation and coping mechanisms in livestock feeds and feeding systems among the livestock keepers in Baringo, Laikipia and Nyeri counties of Kenya. Results obtained from the study showed that over 60% of respondents in Laikipia did not attend school, as compared to literacy levels in other study counties of Nyeri and Baringo (45 and 39% respectively). Lack of feeds was cited as the most important livestock keeping constraints in Nyeri county (61%), whereas lack of water was mentioned by most of the respondents in Laikipia and Baringo counties (50 and 38% respectively). Migration to search for greener pastures and safety was the main coping strategy to drought and floods in Baringo (97%) and Laikipia (64%). In Nyeri however, mobility as a coping strategy was almost non-existence (99%). Water harvesting was most important coping strategy (67%) in Nyeri county. With respect to adoption of improved climate change adaptation strategies, Nyeri county recorded the highest number of adopters, followed by Baringo and Laikipia counties (459>174>128 respectively). Off-farm purchase of feed supplements as a coping strategy was highly recorded in Nyeri county (61%). However, in Laikipia and Baringo counties, feed supplementation was hardly used, with a mention of 44 and 43% respectively. The study shows majority of the respondents from Baringo county were seeking for agricultural information from various sources namely; newspapers (100%), NGOs (100%), television (80%), chiefs' 'baraza' (80%) and a small number (45%) from village elders. Higher percentage of respondents in Nyeri county received agricultural information through the extension (100%), while in Laikipia county, village elders were the main source of agricultural information (42%). It is concluded that livestock as mainstay in Laikipia and Baringo counties is more vulnerable to climate

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			change than in Nyeri. However, although efficient agricultural information channels were used in Nyeri county, the high recorded cases of purchasing feeds off-farm is a challenge in adapting to climate change for a sustainable livelihood in this region.
167	Kenya	Tari, D., King-Okumu, C., & Jarso, I. (2015). Strengthening Local Customary Institutions: A Case Study in Isiolo County, Northern Kenya. Ada Consortium, NDMA, <a href="http://www.adaconsortium.org/images/publications/Rapid_Assessment_-_Web_Update.pdf">http://www.adaconsortium.org/images/publications/Rapid_Assessment_-_Web_Update.pdf</a> .	The benefits of adaptations to strengthen the capacities of customary institutions for natural resource stewardship to prepare for climate change, variability and drought risk were investigated through a rapid participatory assessment approach. The objective of the assessment was to weigh the benefits and costs of the investments in adaptation to short-term and long-term climate variability and change. The investments included funds made available through a devolved Climate Adaptation Fund (CAF), as well as from other sources. £66,234 was invested by Ward Adaptation Planning Committees in the wards of Kinna, Garba Tula, Sericho and Merti to build adaptive capacity to shocks and climate variability by strengthening customary institutions known in the local Boran dialect as 'Dedha'. These CAF funds enabled the Dedha to review their institutional functions and procedures and to hold strategic meetings, including cross border meetings with resource users from neighbouring counties. Dedha members then invested their own funds to boost resource surveillance and management of the grazing areas over the long dry season May-October 2014.
168	Morocco	Tekken, V., Costa, L., & Kropp, J. P. (2015). Increasing pressure, declining water and climate change in north-eastern Morocco. <i>Journal of coastal conservation</i> , 17(3), 379-388.	The coastal stretch of north-eastern Mediterranean Morocco holds vitally important ecological, social, and economic functions. The implementation of large-scale luxury tourism resorts shall push socio-economic development and facilitate the shift from a mainly agrarian to a service economy. Enough water availability and intact beaches are among the key requirements for the successful realization of regional development plans. The water situation is already critical, additional water-intense sectors could overstrain the capacity of water resources. Further, coastal erosion caused by sea-level rise is projected. Regional climate change is observable and must be included in regional water management. Long-

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			term climate trends are assessed for the larger region (Moulouya basin) and for the near-coastal zone at Saidia. Possible adjustments are discussed, and the analysis concludes with management recommendations for innovative regional water management of tourism facilities.
169	Kenya	Thomson, K., Kruszewska, I., & Tirado, R. (2015). <i>Building environmental resilience: A snapshot of farmers adapting to climate change in Kenya</i> . Greenpeace Research Laboratories Technical Report 48	Our climate is changing and all over the world we are experiencing more unpredictable and uncertain weather than in the past. Those depending on the weather for their daily bread – farmers and farm workers – are feeling, and will continue to feel, climate change more intensively than everyone else. East Africa has first-hand experience in climate change. It is predicted that long rains will decrease, and droughts will be more common, resulting in food insecurity. Fortunately, there are ecological farming practices that will increase farmers’ capacity to adjust to climate change. These practices will help farmers and their communities cope with, and recover from, climate shocks whilst giving them the ability to further adapt in the long-term to changing weather patterns. The strategies fundamentally build on four key elements that ensure resilience in farming systems: soil, water, diversity and communities.
170	sub-Saharan Africa	Thornton, P. K., & Herrero, M. (2015). Adapting to climate change in the mixed crop and livestock farming systems in sub-Saharan Africa. <i>Nature Climate Change</i> , 5(9), 830.	Mixed crop–livestock systems are the backbone of African agriculture, providing food security and livelihood options for hundreds of millions of people. Much is known about the impacts of climate change on the crop enterprises in the mixed systems, and some, although less, on the livestock enterprises. The interactions between crops and livestock can be managed to contribute to environmentally sustainable intensification, diversification and risk management. There is relatively little information on how these interactions may be affected by changes in climate and climate variability. This is a serious gap, because these interactions may offer some buffering capacity to help smallholders adapt to climate change.
171	Congo	Tiani, A.M, Besa, M.C, Devisscher, T, Pavageau, C, Butterfield R, Bharwani, S & Bele, M.Y. (2015). Assessing	The present paper describes the participatory methodology used to assess the current vulnerability of local communities in the Congo Basin. Vulnerability has been studied through the lenses of different dimensions:

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		current social vulnerability to climate change: A participatory methodology. <i>Working Paper 169</i> . Bogor, Indonesia: CIFOR.	system and exposure units, dynamic processes, multiple threats, differential exposure, social capital and collective action. The purpose of this framework is to grasp the social (and ecological) dynamics in the system over the past decades, in order to identify future actions for reducing vulnerability and to enhance adaptive capacity.
172	Africa	Tosam, M. J., & Mbih, R. A. (2015). Climate change, health, and sustainable development in Africa. <i>Environment, development and sustainability</i> , 17(4), 787-800.	This paper critically examines the effects of climate change on the African continent and suggests ways in which the negative effects of climate change can be effectively combatted to ensure sustainable development. Although responsible for a small share of global climate change, Africa is the most vulnerable region of the world to climate change, which destroys the people's source of food, medication, shelter, and income, leading to poor nutrition and exposure to infectious diseases, more hospitalizations, less working hours, and heavy financial losses. Apart from global environmental deterioration, Africa is one of the regions of the world experiencing the severest droughts and water scarcity. The impact of all this on Africa's already fragile socio-economic and political structures is grave. Climate change threatens the political stability of the continent. In this paper we argue that the effects of climate change on the continent have been amplified by human choices and political ineptitude of the ruling elites in Africa. We maintain that good governance, the promotion of African traditional values that encourage the protection of the environment, paying attention to rural development and the emancipation of women economically and politically, and investing in alternative and renewable energy are the necessary pre-conditions for effectively mitigating the effects of climate change and ensuring sustainable development in Africa.
173	Africa	Tucker, J., Daoud, M., Oates, N., Few, R., Conway, D., Mtisi, S., & Matheson, S. (2015). Social vulnerability in three high-poverty climate change hot spots: What does the climate change literature	This paper reviews the state of knowledge on social vulnerability to climate change in three hot spots (deltas, semi-arid regions and snowpack- or glacier-fed river basins) in Africa, Central Asia and South Asia, using elements of systematic review methods. Social vulnerability is defined as a dynamic state of societies comprising exposure, sensitivity and adaptive

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		tell us? <i>Regional Environmental Change</i> , 15(5), 783-800.	capacity. We examine whether the hot spots have specific characteristics that tend to increase or decrease social vulnerability, consider suitable scales of analysis for understanding vulnerability, and explore the conceptions of vulnerability adopted in the climate change literature and the nature of the insights this generates. Finally, we identify knowledge gaps in this literature. All three hot spots are characterized by high levels of natural resource dependence, with increasing environmental degradation. They also exhibit unequal policies and patterns of development, which benefit certain segments of society while making others more vulnerable. Vulnerability is driven by multiple factors operating at different scales; however, characterization of cross-scalar interactions is poorly developed in most studies reviewed. Most studies are either large scale, such as broad comparisons of vulnerability across countries, or local, documenting community-level processes. Detailed understanding of the interactions between climate change impacts on natural systems, and socio-economic trajectories, including adaptation, also emerges as a knowledge gap
174		Vignola, R., Harvey, C. A., Bautista-Solis, P., Avelino, J., Rapidel, B., Donatti, C., & Martinez, R. (2015). Ecosystem-based adaptation for smallholder farmers: Definitions, opportunities and constraints. <i>Agriculture, Ecosystems &amp; Environment</i> , 211, 126-132.	Despite the growing interest in Ecosystem-based Adaptation, there has been little discussion of how this approach could be used to help smallholder farmers adapt to climate change, while ensuring the continued provision of ecosystem services on which farming depends. Here we provide a framework for identifying which agricultural practices could be considered 'Ecosystem-based Adaptation' practices and highlight the opportunities and constraints for using these practices to help smallholder farmers adapt to climate change. We argue that these practices are (a) based on the conservation, restoration or management of biodiversity, ecosystem processes or services, and (b) improve the ability of crops and livestock to maintain crop yields under climate change and/or by buffering biophysical impacts of extreme weather events or increased temperatures. To be appropriate for smallholder farmers, these practices must also help increase their food security, increase or diversify their sources of income

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			generation, take advantage of local or traditional knowledge, be based on local inputs, and have low implementation and labor costs. To illustrate the application of this definition, we provide some examples from smallholders' coffee management practices in Mesoamerica. We also highlight three key obstacles that currently constrain the use of Ecosystem-based Adaptation practices (i) the need for greater understanding of their effectiveness and the factors that drive their adoption, (ii) the development supportive and integrated agriculture and climate change policies that specifically promote them as part of a broader agricultural adaptation program; and (iii) the establishment and maintaining strong and innovative extension programs for smallholder farmers. Our framework is an important starting point for identifying which Ecosystem-based Adaptation practices are appropriate for smallholder farmers and merit attention in international and national adaptation efforts
175	South Africa	Watermeyer, K. E. (2015). <i>Ecosystem implications of the recent southward shift of key components in the southern Benguela</i> (Doctoral dissertation) University of Cape Town, South Africa.	Several ecologically and economically important species in the southern Benguela have undergone southward/eastward shifts in their distribution in recent decades, including sardine <i>Sardinops sagax</i> and anchovy <i>Engraulis encrasicolus</i> in the mid-1990s. This has affected prey availability to top predators such as seabirds, and the spatially-distinct nature of the system - the west coast characterised by seasonal, wind-driven upwelling, and the south coast with characteristics of both a shelf system and an upwelling system - means the location of a stock may have implications for its productivity. To investigate possible impacts of these shifts and their drivers on the ecosystem as a whole and on the south coast subsystem, now playing a more important role both commercially and biologically: i) the physical and biological characteristics of the west and south coasts (divided at Cape Agulhas) were comprehensively investigated using existing literature to better understand differences in structure and functioning; ii) distribution maps for before (1985 – 1991), during (1997-2000) and after (2003 – 2008) the shift in small pelagic fish

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			<p>were constructed for 14 key species using catch and survey data, and used to calculate spatial indicators (relative overlap in biomass and area, index of diversity, connectivity); iii) SST data previously used to link shifts in anchovy distribution and changes in cross-shelf SST gradient on the Agulhas Bank were reanalysed with refined and extended domains using a sequential t-test algorithm for detecting regime shifts (STARS) to re-evaluate this hypothesis; iv) results from the above were used to inform the design of a frame-based model (FBM). Sensitivity analyses and a series of model tests were performed, and the usefulness of this approach in the context of understanding spatial changes in sardine and anchovy explored. Results show that the south coast is more diverse than the west and may be more constrained in terms of nutrient availability. For several species, previously unidentified increases in the proportion of biomass east of Cape Agulhas were shown to have occurred over the same period as that of small pelagic fish, although none to the same degree. On average overlap with small pelagic fish increased over time, but overall system connectivity was lowest in the intermediate period, possibly indicating a system under transition. Previously identified shifts in SST data were confirmed and additional undescribed shifts identified on the central Agulhas Bank and in the cross-shelf SST gradient on the western Agulhas Bank. A FBM approach appears to be useful within the context, allowing for the exploration of current thinking regarding drivers of distributional changes in small pelagic fish and the potential role of fishing, and for the development of an indicator of the capacity of the system to support top predators in terms of prey availability. The model was most sensitive to fishing parameters and was not more sensitive than expected to alternate assumptions regarding the effects of the environmental driver used (ESI). Results suggest that the modelled productivity of the 8 sardine resource, and as a result the ability of the system to support top predators, is highly dependent on the spatial characteristics of fishing pressure. The role of anchovy within the model system has not yet been fully developed.</p>



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			Increasing our understanding of the relative suitability of environmental conditions on the west and south coasts, as well as the relationship between the two, is important if we are to increase our capacity to predict trends in abundance and distribution. In the context of the management of the small pelagic fishery, a FBM approach provides a useful alternative to a spatial model when attempting to better understand changes in sardine distribution
176	Sub-Saharan Africa	Webber, H., Gaiser, T., & Ewert, F. (2015). What role can crop models play in supporting climate change adaptation decisions to enhance food security in Sub-Saharan Africa? <i>Agricultural Systems</i> , 127, 161-177.	According to the authors of this article, crop models are the primary tools available available to assess the impacts of climate change and other drivers on crop productivity, a key aspect of food security. This study examines the role and suitability for informing climate change adaptation decisions in Sub Saharan Africa. This study further identified several areas where crop models could aid in adaptation decision making. These crop models can: test which changes farmers are making are most robust to future climate scenarios; be used as tools for experimentation in farmer organizations to build farmer capacity, minimize risk and empower farmers; be linked to economic, farm systems or livestock models to widen the scope of potential impacts, adaptations and farmer constraints considered, and to probe the interactions of cropping systems with other systems; and evaluate various indicators of resilience. The study concludes that one of the greatest benefits of linking crop models across disciplines will be Providing a platform to bring specialists and stakeholders from diverse backgrounds together to assess climate change adaptation options to enhance food security.
177	Africa	Wild, S. (2015). FACTSHEET: Why do many scientists think Africa will be hardest hit by climate change? Retrieved October 16, 2018, from <a href="https://africacheck.org/factsheets/factsheet-why-do-many-scientists-think-">https://africacheck.org/factsheets/factsheet-why-do-many-scientists-think-</a>	While scientists and policymakers agree that African countries will be vulnerable to climate change for myriad reasons, there are still many gaps in our understanding of exactly how climate change will affect different parts of the world, different places within the different continents and to what extent. Climate scientist are more sceptical about the claim that Africa will be the continent hardest hit by climate change. The claim is based on two things: geographically and climatically Africa is exposed.

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		africa-will-be-hardest-hit-by-climate-change/	Africa in general is already quite hot. Heat it up more and it's just downhill for animal production, plant production and human health. However, other parts of the world are also quite hot and have their own vulnerabilities. And there are a number of regions within the African continent. Scientists think Africa is particularly vulnerable to climate change due to its poverty levels, areas with scarce water sources and rain-fed agricultural production. This factsheet, the second on the topic of climate change, explores these reasons.
178	Africa	Williams, T. O., Mul, M., Cofie, O. O., Kinyangi, J., Zougmore, R. B., Wamukoya, G., & Frid-Nielsen, S. (2015). Climate Smart Agriculture in the African Context. Background Paper. Feeding Africa Conference 21-23 October 2015.	Agriculture remains vital to the economy of most African countries and its development has significant implications for food security and poverty reduction in the region. Increase in agricultural production over the past decades has mainly been due to land area expansion, with very little change in production techniques and limited improvement in yields. Currently one in four people remains malnourished in Africa. CSA integrates all three dimensions of sustainable development and is aimed at (1) sustainably increasing agricultural productivity and incomes; (2) adapting and building resilience to climate change from the farm to national levels; and (3) developing opportunities to reduce greenhouse gas emissions from agriculture compared with past trends. It is an approach to identify the most suitable strategies according to national and local priorities and conditions to meet these three objectives. There is no such thing as an agricultural practice that is climate smart per se. Whether or not a practice or production system is climate smart depends upon the particular local climatic, biophysical, socio-economic and development context, which determines how far a particular practice or system can deliver on productivity increase, resilience and mitigation benefits. For Africa to reap the potential benefits CSA, concrete actions must be taken to: enhance the evidence base to underpin strategic choices, promote and facilitate wider adoption by farmers of appropriate technologies; develop institutional arrangements to support, apply and scale-out CSA from the farm level to the agricultural landscape level; manage tradeoffs in

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			perspectives of farmers and policymakers; strengthen technical, analytical and implementation capacities; ensure policy frameworks and public investments are supportive of CSA; develop and implement effective risk-sharing schemes.
179	Tanzania	Zakayo, R. (2015). <i>Pastoral adaptive capacity in the changing climate in Kilosa district</i> (Doctoral dissertation), Sokoine University of Agriculture, Tanzania.	Kilosa District is the district in Morogoro Region that has been affected by climate change for many years. This study assessed the pastoral adaptive capacity in the changing climate in Kilosa District. Both simple random and purposive sampling techniques were used to obtain sample. Qualitative data were collected using key informant interview, Focus group discussions and field observation, while quantitative data were collected using household questionnaire survey. Analysis of qualitative data was done using content analysis technique, while quantitative data were analyzed using Excel SPSS computer software. The result revealed that there is a significant shift of rainfall in the study area which started to manifest in 1972-1974 leading to change of rainfall pattern from bimodal to unimodal. The trend in current decades has been consistent with climate change scenarios, with lower rainfall and more frequent, and severe droughts most pastoralists were aware of climate change impacts and how to overcome the problems. The results show that climate change lead to water scarcity, disease to livestock and increased distance to the grazing land Pastoralists have started adapting to climate change by migrating, diversifying to other economic activities such as crop farming and business. Some were reducing the number of livestock as well as using improved breeds. Various institution played important roles in ensuring the sustainability of natural resources, such as setting a grazing land (Olailili as named in Maasai language) to be used during dry season. Some construct charco dams “lambo” for water harvesting. This study recommends that the community should diversify to other economic activities so that they can earn income rather than relying on livestock while climatic condition is not favorable and the government of Tanzania

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			should put more effort on training and advocating pastoral to use high breed animal to avoid overgrazing also regular review of policies.
180	West Africa	Zougmore, R., Traoré, A.S., Mbodj, Y. (Eds.). (2015). Overview of the Scientific, Political and Financial Landscape of Climate-Smart Agriculture in West Africa. CCAFS Working Paper No. 118. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)	The ECOWAS has put in place various policy instruments such as the Economic Community of West Africa States Agricultural Policy (ECOWAP) and its derived Regional Agricultural Investment Plan (RAIP) in order to promote a modern and sustainable agriculture based on effective and efficient family farms and the promotion of agricultural enterprises through the involvement of the private sector. Taking stock on member States' expressed needs, ECOWAS would like to integrate a new type of public policy instruments into the RAIP: instruments for adapting the West-African agriculture to climate change, towards a Climate-Smart Agriculture (CSA) focusing on adaptation, mitigation and food & nutrition security joint objectives. This book documents and analyses specific features of the scientific, institutional, policy and funding CSA landscape in West Africa. It provides relevant information that could guide the definition of the ECOWAS Framework for CSA Intervention, Funding, Monitoring and Evaluation. Five major agricultural sectors have been covered: crop production, livestock, fisheries, forestry/agroforestry, and water. For each sector, a emphasis was given to the current status, the climate projections and likely socio- economic and environmental impacts expected, the bottlenecks to action and suggested next steps for adaptation and mitigation. Actionable messages and recommendations have been directed to ECOWAS stakeholders to incentivise CSA in West Africa. Key words: Climate change; Climate-smart agriculture; Crop production; Livestock; Water resources; Fisheries; Forestry; Agroforestry; West Africa

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1	South Africa	Abiodun, G. J., Maharaj, R., Witbooi, P., & Okosun, K. O. (2016). Modelling the influence of temperature and rainfall on the population dynamics of <i>Anopheles arabiensis</i> . <i>Malaria journal</i> , 15(1), 364.	In this study, a climate-based, ordinary-differential-equation model is developed to analyse how temperature and the availability of water affect mosquito population size. In the model, the influence of ambient temperature on the development and the mortality rate of <i>Anopheles arabiensis</i> is considered over a region in KwaZulu-Natal Province, South Africa. In particular, the model is used to examine the impact of climatic factors on the gonotrophic cycle and the dynamics of mosquito population over the study region. The results accurately quantify the seasonality of the population of <i>An. arabiensis</i> over the region and also demonstrate the influence of climatic factors on the vector population dynamics. The model simulates the population dynamics of both immature and adult <i>An. arabiensis</i> . The simulated larval density produces a curve which is like observed data obtained from another study. The model is efficiently developed to predict <i>An. arabiensis</i> population dynamics, and to assess the efficiency of various control strategies. In addition, the model framework is built to accommodate human population dynamics with the ability to predict malaria incidence in future.
2	Southern Africa	Abiye, T. (2016). Synthesis on groundwater recharge in Southern Africa: A supporting tool for groundwater users. <i>Groundwater for Sustainable Development</i> , 2–3(September), 182–189. <a href="https://doi.org/10.1016/j.gsd.2016.10.002">https://doi.org/10.1016/j.gsd.2016.10.002</a>	This paper examines a synthesis on groundwater recharge in southern Africa as a supporting tool for groundwater users. They argue that the presence of reliable groundwater recharge from rainwater in the region is fundamental factor for sustainable use of resources and enhancing economic development. This knowledge is also critical for water management in the region. From the study several methods were identified in determining recharge proportions from rainfall which include; chloride mass balance, water table fluctuation and saturated volume fluctuations.

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3	Nigeria	Acey, C. (2016). Managing wickedness in the Niger Delta: Can a new approach to multi-stakeholder governance increase voice and sustainability? <i>Landscape and Urban Planning</i> , 154, 102–114. <a href="https://doi.org/10.1016/j.landurbplan.2016.03.014">https://doi.org/10.1016/j.landurbplan.2016.03.014</a>	The paper asserted that recent efforts by largest oil companies in Nigeria have shifted their corporate responsibility to reflect more bottom up participatory approaches to development and environmental conflict management in the Niger Delta. The newest approach known as Global memorandum of understanding has been regarded and a model of network governance, clustering groups of communities together into representative boards that make decision on local development projects. According to the paper, this model offers the opportunity and proves to be an important tool for managing conflict over resources, and revenues in the oil producing regions of the country. The paper traces the gradual shift from competition to collaboration among stakeholders for social and environmental justice. The paper used content analysis of secondary data to apply the wicked problems framework to the problem of local governance amid political ecology of social and natural resources conflicts and increasing expectation for public involvement in resource allocation decision making.
4	Africa	Adole, T., Dash, D., Atkinso, P.M. (2016). A systematic review of vegetation phenology in Africa. <i>Ecological Informatics</i> , Volume 34, Pages 117-128	The study of vegetation phenology is important because it is a sensitive indicator of climate changes and it regulates carbon, energy and water fluxes between the land and atmosphere. Africa, which has 17% of the global forest cover, contributes significantly to the global carbon budget and has been identified as potentially highly vulnerable to climate change impacts. In spite of this, very little is known about vegetation phenology across Africa and the factors regulating vegetation growth and dynamics. Hence, this review aimed to provide a synthesis of studies of related Africa's vegetation phenology and classify them based on the methods and techniques used in order to identify major research gaps. Significant increases in the number of phenological studies in the last decade were observed, with over 70% of studies adopting a satellite-based remote sensing approach to monitor vegetation phenology. Whereas ground-based studies that

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			provide detailed characterisation of vegetation phenological development, occurred rarely in the continent. Similarly, less than 14% of satellite-based remote sensing studies evaluated vegetation phenology at the continental scale using coarse spatial resolution datasets. Even more evident was the lack of research focusing on the impacts of climate change on vegetation phenology. Consequently, given the importance and the uniqueness of both methods of phenological assessment, there is need for more ground-based studies to enable greater understanding of phenology at the species level. Likewise, finer spatial resolution satellite sensor data for regional phenological assessment is required, with a greater focus on the relationship between climate change and vegetation phenological changes. This would contribute greatly to debates over climate change impacts and, most importantly, climate change mitigation strategies.
5	Nigeria	Agbeja, Y.E. (2016) An overview of efforts towards collaborative fisheries management in the Gulf of Guinea by Nigeria. <i>International Journal of fisheries and aquatic science</i> . 4(4): 106-114	Marine fisheries make important contribution to food security, employment and income of coastal communities in the developing countries. The Guinea Current Large Marine Ecosystem (GCLME) is ranked among the five most productive Large Marine Ecosystems (LMEs) in the world today in terms of biomass yields. The region is rich in many resources such as fisheries, oil and gas reserves and precious minerals. It also has a high potential for tourism and harbors marine biological diversity of global significance that contribute greatly to the livelihood and employment of the people of countries bordering the GCLME. However, in recent years there is more awareness about the dwindling fish catches from the region; hence better fisheries management instruments have become crucial. To promote co-operation in the management of fisheries within and between coastal States and on the high seas, States have created a series of regional arrangements and agreements. Regional Fisheries Management Organizations (RFMOs) and Regional Fisheries Bodies (RFBs) have become progressively more important in fisheries



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			management. This aim of this paper is to highlight the basis for regional fisheries management in Nigeria and the Gulf of Guinea Large Marine Ecosystem (GCLME) and progress made towards regional collaborative sustainable fisheries management practices in Nigeria. This article will be concluded by suggesting efforts that will enhance collaboration in the region.
6	Ghana	Ahmed, A., Lawson, E.T., Mensah, A., Gordon, C., Padgham, J. (2016). Adaptation to climate change or non-climatic stressors in semi-arid regions? Evidence of gender differentiation in three agrarian districts of Ghana. <i>Environmental Development</i> , Volume 20, Pages 45-58	With the increasing impacts of climate change in Africa, a relationship between rainfall and yields in semi-arid Ghana has been observed. Drawing insights from three agrarian societies in the semi-arid region of Ghana using qualitative research methods, the study reports how people currently deal with climate variability as insight on how they will deal with climate change in the future. The findings indicate wide gender inequality in decision making processes and land access resulting from patriarchal local customs and institutions that shape adaptation responses of different vulnerable social groups to climatic or non-climatic stressors. Different adaptation practices of groups indicate that both climatic and non-climatic stressors shape the kind of responses that groups adopt. From the current adaptation practices, efforts to improve adaptation to future climate change at local levels must give attention to the nexus of both climatic and non-climatic stressors, gender, differential vulnerabilities and other subjectivities that produce a adaptation practice in a given place.
7	North Africa Region	Akrout, M. M., & Othman, B.H. (2016). Environmental disclosure and stock market liquidity: evidence from Arab MENA emerging markets. <i>Applied Economics</i> , 48(20), 1840-1851.	The objective of this study is to examine the impact of environmental disclosure levels on the stock market liquidity of Arab Middle Eastern and North African (MENA) companies. For that, a self-constructed disclosure index was applied to the annual reports for the years 2010, 2011 and 2012 and the bid-ask spread was used as a proxy for stock market liquidity. Results indicate that levels of environmental disclosure in MENA companies are quite low. In addition, using a sample of 276 firm-year observations, multivariate analysis shows that the higher the level of environmental disclosure provided in the

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			annual reports, the lower the spread between the market bid and ask prices, thereby indicating an increase in stock market liquidity.
8	North Africa Region	Alboghady, M., & El-Hendawy, S. E. (2016). Economic impacts of climate change and variability on agricultural production in the Middle East and North Africa region. <i>International Journal of Climate Change Strategies and Management</i> , 8(3), 463-472.	The purpose of this study is to analyze the impact of climate change and variability on agricultural production in Middle East and North Africa region (MENA) where the deleterious impacts of climate change are generally projected to be greatest. The study used a production function model using Fixed Effect Regression (FER) analysis and then using marginal impact analysis to assess the impact of climate change and variability on agricultural production. Therefore, the study utilized panel data for the period 1961-2009 pooled from 20 countries in MENA region.
9	South Africa	Altieri, K.; Trollip, H.; Caetano, T.; Hughes, A.; Merven, B.; Winkler, H. (2016) Achieving development and mitigation objectives through a decarbonisation development pathway in South Africa. <i>Clim. Policy</i> , 16, 78–91.	Achieving the international 2 °C limit climate policy requires stringent reductions in GHG emissions by mid-century, with some countries simultaneously facing development-related challenges. South Africa is a middle-income developing country with high rates of unemployment and high levels of poverty, as well as an emissions-intensive economy. South Africa considers an assessment of what a fair contribution to reducing global emissions might be, and is committed to a 'peak, plateau and decline' emissions trajectory with absolute emissions specified for 2025 and 2030, while noting the need to address development imperatives. This work utilizes an economy-wide computable general equilibrium model (e-SAGE) linked to an energy-system optimization model (TIMES) to explore improving development metrics within a 14 GtCO <sub>2</sub> e cumulative energy sector carbon constraint through to 2050 for South Africa.
10	Sub-Saharan Africa	Amjath-Babu, T. S., Krupnik, T. J., Kaechele, H., Aravindakshan, S., & Sietz, D. (2016). Transitioning to groundwater irrigated intensified agriculture in Sub-Saharan Africa: An indicator-based assessment. <i>Agricultural Water</i>	The paper assesses the potential of transitioning to groundwater irrigated intensified agriculture in the sub Saharan African countries in boosting food production and ensuring food security in changing climate, rapid population growth, and changing marketing conditions. The authors contended that groundwater irrigation although underutilized could be of great potential for transitioning from rain

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		<i>Management</i> , 168, 125–135. <a href="https://doi.org/10.1016/j.agwat.2016.01.016">https://doi.org/10.1016/j.agwat.2016.01.016</a>	fed agriculture. Several factors have been mentioned that can be barriers to this transitioning including energy availability and cost, market access, infrastructure, farm conditions, labor availability, natural resources stocks as well as the unfavorable political environment and support.
11	West Africa	Amole, T. A., & Ayantunde, A. A. (2016). <i>Climate-smart livestock interventions in West Africa: a review</i> . Working Paper no. 178. CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS)	The livestock sector is one of the major contributors in agriculture, by some estimates contributing up to 18% of the global greenhouse gas (GHG) emissions. Of this, about one third is reported to be due to land use change associated with livestock production, another one third is nitrous oxide from manure and slurry management, and roughly 25% is attributed to methane emissions from ruminant digestion. Recent analysis suggests that developing world regions contribute about two thirds of the global emissions from ruminants, with sub-Saharan Africa a global hotspot for emissions intensities, largely due to low animal productivity, poor animal health and low-quality feeds. These numbers suggest, therefore, that there are opportunities for easy gains to be made in terms of mitigation in the livestock sector, as improving feed resource use efficiencies would improve livestock productivity as well as reduce emissions per unit of product. In this context, climate-smart agricultural practices are necessary in the West Africa region and in sub-Saharan Africa in general. Climate-Smart Agriculture (CSA) is an approach that provides a conceptual basis for assessing the effectiveness of agricultural practice change to support food security under climate change. This review focuses on livestock-related CSA options in West Africa looking at herd management, feed, grazing management, animal breeding strategies, manure management, and policy options.
12	South Africa	Amusan, L., & Olutola, O. (2016). Addressing Climate Change in Southern Africa: Any Role for South Africa in the Post-Paris Agreement? <i>India Quarterly</i> , 72(4), 395-409	Southern Africa is singled out as a potentially vulnerable sub region to climate change. Representing a milestone in the trajectory of the global climate change process, the 21st session of the Conference of Parties (COP-21) resolved with a consensual climate change deal

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			known as the Paris Agreement. The Agreement, through the instrumentality of a ratchet up mechanism, otherwise described as Intended Nationally Determined Contributions (INDCs), seeks significant cuts in greenhouse gas (GHG) emissions effectively from 2020. It calls for a novel though gradual shift from carbon-emission approach to low emission development strategy. This, no doubt, is indispensable to sustainable development at all levels. Beyond national commitments as obligatory for parties, there is a need for regional cooperative efforts which should bring about shared appropriate policy responses that promote green energy as well as seize opportunities inherent in it for national and deterritorialised gains. Adopting neoliberal and green theories, the institutional framework of the Southern Africa Development Community (SADC) where South Africa is expected to take a lead is examined in this article.
13	Africa	Ansems H.L.G., Boonstra, H., Gärtner, A., and Sari, F.P. (2016) <i>Adaptation Experiences in Deltas throughout the World</i> . Wageningen University & Research course: WSG-60812 - Design of Climate Change Mitigation and Adaptation Strategies.	This desk-study performed by MSC students of Wageningen University & Research identifies trends in climate change adaptation literature and projects over the last 15 years for eight countries of the Delta Coalition: Bangladesh, Colombia, Egypt, Indonesia, Mozambique, Myanmar, The Philippines, and Vietnam. A series of recommendations to achieve good practices in climate change adaptation implementation options was developed. This series of recommendations aims to improve the development of adaptation policies (policy process-based) and the actual execution of adaptation practices (practice process-based).
14	Kenya	Anthonj, C., Rechenburg, A., & Kistemann, T. (2016). Water, sanitation and hygiene in wetlands. A case study from the Ewaso Narok Swamp, Kenya. <i>International Journal of Hygiene and Environmental Health</i> . 219(7), 606–616. <a href="https://doi.org/10.1016/j.ijheh.2016.06.006">https://doi.org/10.1016/j.ijheh.2016.06.006</a>	The paper examines the interplay between water, sanitation and hygiene in wetlands using a case study from the Ewaso Narok Swamp, Kenya. Although wetlands provide enormous ecological services such as water purification, climate regulation, flood control and prevention among others, the authors argue that wetlands can also be a curse. This is because they are known to be sources of disease-causing

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			microorganisms and invertebrates that can threaten human health. The overall aim of this study was to provide insights into water, sanitation and hygiene conditions and the behavioral determinants of households in wetlands areas. The results indicated that wetland users in the study use by far less improved water sources and sanitation facilities than nationwide coverage for rural populations. Recommended approaches include integrative approach that complemented by public health intervention. (Anthonj, Rechenburg, & Kistemann, 2016)
15	Ghana	Arranz-piera, P., Bellot, O., Gavalda, O., Kemausuor, F., & Velo, E. (2016). Trigeneration based on biomass - specific field case: agricultural residues from smallholder farms in Ghana. <i>Energy Procedia</i> , 93, 146–153. <a href="https://doi.org/10.1016/j.egypro.2016.07.163">https://doi.org/10.1016/j.egypro.2016.07.163</a>	This paper investigates trigeneration based on biomass with specific field case on agricultural residues from smallholder farms in Ghana. The authors noted that many of the rural communities cultivate crops whose residues offers a potential solid biomass fuel for power generation with the appropriate technologies. Therefore, this paper sought to explore the feasibility of trigeneration thus producing heat, power and cold from small farm typologies with enough clustered crop residue in selected communities sin Ghana. the study examined 11 districts using a survey to assess the level of agricultural waste produced in small holder farms and their possible clustering for supplying these wastes to a hypothetical centralized trigeneration plant. The results of the study indicate that about 600kw and 1MW CHP plants run on local agro waste are feasible in Ghana with minimum 20% yearly profit for investors. The crop residues biomass could also generate additional income for rural farmers in the range of 29 to 64 UD/tonne. this therefore call for national integration and appropriate policy and framework to ensure nationwide energy access whilst at the same time create jobs, improve waste management for environmental sustainability
16	Nigeria	Asiyanbi, A. P. (2016). Geoforum A political ecology of REDD: Property rights, militarised protectionism, and carbonised exclusion in Cross	Reducing Emission from Deforestation and Degradation (REDD+) has been a promising ecosystem approach that offer both environmental and human livelihood benefits for sustainable development. This paper offers a critical assessment of the REDD+ in

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		River. <i>Geoforum</i> , 77, 146–156. <a href="https://doi.org/10.1016/j.geoforum.2016.10.016">https://doi.org/10.1016/j.geoforum.2016.10.016</a>	Nigeria from the political ecology perspective with focus on property rights and resources access.
17	Africa	Aurecon. (2016). <i>Development of a Climate Change Response Strategy for the Ugu District Municipality, Prepared by Aurecon for Ugu District Municipality</i> . Available online: <a href="http://ugu.gov.za/Documents/Other/Ugu%20CCRS%20complete%20draft_20161115.pdf">http://ugu.gov.za/Documents/Other/Ugu%20CCRS%20complete%20draft_20161115.pdf</a>	Main objective of the study was to compile a comprehensive survey in order to assess the vulnerability of the district's sectors to climate change. This process entailed a combination of desktop research, stakeholder engagement and targeted fieldwork, if required. The vulnerability assessment then formed the basis for the development of a climate change response strategy and implementation framework for the Ugu District to facilitate the formalizing of programmes and projects that will focus on adaptation and mitigation. The project seeks to interpret and assess various data sources and analyses with the aim of presenting the complex and interrelated challenges posed through projected climate changes in a locally applicable and practical. This is undertaken in a manner such that the strategies, decisions and projects are drawn home to the local context of Ugu District Municipality allowing increased resilience and exposure to the climate hazards and for the benefit of the district population.
18	Africa	Awotwi, A., Asare, M., & Harris, E. (2016). <i>Water Quality Changes Associated with Cassava Production: Case Study of White Volta Basin. HLY</i> . <a href="https://doi.org/10.1016/j.heliyon.2016.e00149">https://doi.org/10.1016/j.heliyon.2016.e00149</a>	This article sought to investigate the water quality changes that are associated with cassava production using a case of the white Volta basin. This is primary because the volta basin is an important freshwater ecosystem that provide key ecosystem service for many people abd contribute significantly to national development. The outcome of the investigation shows that the land use in the catchment areas change from mixed agricultural to cassava cultivation indicated a reduction in the loads and concentration of nitrogen species form the cassava for the current land use scenario using a simulated loads and concentration model. The findings of this study form a baseline information on water quality of the White Volta basin for the effective management of the ecosystem for sustainable water resources management.

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19	Africa	Bahri, A., Brikké, F., & Vairavamoorthy, K. (2016). Managing Change to Implement Integrated Urban Water Management in African Cities. <i>Aquatic Procedia</i> , 6, 3–14. <a href="https://doi.org/10.1016/j.aqpro.2016.06.002">https://doi.org/10.1016/j.aqpro.2016.06.002</a>	One of the most challenges of the 21st Century is to provide safe drinking water and basic sanitation for all particularly for urban centers in developing countries. Managing change to implement integrated urban water management is deemed crucial solution to handling this challenge. This form the basis of this paper. This paper describes the African water facility's experience to apply this integrated approach. This integrated approach differs from the conventional methods in several ways through involvement of key stakeholders needs, uses of green and grey infrastructure, value creation, and decentralized systems. These will help ensure urban water security in change climate and rapid urban population growth with increasing demand.
20	Africa	Balama, C., Augustino, S., Eriksen, S., Makonda, F.B (2016). Forest adjacent households' voices on their perceptions and adaptation strategies to climate change in Kilombero District, Tanzania. <i>Springerplus</i> . 21; 5(1):792.	Climate change is a global and local challenge to both sustainable livelihoods and economic development. Tanzania as other countries of the world has been affected. Several studies have been conducted on farmers' perceptions and adaptation to climate change in the country, but little attention has been devoted to forest adjacent households in humid areas. This study assessed this gap through assessing forest adjacent households' voices on perceptions and adaptation strategies to climate change in Kilombero District, Tanzania. The perceived change in climate has impacted agriculture productivity as the main livelihood source. Different coping and adaptation strategies are employed. These are; crop diversification, changing cropping calendar, adopting modern farming technologies, and increasing reliance on non-timber forest products. These strategies were positively and significantly influenced by socio-economic factors including household size, residence period, land ownership and household income.
21	Cameroon	Balgah, R. A., Kimengsi, J. N., Bime, M. J. W., & Forti, K. A. (2016). Farmers' Knowledge and Perceptions to Climate Variability in North West	Global climate variability exerts negative impacts especially on agriculture-dependent economies. Contemporary climate modelling suggests that farming households in developing countries will bear the



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		Cameroon. <i>World Journal of Social Science Research</i> , 3(3), 261.	greatest brunt from climate variability. However, information on farmers' knowledge and perceptions to climate variability and possible influence on household adaptation strategies especially in developing countries is scarce. This paper assesses farmers' knowledge and perceptions to climate variability, based on a case study from the North Western region of Cameroon. The study concludes with the need for climate variability research to increasingly pay attention to farmers indigenous knowledge and perceptions as prerequisites to building resilience among farmers in Cameroon.
22	Ghana	Bandanaa, J., Egyir, I. S., & Asante, I. (2016). Cocoa farming households in Ghana consider organic practices as climate smart and livelihoods enhancer. <i>Agriculture and Food Security</i> , 5(1), 1–9. <a href="https://doi.org/10.1186/s40066-016-0077-1">https://doi.org/10.1186/s40066-016-0077-1</a>	This study considers the adoption of organic farming practices by cocoa farming household in Ghana as a climate smart and means of enhancing their livelihoods as compared to the conventional farming methods. The objective of this study sought to measure the flora diversity and the livelihoods position of farmers in the organic farms and compared that with the conventional farming ones using various diversity indices (Jaccard similarity index, Shannon and Simpson diversity indices). The livelihoods position of the organic farmers were determined using the food security, income and vulnerability and well-being as sustainable livelihoods indicators. Some of the practices of the organic farming include non-chemical-based fertilizers and pesticides, mulching, compost, manures, and catch cropping as well as agroforestry. The results of the study indicated that households who adopted organic farming practice had more flora diversity in their farms, had more income, and were more food secure and resilient as compared to those using the conventional approaches. The uptake of organic farming practice and its integration in the farming systems in other crops varieties should therefore be promoted as an ecosystem-based approach for sustainable food production and environmental conservation.

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23	Africa	Barbier, E.B. (2016) The protective service of mangrove ecosystems: A review of valuation methods. <i>Pubmed</i> . 30; 109(2):676-81.	Concern over the loss of mangrove ecosystems often focuses on their role in protecting coastal communities from storms that damage property and cause deaths and injury. With climate change, mangrove loss may also result in less protection against coastal storms as well as sea-level rise, saline intrusion and erosion. Past valuations of the storm protection benefit of mangroves have relied on the second-best replacement cost method, such as estimating this protective value with the cost of building human-made storm barriers. More reliable methods instead model the production of the protection service of mangroves and estimate its value in terms of reducing the expected damages or deaths avoided by coastal communities. This paper reviews recent methods of valuing the storm protection service of mangroves and their role in protecting coastal areas and communities of tropical developing countries.
24	Ghana	Baruah, M., Bobtoya, S., Mbile, P., & Walters, G. (2016). Governance of restoration and institutions: Working with Ghana's Community Resource Management Areas. <i>World Development Perspectives</i> , 3, 38–41. <a href="https://doi.org/10.1016/j.wdp.2016.11.008">https://doi.org/10.1016/j.wdp.2016.11.008</a>	Ecosystem restoration is an important ecosystem management tool in ecosystem sustainability and resilience. Policies and framework aim at ensuring restoration of degraded landscapes in developing countries could be challenged by governance and institutional barriers. The focus of the paper sought to assess how working with community resource management area CREMAs on these governances' issues could enable restoration to occur by identify success, barriers and key lessons for policy. Overall it became clear that the issues of accountability and transparency in the operation of CREMAs are more critical that can enhance restoration success. Restoration project must also take into consideration the livelihoods and well-being of the communities involved and foster strong engagement and participation.
25	Kenya	Bedelian, C. & Ogutu, J.O. (2016) Trade-offs for climate resilient pastoral livelihoods in wildlife conservancies in the Mara Ecosystem, Kenya. <i>Pastoralism, research, policy and practice</i> . 7:10.	Pastoralists in the wildlife-rich East African rangelands use diversification into conservation and tourism as a strategy to supplement livestock-based livelihoods and to spread risk. Tourism incomes are an important alternative source during drought, when

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			livestock incomes decline. However, tourism may also reduce access to rangeland resources, and an abundant wildlife may destroy crops and injure, kill or transmit disease to livestock or people. This paper investigates the ability of wildlife conservancies in the Mara, Kenya, to act as an alternative for pastoralists that mitigates risks and maintains resilience in a changing climate. It analyses data to examine how conservancies contribute to and integrate with pastoral livelihoods, and to understand how pastoralists are managing their livestock herds in response to conservancies. It finds conservancy payments can provide an important, reliable, all-year-round source of income and prevent households from selling their animals during stress and for cash needs. Conservancies also retain grass banks during the dry season and provide opportunities for pastoralists to access good-quality forage. However, they reduce access to large areas of former grazing land and impose restrictions on livestock mobility. This affects the ability of pastoralists to remain flexible and able to access seasonally variable resources. Conflicts between grazing and conservancies may also heighten during drought times. Furthermore, income from land leases is not more than the contribution of livestock, meaning conservancy land leases create trade-offs for livestock-based livelihoods. Also, income is based on land ownership, which has inequity implications: women and other marginalised groups are left out.
26	Africa	Bennett, E. M., & Chaplin-Kramer, R. (2016). Science for the sustainable use of ecosystem services. <i>F1000 Research</i> , 5, 2622. doi:10.12688/f1000research.9470.1	Sustainability is a key challenge for humanity in the 21st century. Ecosystem services—the benefits that people derive from nature and natural capital—is a concept often used to help explain human reliance on nature and frame the decisions we make in terms of the ongoing value of nature to human wellbeing. Yet ecosystem service science has not always lived up to the promise of its potential. Despite advances in the scientific literature, ecosystem service science has not yet answered some of the most critical questions posed by decision-

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			makers in the realm of sustainability. Here, we explore the history of ecosystem service science, discuss advances in conceptualization and measurement, and point toward further work needed to improve the use of ecosystem service in decisions about sustainable development.
27	Africa	Bennett, N., Roth, R., Klain, S., Chan, K., Christie, P., Clark, D., Cullman, G., Curran, D., Durbin, T., Epstein, G., Greenberg, A., Nelson, P., Sandlos, J, Stedman, R., Teel, T., Thomas, R., Verissimo, D. and Wyborn, C. (2016). Conservation social science: Understanding and integrating human dimensions to improve conservation. <i>Biological Conservation</i> . 205: 93–108.	It has long been claimed that a better understanding of human or social dimensions of environmental issues will improve conservation. The social sciences are one important means through which researchers and practitioners can attain that better understanding. Yet, a lack of awareness of the scope and uncertainty about the purpose of the conservation social sciences impedes the conservation community's effective engagement with the human dimensions. This paper examines the scope and purpose of eighteen subfields of classic, interdisciplinary and applied conservation social sciences and articulates ten distinct contributions that the social sciences can make to understanding and improving conservation.
28	Africa	Bennett, N.J., Blythe, J., Tyler, S. (2016). Communities and change in the anthropocene: understanding social-ecological vulnerability and planning adaptations to multiple interacting exposures. <i>Reg Environ Change</i> 16: 907.	Most of the vulnerability and adaptation scholarship, policies and programs focus exclusively on climate change or global environmental change. Yet, individuals, communities and sectors experience a broad array of multi-scalar and multi-temporal, social, political, economic and environmental changes to which they are vulnerable and must adapt. While extensive theoretical—and increasingly empirical—work suggests the need to explore multiple exposures, a clear conceptual framework which would facilitate analysis of vulnerability and adaptation to multiple interacting socioeconomic and biophysical changes is lacking. This review and synthesis paper aim to fill this gap through presenting a conceptual framework for integrating multiple exposures into vulnerability analysis and adaptation planning.
29	South Africa	Black, D., Turpie, J. K., & Rao, N. (2016). Evaluating the cost-effectiveness of ecosystem-based adaptation: Kamiesberg wetlands case	Ecosystem-based adaptation (EbA) is increasingly being promoted as a cost-effective means of adaptation to climate change. However, in spite of considerable international press, there is still little evidence to

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		study. <i>South African Journal of Economic and Management Sciences</i> , 19(5), 702-713.	substantiate this claim. This study proposes a method through which the cost-effectiveness of EbA strategies can be evaluated against alternative adaptation options and contributes to South African literature on the subject. The potential cost-effectiveness of wetland restoration is assessed as a means of securing the carrying capacity of land for pastoralist communities of the Kamiesberg communal area in South Africa under projected future climate conditions. The conventional alternatives would be to respond to increasingly dry conditions by drilling boreholes and using supplemental feed for livestock. It was assumed that the EbA interventions would occur upfront, whereas the alternatives are more likely to be implemented in reaction to droughts over a longer time period. The study found the implementation of conventional alternatives to be more cost-effective than EbA to sustaining livestock stocking rates, with EbA being twice as costly. However, this is framed from the perspective of those directly affected (the landowners) and does not include the benefits to broader society.
30	Africa	Blankespoor, B., Dasgupta, S., & Lange, G. M. (2016). Mangroves as a protection from storm surges in a changing climate. <i>Ambio</i> . 1-14.	Adaptation to climate change includes addressing sea-level rise (SLR) and increased storm surges in many coastal areas. Mangroves can substantially reduce vulnerability of the adjacent coastal land from inundation but SLR poses a threat to the future of mangroves. This paper quantifies coastal protection services of mangroves for 42 developing countries in the current climate, and a future climate change scenario with a 1-m SLR and 10 % intensification of storms. Findings demonstrate that while SLR and increased storm intensity would increase storm surge areas, the greatest impact is from the expected loss of mangroves.
31	Ghana	Boafo Y. A., Osamu. S., Godfred. S. J., Kei. O., (2016). Provisioning ecosystem services-sharing as a coping and adaptation strategy among rural communities in Ghana's semi-arid ecosystem.	The objective of this article was to investigate how households in rural semi-arid Ghana use communal sharing as a strategy to enhance access and management of nine ecosystem services including crops and vegetables, livestock and poultry, bush meat, freshwater, wild

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		<i>Ecosystems service</i> , 19(2016) 92-102. <a href="http://dx.doi.org/10.1016/j.ecoser.2016.05.002">http://dx.doi.org/10.1016/j.ecoser.2016.05.002</a>	plants, fodder and forage, traditional medicine, fuelwood, and building materials. The authors argued that sharing has long been regarded as an important and effective mechanism for addressing the problem of scarcity for redistribution of resources among social groups. The results of the study indicated that the variation in the sharing patterns of the ecosystem services are closely linked to socioeconomic, cultural and environmental factors. This information provides a baseline data and useful evidence for livelihoods enhancement and the ecosystem sustainability under climate change and environmental degradation
32	Kenya	Bobadoye, A. O.; Ogara, W. O.; Ouma, G. O., and Onono, J. O. (2016) Assessing climate change adaptation strategies among rural Maasai pastoralist in Kenya. <i>American Journal of Rural Development</i> , Vol. 4, No. 6, 120-128, DOI:10.12691/ajrd-4-6-1	The article evaluates household vulnerability, adaptation and coping strategies of Maasai pastoralist to climate change and variability. It identifies viable adaptation options to reduce the impact of climate change among Maasai pastoralist in the arid and semi-arid (ASALS) in Kajiado County, Kenya. The authors emphasized that understanding adaptive strategies at the local level is important in planning effective adaptation options in semi-arid environment. It indicated that measures such as rain harvesting, livestock diversity, efficient early warning system using technologies such as mobile phones and community radio for climate information dissemination and mobility are no regret adaptation options that will reduce vulnerability of rural pastoral communities to climate change and variability. The article can be useful for pastoralists and guide policy makers in adaptation strategies to climate change and variability
33	Africa	Bouamrane, M., Spierenburg, M., Agrawal, A., Boureima, A., Cormier-Salem, M, C., Etienne, M., Le Page, C., Levrel, H., and Mathevet, R. (2016). Stakeholder engagement and biodiversity conservation challenges in social-ecological systems: some insights from biosphere reserves in	Biosphere reserves are an example of social-ecological systems that combine biodiversity conservation and socioeconomic development with knowledge generation and dissemination (both scientific and local). The authors review lessons learned from case studies biosphere reserves in western African and France, highlighting the importance of early stakeholder engagement to build knowledge for achieving sustainable development. They discuss the evolution of the concept of

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		western Africa and France. <i>Ecology and Society</i> , 21(4):25.	biosphere reserves and its application over time in different socioeconomic and cultural settings. According to the authors, the diversity of stakeholders and their different needs and perceptions about nature conservation complicate implementation processes, sometimes resulting in conflicts about the objectives and zonation of biosphere reserves. Dialogue among the different stakeholders must start at an early planning phase and be based on the principle of social and ecological solidarity. Dialogue must then be pursued, formalized, ritualized, and translated both in terms of biosphere reserve management and in terms of political support. Tools and methods exist that can facilitate such dialogue and colearning.
34	South Africa	Bourne, A., Holness, S., Holden, P., Scorgie, S., Donatti, C. I., & Midgley, G. (2016). A socio-ecological approach for identifying and contextualising spatial ecosystem-based adaptation priorities at the sub-national level. <i>PloS one</i> , 11(5), e0155235.	Climate change adds an additional layer of complexity to existing sustainable development and biodiversity conservation challenges. The impacts of global climate change are felt locally, and thus local governance structures will increasingly be responsible for preparedness and local responses. Ecosystem-based adaptation (EbA) options are gaining prominence as relevant climate change solutions. Local government officials seldom have an appropriate understanding of the role of ecosystem functioning in sustainable development goals, or access to relevant climate information. The paper presents and demonstrates a methodology for combining complex information into user-friendly spatial products for local level decision making on EbA. The authors focused on illustrating the kinds of products that can be generated from combining information in the suggested ways, and do not discuss the nuance of climate models nor present specific technical details of the model outputs here. Two representative case studies from rural South Africa demonstrate the replicability of this approach in rural and peri-urban areas of other developing and least developed countries around the world.
35	Africa	Brink, E., Aalders, T., Adam, D., Feller, R., Henselek, Y., Hoffmann, A., Ibe, K., Mathev-	Climate change impacts increase pressure on challenges to sustainability and the developmental needs of cities. Conventional



No	Region	Citation	Annotation
		Doret, A., Mever, M., Lucian, N. (2016). Cascade of green: A review of ecosystem-based adaptation in urban areas. <i>Global environmental change</i> , 34, 111-123.	high adaptation measures are often associated with high costs, inflexibility and conflicting interests related to the dense urban fabric, and ecosystem-based adaptation has emerged as a potentially cost effective, comprehensive and multifunctional approach. This paper reviews the systematisis research on urban EBA and proposes an analytical framework that draws on theory from ecosystem services, climate change adaptation and sustainability science.
36	Africa	Brondizio, E. S. 2016. Entangled Futures: Anthropology's engagement with global change research. In Crate, S and Nuttall, M (eds.) 2015. <i>Anthropology and Climate change</i> , Routledge	The first edition of Anthropology and Climate Change pioneered the study of climate change through the lens of anthropology, covering the relation between human cultures and the environment from prehistoric times to the present. This second, heavily revised edition brings the material on this rapidly changing field completely up to date, with major scholars from around the world mapping out trajectories of research and issuing specific calls for action.
37	North Africa	Carrington, D. P., Gallimore, R. G., & Kutzbach, J. E. (2016). Climate sensitivity to wetlands and wetland vegetation in mid-Holocene North Africa. <i>Climate Dynamics</i> , 17(2-3), 151-157.	Wetland regions are important components of the local climate, with their own characteristic surface energy and moisture budgets. Realistic representation of wetlands, including the important vegetation component, may therefore be necessary for more accurate simulations of climate and climate change. However, many land-atmospheres coupled models either ignore wetlands or treat wetlands as bare, water-saturated soil, neglecting the vegetation present within wetland environments. This study investigates the possible response of the mid-Holocene climate of North Africa to changes in orbital forcing, both with and without the presence of wetlands. The location of these wetlands is guided by analysis of paleovegetation and wetland distribution. In this study, the wetland regime in the land surface component of a climate model was modified to incorporate vegetation. Based on an analysis of the model surface water balance, the calculated area of mid-Holocene wetland coverage for North Africa closely matches the observed. For the North African region, the effects of adding vegetation to the wetland produced relatively

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			small changes in climate, but local recycling of water may have served to help maintain paleo wetland communities
38	Africa	Casparus, J.C., Malan, F.S., & Wingfield, M.J. (2016). Securing African forests for future drier climates: applying ecophysiology in tree improvement. <i>Southern Forests: a Journal of Forest Science</i> , Volume 78, 2016 - Issue 4	Increasing incidences of drought-induced tree mortality are being recorded worldwide, including Africa. African forests cover a significant proportion of the continent, which implies that African forest sustainability is threatened from a climate-change perspective. This is especially problematic in a developing nation context, because forest ecosystems such as plantation forestry provide important goods and services that sustain human well-being and economic growth. Disentangling the likely triggers of tree mortality (including those linked to drought) in landscapes would not only explain the mechanisms underlying local die-offs, but also better predict future mortality events. Methods applied in the field of ecophysiology are particularly useful to study in situ plant responses to an environment. The authors considered the status quo of global peer-reviewed publication outputs during the past century that have made use of key ecophysiological research approaches, specifically studies concerning ‘tree xylem anatomy’, ‘tree xylem cavitation’, ‘tree leaf gas-exchange’ and ‘tree xylem hydraulic conductivity’. They highlighted the growth and applicability of this research field in understanding tree ecology.
39	Africa	Cervigni, R., Losos, A. M., Chinowsky, P., & Neumann, J. L. (2016). <i>Enhancing the climate resilience of Africa’s Infrastructure: the roads and bridges sector (No. 110137)</i> . The World Bank.	A dependable road network has the potential to move Africa’s economy forward, and to ensure everyone across the region can access opportunity and services. However, road infrastructure is particularly vulnerable to climate change. In Africa, most projections are showing that higher temperatures, increased precipitation, and flooding will push an already stressed road system to the limit. As it prepares to invest heavily in infrastructure, the region has a unique opportunity to anticipate the consequences of a changing climate by retrofitting existing roads and adapting new ones. To support resilience in the road sector, a new World Bank study helps planners determine the

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			most cost-effective and appropriate adaptation pathway under a variety of climate scenarios
40	Africa	Chanza, N., De Wit, A. (2016) Enhancing climate governance through indigenous knowledge: Case in sustainability science. <i>Afr J Sc</i> , 112(3/4)	The current tempo of climate change strategies puts the notion of sustainability in question. In this philosophy, mitigation and adaptation strategies ought to be appropriate to the sectors and communities that are targeted. There is a growing realisation that the effectiveness of both strategies' hinges on climate governance, which also informs their sustainability. The application of the climate governance concept by the technocratic divide (policymakers and climate practitioners) to communities facing climate change impacts, however, is still a poorly developed field, despite extensive treatment by academia. By drawing heavily from conceptual and analytical review of scholarship on the utility of indigenous knowledge (IK) in climate science, these authors argue that Indigenous knowledge can be deployed in the practice of climate governance. It reveals that the merits of such a deployment lie in the understanding that the tenets of Indigenous knowledge and climate governance overlap and are complementary.
41	Africa	Chen, M., Graedel, T.E. (2016) A half-century of global phosphorus flows, stocks, production, consumption, recycling, and environmental impacts. <i>Global Environmental Change</i> , Volume 36, Pages 139-152	Many contemporary aspects of the global phosphorus cycle have been evaluated over the last several years, but a comprehensive picture over time has not yet been provided. In this work, we generate a detailed quantitative picture of dynamic phosphorus stocks and flows, for both human and animal uses, from 1961 to 2013. During that half-century, total phosphorus consumption has increased fivefold, to 31 million metric tons (31 Tg). However, losses and diversions from extraction to final consumption result in only about 22% of the extracted phosphorus being actually consumed as human food. Agricultural practices have changed as well, with on-farm wastes yielding to manufactured fertilizers as the primary source of phosphorus. Non-food uses such as detergents and metal coatings were about five times larger in 2013 than in 1961, though they currently account for only

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			about a quarter of all phosphorus use. Waste phosphorus flows to water, dominated by agricultural operations in 1961, have now been overtaken by loss from phosphate rock mining. Overall, the phosphorus cycle shows a history of inefficiency and loss, but also many opportunities for improvements that could lead to a much more sustainable situation going forward.
42	Africa	Chomba, S., Kariuki, J., Lund, J. and Sinclair, F. (2016), “Roots of inequality: how the implementation of REDD + reinforces past injustices”. <i>Land Use Policy</i> , Vol. 50, pp. 202-213.	The extent to which REDD+ initiatives should be a mechanism to address poverty and provide other co-benefits apart from carbon storage, is hotly debated. Here, we examine the benefit distribution policy and practice of a prominent REDD+ project in Kenya with the aim of understanding the extent to which it addresses equity. We reveal that while the project design was attentive to equity concerns in distributing benefits amongst the project implementer, landowners and the wider population of small-scale farmers and pastoralists in the area, in practice, the initial flow of benefits were concentrated in the hands of a few. This was because developments in land tenure since pre-colonial times had involved processes of dispossession and elite capture, enabled by colonial and post-colonial land policies that left the majority of local people with little or no land entitlement. As the distributive policy of the project maps onto the existing unequal land distribution, it reinforces inequality. By illustrating how current, well-intended, REDD+ efforts inadvertently come to entrench a long process of dispossession of marginalized people, we call attention to the pivotal importance that historical context plays in discussions of equity and social safeguards related to implementing REDD+ initiatives and related policy.
43	Ethiopia	Christopher, J.P., Erika, S.W., Bellemare, M.F., Jeuland, M.A. (2016) Social capital, trust, and adaptation to climate change: Evidence from rural Ethiopia. <i>Global Environmental Change</i> , Volume 36, Pages 124-138	Climate change is expected to have particularly severe effects on poor agrarian populations. Rural households in developing countries adapt to the risks and impacts of climate change both individually and collectively. Empirical research has shown that access to capital—financial, human, physical, and social—is critical for building

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			resilience and fostering adaptation to environmental stresses. Little attention, however, has been paid to how social capital generally might facilitate adaptation through trust and cooperation, particularly among rural households and communities. This paper addresses the question of how social capital affects adaptation to climate change by rural households by focusing on the relationship of household and collective adaptation behaviors. A mixed-methods approach allows us to better account for the complexity of social institutions—at the household, community, and government levels—which drive climate adaptation outcomes. We use data from interviews, household surveys, and field experiments conducted in 20 communities with 400 households in the Rift Valley of Ethiopia. Our results suggest that qualitative measures of trust predict contributions to public goods, a result that is consistent with the theorized role of social capital in collective action. Yet qualitative trust is negatively related to private household-level adaptation behaviors, which raises the possibility that social capital may, paradoxically, be detrimental to private adaptation. Policymakers should account for the potential difference in public and private adaptation behaviors in relation to trust and social capital when designing interventions for climate adaptation.
44	Ghana	Codjoe, S. N. A., & Issah, A. D. (2016). Cultural dimension and adaptation to floods in a coastal settlement and a savannah community in Ghana. <i>GeoJournal</i> , 81(4), 615-624.	This study uses household surveys and focus group discussion to methodically assess cultural dimensions (using Hofstede) of communities, and how these dimensions influence preference for adaptation options to floods in a coastal settlement (James Town) and a savannah community (Dungu) in Ghana. The results show that first, inequalities in rank and traditional hierarchical governance structures in Dungu are relatively lower than in James Town, second, that there is considerable gender bias in favour of males in Dungu, third, there is high level of avoidance of unstructured and unpredictable situations in both communities, fourth, members in both communities are at present very willing to sacrifice their time and resources in order to

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			achieve a better life in the future, and fifth, community members in Dungu perceive themselves as a single unit, and will do their best to come to the aid of members who need help during environmental disasters. The analysis further shows that cultural dimensions in the two communities generally influence the choice of adaptation options to floods. It has been recommended that specific local research such as this one which provides opportunities to analyse the cultural dimensions of adaptation within communities should be encouraged. This is because an understanding of the local cultural context has the potential to assist with the design of effective adaptation options in communities
45	Sub-Saharan Africa	Connolly-Boutin, L., & Smit, B. (2016). Climate change, food security, and livelihoods in sub-Saharan Africa. <i>Regional Environmental Change</i> , 16(2), 385-399.	Sub-Saharan Africa is particularly vulnerable to climate change. Multiple biophysical, political, and socioeconomic stresses interact to increase the region's susceptibility and constrain its adaptive capacity. Climate change is commonly recognized as a major issue likely to have negative consequences on food security and livelihoods in the region. This paper reviews three bodies of scholarship that have evolved somewhat separately, yet are inherently interconnected: climate change impacts, vulnerability and adaptation, food security, and sustainable livelihoods. The paper develops a conceptualization of the relationships among the three themes and shows how food security's vulnerabilities are related to multiple stresses and adaptive capacities, reflecting access to assets. Food security represents one of several livelihood outcomes. The framework shows how several research paradigms relate to the issue of food security and climate change and provides a guide for empirical investigations. Recognizing these interconnections can help in the development of more effective policies and programs. The framework is applied here to synthesize findings from an array of studies in sub-Saharan Africa dealing with vulnerability to climate change, food security, and livelihoods.

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46	Burkina Faso	Crawford, A., Price-Kelly, H., Terton, A., & Echeverría, D. (2016). <i>Review of current and planned adaptation action in Burkina Faso. CARIAA working paper; no. 17.</i> Burkina Faso.	For the landlocked West African country of Burkina Faso, climate change presents a significant challenge. The country is among the least developed countries in the world, and many Burkinabe continue to live in multi-dimensional poverty, have limited access to social services, and depend on climate sensitive livelihood activities — particularly agriculture and livestock raising. The government has responded by engaging in adaptation planning, prioritizing actions related to water, agriculture, livestock, and forestry. It has also begun to mainstream climate change considerations into the policies and plans of its most vulnerable sectors. The international community is supporting adaptation efforts in Burkina Faso, funding projects that primarily address needs related to its priority sectors. Many of these projects target populations in the country's vulnerable northern areas. Significant additional capacity building within government, including local governments, and support for vulnerable populations is needed for Burkina Faso to maintain and advance the development gains it has achieved in recent years. These issues are more fully explored in this paper, which is one in a series of country reviews prepared to provide the Collaborative Adaptation Research Initiative in Africa and Asia with a snapshot of adaptation action in its countries of engagement
47	Africa	D'Alessandro, C., & Zulu, L. C. (2016). From the Millennium Development Goals (MDGs) to the Sustainable Development Goals (SDGs): Africa in the post-2015 development Agenda. A geographical perspective. <i>African Geographical Review</i> , 36(1), 1-18.	With this special issue, the African Geographical Review aims at offering a multifaceted geographical perspective on Africa's development in the global post-2015 development agenda. This project was born from the conviction that human geography is an applied discipline that has fundamental insights to offer to global debates and to the search for innovative solutions to advance the global development agenda beyond 2015, with a specific focus on Africa, its challenges and potential. Furthermore, human geography, and more specifically political and economic geography, offer invaluable theoretical and methodological understanding for



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			analyzing issues related to development and sustainability and in the search for lasting solutions at the core of the global development agenda. These geographic insights are particularly important for Africa, a continent unique in its development challenges and opportunities compared to other developing regions of the world. At the same time, Africa is rich in internal (inter- and intra-country) geographical variation (sociocultural, economic, political and institutional, ecological, and historical). Africa, therefore requires context-specific nuance in analyzing its problems to arrive at particular sets of context-appropriate solutions in general, and especially as the global community transitions from implementation of the Millennium Development Goals and the post-2015 agenda of the Sustainable Development Goals.
48	East Africa	Daw, T.M., Hicks, C.C., Brown, K., Chaigneau, T., Januchowski-Hartley, F.A., Cheung, W.W.L., Rosendo, S., Crona, B., Coulthard, S., Sandbrook, C., Perry, C., Bandeira, S., Muthiga, N.A., Schulte-Herbruggen, B., Bosire, J., McClanahan, T.R. (2016). Elasticity in ecosystem services: exploring the variable relationship between ecosystems and human well-being, <i>Ecology and Society</i> , vol.21, issue7.	Although ecosystem services are increasingly recognized as benefits people obtain from nature, we still have a poor understanding of how they actually enhance multidimensional human well-being, and how well-being is affected by ecosystem change. This study is used to develop a concept of "ecosystem service elasticity" (ES elasticity) that describes the sensitivity of human well-being to changes in ecosystems. ES Elasticity is a result of complex social and ecological dynamics and is context dependent, individually variable, and likely to demonstrate nonlinear dynamics such as thresholds and hysteresis. We present a conceptual framework that unpacks the chain of causality from ecosystem stocks through flows, goods, value, and shares to contribute to the well-being of different people. This framework builds on previous conceptualizations, but places multidimensional well-being of different people as the final element. This ultimately disaggregated approach emphasizes how different people access benefits and how benefits match their needs or aspirations. Applying this framework to case studies of individual coastal ecosystem services in East Africa illustrates a wide range of

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			social and ecological factors that can affect ES elasticity. For example, food web and habitat dynamics affect the sensitivity of different fisheries ecosystem services to ecological change. Meanwhile high cultural significance, or lack of alternatives enhance ES elasticity, while social mechanisms that prevent access can reduce elasticity. Mapping out how chains are interlinked illustrates how different types of value and the well-being of different people are linked to each other and to common ecological stocks. We suggest that examining chains for individual ecosystem services can suggest potential interventions aimed at poverty alleviation and sustainable ecosystems while mapping out of interlinkages between chains can help to identify possible ecosystem service trade-offs and winners and losers. Finally, the study also looks at the conceptual and practical challenges of applying such a framework and conclude on its utility as a heuristic for structuring interdisciplinary analysis of ecosystem services and human well-being.
49	Sub-Saharan Africa	Dawson, N., Martin, A., Sikor, T. (2016) Green Revolution in Sub-Saharan Africa: Implications of Imposed Innovation for the Wellbeing of Rural Smallholders. <i>World Development</i> , Volume 78, Pages 204-218	Green Revolution policies are again being pursued to drive agricultural growth and reduce poverty in Sub-Saharan Africa. However, conditions have changed since the well-documented successes of the 1960s and 1970s benefitted smallholders in southern Asia and beyond. The authors argue that under contemporary constraints the mechanisms for achieving improvements in the lives of smallholder farmers through such policies are unclear and that both policy rationale and means of governing agricultural innovation are crucial for pro-poor impacts. To critically analyze Rwanda's Green Revolution policies and impacts from a local perspective, a mixed method, multidimensional wellbeing approach is applied in rural areas in mountainous western Rwanda. The authors suggest that policies promoting a Green Revolution in Sub-Saharan Africa should not all be pro-poor or even to be of a similar type, but rather should be the subject of rigorous impact assessment. Such assessment should be

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			based not only on consistent, objective indicators but pay attention to localized impacts on land tenure, agricultural practices, and the wellbeing of socially differentiated people.
50	Ghana	Dazé, A., Echeverría, D. (2016). <i>Review of current and planned adaptation action in Ghana. CARIIA Working Paper no. 9.</i> International Development Research Centre, Ottawa, Canada and UK Aid, London, United Kingdom.	The paper identifies the impact of climate variability including rising sea levels and temperatures and increasing rainfall variability, which challenges the country's efforts to realize its vision of inclusion and prosperity. Although Ghana is comparatively less vulnerable than its neighbors in West Africa, climate change is expected to negatively impact progress in sectors such as agriculture, water, fisheries, energy, and health. The northern part of the country especially will require adaptation efforts to reduce poverty and build resilience. This paper is one of the countries reviewed papers to provide a collaborative adaptation research initiative in Africa and Asia with a snapshot of adaptation action in its country and engagement.
51	South Africa	DEA and SANBI, 2016. <i>Strategic Framework and Overarching Implementation Plan for Ecosystem-Based Adaptation (EbA) in South Africa: 2016 – 2021.</i> Department of Environmental Affairs, Pretoria, South Africa.	South Africa has already observed a changing climate between 1960 and 2010. There have been higher mean annual temperatures, higher minimum and maximum daily temperatures, more frequent hot extremes and fewer cold extremes, as well as more variable rainfall with a tendency towards more intense rainfall events and longer dry spells. Modelled future predictions display a level of uncertainty, but even the most conservative models predict a 1 – 3 degrees Celsius (°C) rise in temperatures by 2050. Significant warming of as much as 5 – 8°C may be expected for the interior parts of South Africa by mid-century, with concurrent drier conditions in the western and southern parts of the country, and wetter conditions in the east. The Climate Change Adaptation Plan for South African Biomes subsequently highlights EbA as one of four categories of actions that could reduce climate threats to biodiversity and goes on to identify EbA actions for each biome alongside other adaptation options. Most recently, the revised National Biodiversity Strategy and Action Plan seeks that

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			“Ecosystem-based Adaptation (EbA) is shown to achieve multiple benefits in the context of sustainable development”.
52	Africa	Diop, S., & Scheren, P. A. (2016). Estuarine, Coastal and Shelf Science Sustainable oceans and coasts: Lessons learnt from Eastern and Western Africa. <i>Estuarine, Coastal and Shelf Science</i> , 183, 327–339. <a href="https://doi.org/10.1016/j.ecss.2016.03.032">https://doi.org/10.1016/j.ecss.2016.03.032</a>	It is evident that marine and coastal ecosystems in Africa provide valuable ecosystem service such as cultural (recreational and tourism, providing (food, timber, firewood) and regulatory (flood protection, climate regulation). These services provide the basics for their economic livelihoods of coastal dwellers. Despite these benefits, the coastal ecosystems are under pressure due to overfishing, pollution, land degradation and encroachment, etc. these pressures have a cumulative effect on the overall stability of the coastal ecosystems and therefore threatens their long term resilience. The focus of this paper was to highlight the challenges faced by coastal states of eastern and western Africa in managing their coastal and marine resources for the sustainable benefits of their population. They reviewed current mechanisms for the governance, management of the coastal and marine environment at the national and regional scales.
53	Africa	Donatti C.I., Andrade A., Burke L., Chhetri N., Cook J., Fedele G., Friedrich C., Goldstein A., Harvey C.A., Hole D., Kontorov A., Leiter T., Mack S., Menazza S., Ndiaye D., Panfil S., Ries F., Rizvi A.R. & Schurman H. (2016). <i>Measuring the adaptation outcomes of ecosystem-based adaptation</i> . Conservation International.	This paper provides a definition for Ecosystem based approaches, identifies the need to measure the adaptation outcome of ecosystem-based approaches, adaptation outcomes can be achieved through EbA and which indicators can be used to measure them and provide examples of EBA approaches that can lead to adaptation outcomes.
54	Africa	Dube, T., Moyo, P., Ncube, M., & Nyathi, D. (2016). The impact of climate change on agro-ecological based livelihoods in Africa: A review. <i>Journal of Sustainable Development</i> , 9 (1).256-269	Several local studies have been carried out on the impact of climate change on livelihoods and development especially in developing countries. However, there is a general scarcity of literature that makes a comparative appraisal of the impacts of climate change on agro-ecological based livelihoods across the African continent. This paper seeks to address that gap by making a comparative analysis of the effects of climate change on agro-based livelihoods across the African continent, focusing on Eastern, Western, Southern Africa and the

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			Sahel region. A cross continental perspective on this issue is important in informing current global climate change negotiations and response strategies both at global level and national levels. While some studies have been conducted at individual country levels about the projected and recorded impacts of climate change, there remains a dearth of literature that reviews and consolidates these findings to give an overall holistic picture about continental and sub-continental impacts in Africa especially as relating to local agro and ecological based livelihoods. This study finds out that the impact of climate change is invariably negative across the whole of Africa as it leads to failing agricultural yields and a reduction of bio-diversity. The paper recommends an intensification for the support of livelihood diversification strategies in rural development planning. It further recommends policy strategies that particularly targets the poor and vulnerable communities whose livelihoods hinge on agriculture and natural ecosystems as these will suffer the most from the impact of climate change.
55	Ghana	Dumenu, W. K., & Obeng, E. A. (2016). Climate change and rural communities in Ghana: Social vulnerability, impacts, adaptations and policy implications. <i>Environmental Science &amp; Policy</i> , 55, 208-217.	This study assessed social vulnerability level, impacts and adaptation strategies to climate change in rural communities in four ecological zones in Ghana. Frequently experienced climate change impacts in the four ecological zones were erratic rainfall, reduction in crop yield, prolonged drought and shift in cropping season. Most engaged adaptation strategies included crop diversification, engagement in non-farm secondary jobs, rural–urban migration and increasing farm size. The results highlight the importance of local-level climate change vulnerability assessment and demonstrate the need for local area-specific actions/policies to reducing vulnerability and enhancing adaptation in rural communities. The study approach and findings are useful for policymakers in developing countries in identifying avenues to building local communities’ resilience to climate change.

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56	Egypt	Elliott, C. P. (2016). The Antonine Plague, Climate Change and Local Violence in Roman Egypt. <i>Past &amp; Present</i> , 231(1), 3-31.	Complaining about the paucity, ambiguity and fragmentary nature of evidence concerning ancient Mediterranean societies is a common pastime among ancient historians. The situation provokes a wide range of reactions. Some scholars have chosen carefully to restrict their conclusions and interpretations to those which can be supported only by an inductive, empirical or, at a pinch, positivistic study of the evidence. Suspicion of generalising approaches, once the ‘dominant orthodoxy’ among ancient historians, has in recent decades given way to a full backlash characterized by a flourishing of engagement with a wide variety of methodological concepts borrowed from other disciplines. In metaphorical terms, generalizations were akin to the individual poles which held up a larger structure: a single pole could not stand on its own, but if several of them pointed the same way, the historian could lean them together and they would ‘point roughly in the same direction, and circumscribe “truth”’.
57	North Africa	Fader, M., Shi, S., Bloh, W. V., Bondeau, A., & Cramer, W. (2016). Mediterranean irrigation under climate change: more efficient irrigation needed to compensate for increases in irrigation water requirements. <i>Hydrology and Earth System Sciences</i> , 20(2), 953-973.	According to this article, irrigation in the Mediterranean is of vital importance for food security, employment and economic development. This study systematically assesses how climate change and increases in atmospheric CO <sub>2</sub> concentrations may affect irrigation requirements in the Mediterranean region by 2080–2090. Future demographic change and technological improvements in irrigation systems are accounted for, as is the spread of climate forcing warming levels and potential realization of the CO <sub>2</sub> -fertilization effect. Vegetation growth, phenology, agricultural production and irrigation water requirements and withdrawal were simulated with the process-based ecohydrological and Agro-ecosystem model LPJmL after a large development that comprised the improved representation of Mediterranean crops. At present the Mediterranean region could save 35% of water by implementing more efficient irrigation and conveyance systems. A country like Egypt have higher saving potential than others. Currently some crops, especially sugar cane and

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			<p>agricultural trees, consume in average more irrigation water per hectare than annual crops. Different crops show different magnitude of changes in net irrigation requirements due to climate change, being the increases most pronounced in agricultural trees. The Mediterranean area might face an increase in gross irrigation requirements between 4 and 18% from climate change alone if irrigation systems and conveyance are not improved (2 _C global warming combined with full CO2-fertilization effect, and 5 _C global warming combined with no CO2- fertilization effect, respectively). Population growth increases these numbers to 22 and 74 %, respectively, affecting mainly the Southern and Eastern Mediterranean. However, improved irrigation technologies and conveyance systems have large water saving potentials, especially in the Eastern Mediterranean and may be able to compensate to some degree the increases due to climate change and population growth. Both subregions would need around 35% more water than today if they could afford some degree of modernization of irrigation and conveyance systems and benefit from the CO2-fertilization effect. Nevertheless, water scarcity might pose further challenges to the agricultural sector: Algeria, Libya, Morocco, and Tunisia have a high risk of not being able to sustainably meet future irrigation water requirements in some scenarios. The results presented in this study point to the necessity establishing climate-friendly Agro-ecosystems and increasing irrigation practices.</p>
58	Africa	<p>Gan, T.Y., Ito, M., Hülsmann, S., Qin, X., Lu, X.X., Liong, S.Y. (2016) Possible climate change/variability and human impacts, vulnerability of drought-prone regions, water resources and capacity building for Africa. <i>Hydrological Sciences Journal</i>, Volume 61, 2016 - Issue 7</p>	<p>This review article discusses the climate, water resources and historical droughts of Africa, drought indices, vulnerability, impact of global warming and land use for drought-prone regions in West, southern and the Greater Horn of Africa, which have suffered recurrent severe droughts in the past. Recent studies detected warming and drying trends in Africa since the mid 20th century. Based on the Fourth Assessment Report of the Intergovernmental Panel on Climate</p>



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			Change and the Coupled Model Intercomparison Project Phase 5 (CMIP5), both northern and southern Africa are projected to experience drying, such as decreasing precipitation, runoff and soil moisture in the 21st century and could become more vulnerable to the impact of droughts. The daily maximum temperature is projected to increase by up to 8°C (RCP8.5 of CMIP5), precipitation indices such as total wet day precipitation (PRCPTOT) and heavy precipitation days (R10 mm) could decrease, while warm spell duration (WSDI) and consecutive dry days (CDD) could increase. Uncertainties of the above long-term projections, teleconnections to climate anomalies such as ENSO and the Madden-Julian Oscillation, which could also affect the water resources of Africa, and capacity building in terms of physical infrastructure and non-structural solutions are also discussed. Given that traditional climate and hydrological data observed in Africa are generally limited, satellite data should also be exploited to fill the data gap for Africa in the future.
59	Africa	García de Jalón, S., Iglesias, A., Barnes, A.P. (2016). Drivers of farm-level adaptation to climate change in Africa: an evaluation by a composite index of potential adoption. <i>Regional environmental change</i> , Volume 17, Issue 2, pp 399-410.	Over recent decades, there has been increasing levels of research dedicated to assess drivers of farm-level uptake of adaptation strategies to climate change. The main purpose of this research being to determine how policy intervention can most effectively increase adoption. This paper aims to synthesise this past research in order to scale up uptake of farm-level adaptation strategies through a composite index of potential adoption in Africa. In doing so, we review the estimated coefficients of econometric regressions in 42 case studies published in peer-review journals to identify the factors that regularly explain adoption. We find that these common factors can be grouped into seven components that is human capital, financial resources, infrastructure and technology, social interaction and governance, food security, dependence on agriculture and attitudes towards the environment. Using national-level indicators of these seven categories, we develop a composite index to inform potential

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			adoption and test the robustness of the index in an in-depth sensitivity analysis. The results show that the highest likelihood of adoption of farm-level adaptation strategies is in Northern African countries namely Tunisia, Egypt, Algeria and Morocco and in Southern African countries such as South Africa and Botswana. Conversely, they indicate that the lowest likelihood of adoption is situated in nations of the Sahel and Horn of Africa and in nations that have recently experienced conflict. We conclude that adoption is associated predominantly with governance, civil rights, financial resources and education. However, it is not necessarily driven by the magnitude of climate change impacts on agricultural production.
60	Africa	Hoogendoorn, G., & Fitchett, J.M. (2016). Tourism and climate change: a review of threats and adaptation strategies for Africa. <i>Current Issues in Tourism</i> , Volume 21, Issue 7	The intersection of tourism and climate change has seen significant research over the past two decades, focusing particularly on issues of mitigation and adaptation in the global North. Research output has predominantly been centred on the Mediterranean and Nordic countries and number of localities in North America. The global South has seen significantly less investigation, despite having significantly lower adaptive capacity to the impacts of climate change, and numerous countries with rapidly growing tourism sectors. The African continent specifically has seen appreciably less research than other countries in the global South, despite arguably having the lowest adaptive capacity and projections of severe impacts of climate change to the tourism sector from temperature increases, changes in precipitation volume and sea level rise. This paper therefore presents a review of the existing literature on adaptation strategies of tourism sectors and participants in African countries.
61		Giuseppe, P., Francesco, F., Flavio, L. (2016). Insights and opportunities from mapping ecosystem services of urban green spaces and potential in planning. <i>Ecosystem services</i> , 22	The paper acknowledges that urbanization and rapid population growth pose the cities in a massive challenge in terms of environmental degradation, resources depletion and exploitation. The aim of the paper was to explore how mapping ecosystem services provided by green infrastructure can contribute to promoting

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		(2016) 1-10 <a href="http://dx.doi.org/10.1016/j.ecoser.2016.09.004">http://dx.doi.org/10.1016/j.ecoser.2016.09.004</a>	cohesion, resilience and livability toward sustained and green cities. It also investigated the interlinkages between ecosystem services paradigm, mapping approaches their benefits for human well-being. This is useful for urban designers, planning practitioners to help and inform policymakers in the process and management of urban resources for sustainable development
62	Ethiopia	Golrokhian, A., Browne, K., Hardin, R., Agrawal, A., Askew, K., Beny, K., Larroquette, B., Morse, B. (2016). A National Adaptation Programme of Action: Ethiopia's responses to climate change. <i>World Development Perspectives</i> , Volume 1, Pages 53-57	This innovative sustainability case on Ethiopia's National Adaptation Programme of Action was created through collaboration among professionals, scholars, students and media design professionals under the auspices of the Michigan Sustainability Case (MSC) initiative. It comprises a terse narrative about a decision maker, multimedia sources including a podcast that link to and enrich the text, and an engaged learning exercise that walks users through the potential and constraints of emerging cost-benefit analysis methods for climate adaptation planning. It challenges learners to address the emerging impacts of climate change by systematically analyzing the challenges faced by Ethiopia's central government in allocating limited financial, technical and administrative resources to mitigate these impacts on its most vulnerable communities. The case not only introduces audiences to climate change risks and vulnerabilities in Ethiopia, but also interweaves those contextual factors with broader technical information, to strengthen understanding of the specific governance challenge at hand. The case thus demonstrates MSC's pedagogical commitment to making ecological, economic, cultural and political context clearer in the development of effective environmental policies. Likewise, the MSC approach deliberately demonstrates to students the challenges of decision-making with imperfect information.
63	West Africa	Gotz, S., Peter, L., Armando, I. M.V., Bunn, C., Jassogne, L. (2016). Vulnerability to Climate Change in Cocoa in West Africa; Patterns,	The purpose of this paper was to analyze the cocoa's vulnerability to climate change in West Africa cocoa belt based on the projections for 2050s of 19 Global Circulation Models under the Intergovernmental

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		Opportunities and Limits to Adaptation. <i>Science of Total Environment</i> 556 (2016) 231-241. <a href="http://dx.doi.org/10.1016/j.scitotenv.2016.03.024">http://dx.doi.org/10.1016/j.scitotenv.2016.03.024</a>	Panel on Climate Change intermediate emissions scenario RCP 6.0. The study results indicated that maximum dry season temperature is projected to become as or more limiting for cocoa as dry season water availability. This makes cocoa more vulnerable to climate change. The authors proposed that in order to reduce this vulnerability, there is the need to employ the use of ecosystem-based strategy such as panting shade trees in cocoa farms. This will seek to reduce the impacts of increase temperature on cocoa production and provide conducive environment for maximum yields.
64	West Africa	Hänke, H., Börjeson, L., Hylander, K., Enfors-Kautsky, E. (2016). Drought tolerant species dominate as rainfall and tree cover returns in the West African Sahel. <i>Land Use Policy</i> , Volume 59, Pages 111-120	After the severe droughts in the 1970s and 1980s, and subsequent debates about desertification, analyses of satellite images reveal that the West African Sahel has become greener again. In this paper we report a study on changes in tree cover and tree species composition in three village landscapes in northern Burkina Faso, based on a combination of methods: tree density change detection using aerial photos and satellite images, a tree species inventory including size class distribution analysis, and interviews with local farmers about woody vegetation changes. Our results show a decrease in tree cover in the 1970s followed by an increase since the mid-1980s, a pattern correlating with the temporal trends in rainfall as well as remotely sensed greening in the region. However, both the inventory and interview data show that the species composition has changed substantially towards a higher dominance of drought-resistant and exotic species. This shift, occurring during a period of increasing annual precipitation, points to the complexity of current landscape changes and questions rain as the sole primary driver of the increase in tree cover. We propose that the observed changes in woody vegetation (densities, species composition and spatial distribution) are mediated by changes in land use, including intensification and promotion of drought tolerant and fast-growing species. Our findings, which indicate a rather surprising trajectory of land cover change,

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			highlight the importance of studies that integrate evidence of changes in tree density and species composition to complement our understanding of land use and vegetation change trajectories in the Sahel obtained from satellite images. We conclude that a better understanding of the social-ecological relations and emerging land use trajectories that produce new types of agroforestry parklands in the region is of crucial importance for designing suitable policies for climate change adaptation, biodiversity conservation and the sustainable delivery of ecosystem services that benefit local livelihoods in one of the world's poorest regions.
65	Africa	Hersalman, M., Botha, A., Toivenen, H., Myllyoja, J. (2016). <i>A Digital Health Innovation Ecosystem for South Africa</i> . Conference: IST Africa. Durban, South Africa.	The purpose of this paper is to provide an overview of how a digital health innovation ecosystem was conceptualised and validated for South Africa. Largely, we focus on defining strategies to build Digital Health Innovation Ecosystems in the context of developing countries and pay attention to the challenges and potentials. Over a period of two years the conceptualisation was done by applying Design research as a methodology and the validation through two cycles of expert review feedback in order to improve the artifact. The conceptual digital health innovation ecosystem for South Africa portrays the inputs from research experts and practitioners in South Africa, Africa and Europe working in the Health domain. Feedback indicated that the conceptual digital health innovation ecosystem for South Africa is a good reflection of the realities of developing contexts where all role players and systems are indicated that affect digital health. This conceptualisation allows for the positioning of sub innovation ecosystems and related new products through applying an open innovation life cycle to improve the quality of life of ordinary citizens.
66	Africa	Herslund, L.B., Jalayer, F., Jean-Baptiste, N., Jørgensen, G., Kabisch, S., Kombe, W., Lindley, S., Nyed, P.K., Pauleit, S., Printz, A., Vedeld, T. (2016). A multi-dimensional assessment of urban	Many projections of the impact of climate change on the crop, livestock and fishery production sectors of African agriculture are reported in the literature. However, they may be arguably too general to understand the magnitude of impact and to inform adaptation

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		vulnerability to climate change in Sub-Saharan Africa. <i>Natural hazards</i> , Volume 82, pp 149–172	strategies and policy development efforts that are tailored to promoting climate-smart agriculture in the West African region alone. This paper was synthesized from several scholarly literature and aimed at providing up-to-date information on climate change impacts, adaptation strategies, policies and institutional mechanisms that each agriculture subsector had put in place in dealing with climate change and its related issues in West Africa.
67	Tanzania	Hotte, N., Mahony, C., & Nelson, H. (2016). The principal-agent problem and climate change adaptation on public lands. <i>Global Environmental Change</i> , 36, 163-174.	Climate change presents clear risks to natural resources, which carry potential economic costs. The limited nature of physical, financial, human and natural resources means that governments, as managers of natural resources, must make careful decisions regarding trade-offs and the potential future value of investments in climate change adaptation. This paper presents cost-benefit analysis of scenarios to characterise economic benefits of adaptation from the perspective of a public institution (the provincial government) and private agents (forest licensees). The example provided is the context of assisted migration strategies for regenerating forests that are currently being implemented in Tanzania to reduce future impacts of climate change on forests. The analysis revealed positive net present value of public investment in assisted migration across all scenarios under a range of conditions; however, private sector agents face disincentives to adopt these strategies. Uncertainty about how the costs, benefits and risks associated with climate change impacts will be distributed among public institutions and private actors' influences incentives to adapt to climate change (the "principal-agent problem") and further complicates adaptation. Absent development of risk-sharing mechanisms or re-alignment of incentives, uptake of assisted migration strategies by private agents is likely to be limited, creating longer-term risks for public institutions. Analyzing incentives and disincentives facing principals and agents using a well-known tool (cost-benefit analysis) can help decision-makers to identify and

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			address underlying barriers to climate change adaptation in the context of public lands management
68	West Africa	Hummel, D. (2016). Climate change, land degradation and migration in Mali and Senegal—some policy implications. <i>Migration and Development</i> , 5(2), 211-233.	The study presents the Interactions between climate change, environmental degradation and population movements in the West African Sahel have received a great deal of scholarly attention in recent years. Since most of the population living in Sahelian countries depend on subsistence and small-scale farming, climate changes such as increasing temperatures and declining rainfall pose considerable risks to their livelihoods. Migration is one possible response to changing ecosystems. This paper examines the interactions between climate change, land degradation and migratory processes in rural areas of the West African Sahel. The analysis is based on empirical research conducted in Bandiagara, Mali, and Linguère, Senegal, using an interdisciplinary and transdisciplinary approach. From a theoretical perspective, the nexus of climate, environment and migration is conceptualised as a social-ecological system. Against this background, the paper addresses empirical findings on the motives for migration, the mobility patterns and the issue of migration as a strategy to adapt to climate change. The paper further discusses relevant institutions and policy frameworks that impact the livelihoods and mobility of people in the study regions.
69	Nigeria	Ifeanyieze, F.O., Alkali, M., Okoye, R. N. & Ikehi, M. E. (2016). Altered climate and livelihood of farming families in Niger Delta region of Nigeria. <i>African Journal of Agricultural Research</i> , 11(10), 882-888. <a href="http://dx.doi.org/10.5897/AJAR2015.10716">http://dx.doi.org/10.5897/AJAR2015.10716</a>	This study focused on how altered climate has affected the livelihood of the farmer and the farming families in Niger Delta region of Nigeria. The study adopted descriptive survey research design. This study had two research questions and two hypotheses. The population for the study was 246,807 made up of registered farmers. Proportionate stratified random sampling technique was used to select a sample size of 4,936 as respondents. Structured questionnaire was used to collect data. The instrument was face validated by three experts. Cronbach alpha method was used to determine the internal consistency of the questionnaire items which yielded a coefficient of



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			0.81. Mean, standard deviation, and t-test were used for data analysis. The findings of the study revealed that altered climate have adversely influenced the livelihood and living conditions of the farmer and the farming families in the area studied. Findings further revealed that the altered climate has led to increased poverty level and raised cost of production (input and labour cost), thus affecting farmers hitherto coordinated livelihood. Adoption of local adaptation approaches will help the farmers survive.
70	Burkina Faso	IUCN/PACO (2016). <i>Regional Assessment on Ecosystem-based Disaster Risk Reduction and Biodiversity in West and Central Africa</i> . A report for the Resilience through Investing in Ecosystems – knowledge, innovation and transformation of risk management (RELIEF Kit) project. Ouagadougou, Burkina Faso: IUCN. 58pp.	This assessment is being conducted as part of the RELIEF-Kit (Resilience through Investing in Ecosystems-knowledge, innovation and transformation of risk management) project implemented by IUCN. The project aims to contribute to knowledge dissemination and capacity development for the effective implementation of ecosystem-based disaster risk reduction Eco-DRR, with a focus on the role of biodiversity conservation. The current assessment focuses on the following countries in West and Central Africa: Burkina Faso, Togo, Senegal, Mali, Ghana, Nigeria, Cameroon and Democratic Republic of the Congo (DRC). Several hazards especially droughts and floods have been recorded for many decades in the region. The Sahel is the most affected and vulnerable part of the region as it depends on rainfall patterns.
71	South Africa	Jiri, O., Mafongoya, P. L., Mubaya, C., & Mafongoya, O. (2016). Seasonal climate prediction and adaptation using indigenous knowledge systems in agriculture systems in Southern Africa: a review. <i>Journal of Agricultural Science</i> , 8(5), 156.	Erratic rainfall and increasing temperature is rapidly emerging as one of the most serious global problems affecting many sectors in the world. It is considered to be one of the most serious threats to sustainable development with adverse impact on environment, human health, food security, economic activities, natural resources and physical infrastructure. Southern Africa is one of the most vulnerable regions to climate change in the world, particularly because of widespread poverty, recurrent droughts, inequitable land distribution, over-dependence on rain-fed agriculture and low adaptive capacity. Yet rural farmers in southern Africa have managed to survive the

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			vagaries of climate change over the years. This review reveals that these rural farmers can use indigenous knowledge to cope and adapt to climate change. Availability and access to scientific weather information to make cropping and other decisions at the local level remain key issues to usage of climatic data by rural farmers. On the other hand, indigenous knowledge is what rural farmers have been using but is also becoming unreliable due to climate change and variability. Integration of indigenous knowledge and scientific seasonal forecast seems to be a key possible thrust to reduce vulnerability, enhance resilience of rural farmers and increase their adaptive capacity.
72	Malawi	Joshua, K., Ngongondo, C., Chipungu, F., Monjerezi, M., Liwenga, Majule, E., Stathers, T., Lamboll, R. (2016) Climate change in semi-arid Malawi: Perceptions, adaptation strategies and water governance. <i>Jamba</i> v.8(3);	Climate change and variability are a threat to sustainable agricultural production in semi-arid areas of Malawi. Overdependence on subsistence rain-fed agriculture in these areas calls for the identification of sustainable adaptation strategies. A study was therefore conducted in Chikwawa, a semi-arid district in southern Malawi, to: assess community's perception of a changing climate against empirical evidence, determine their local adaptive measures, evaluate the potential of irrigated agriculture as an adaptive measure in household food security and challenges over access to available water resources.
73	East Africa	Kahsay, G. A., Hansen, L. G. (2016). The effect of climate change and adaptation policy on agricultural production in Eastern Africa. <i>Ecological Economics</i> Volume 121, Pages 54-64	We estimate the production function for agricultural output in Eastern Africa incorporating climate variables disaggregated into growing and non-growing seasons. We find a substantial negative effect of within growing season variance of precipitation. We simulate predicted climate change for the region and find a resulting output reduction of between 1.2% and 4.5%. Our simulation also demonstrates substantial potential for economic benefits from mitigating the effects of within growing season precipitation variability through conventional technologies such as flexible planting and rainwater harvesting on the same scale as the potential loss from predicted climate change.

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74	Zambia	Kalaba, F. K. (2016). Barriers to policy implementation and implications for Zambia's forest ecosystems. <i>Forest Policy and Economics</i> , 69, 40–44. <a href="https://doi.org/10.1016/j.forpol.2016.04.004">https://doi.org/10.1016/j.forpol.2016.04.004</a>	Recognizing the vital role policies play in setting the priorities and actions for forest use and management, this study was conducted to ascertain the barriers to policy implementation and implications for Zambia's forest ecosystems. The study examined the policy actors' perception of implementation of policies aimed at reducing forestation and forest degradation and their implications for forest resources. They examined 55 policy actors across national regional and local levels including government officials, NGOs, traditional leaders and local people using interviews and discourse analysis. The outcome of the study revealed that there were policy implementation deficits are prevalent in Zambia's forest sector due to the following barriers; inadequate institutional capacity, inadequate legal framework, political influences, insecure land tenure, poor funding, and lack of inter-sectoral coordination.
75	Ghana	Kleemann, L. (2016). Organic Pineapple Farming in Ghana - A Good Choice for Smallholders? <i>The Journal of Developing Areas</i> , 50(3), 109–130. <a href="https://doi.org/10.1353/jda.2016.0096">https://doi.org/10.1353/jda.2016.0096</a>	This article questioned whether organic pineapple is a good choice for smallholders in Ghana. In order to satisfy the growing demand for organic food and the increasing pressure for organic certification for developing countries, there is the need of local uptake and radical scaling of the organic farming for the pineapple crop growers both for local markets and international export market. The purpose of this study was to shed light on the feasibility and profitability of the pineapple food sector in Ghana for small scale production. The finding of the study emerged that, organic production is more profitable for smallholders that the conventional production and farmers collect a fair share of the price premium on retail level. In this paper the common organic practice cited include hand weeding for weeds control, use of compost made of cocoa husk, no use of pesticides, organic manures.
76	South Africa	Knüppe, K., Meissner, R. (2016). Drivers and barriers towards sustainable water and land management in the Olifants-Doorn Water	Over the last 17 years South Africa's water and land resources management has changed dramatically. This rapid evolution has been accompanied by a growing number of laws and policies to co-balance

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		Management Area, South Africa. <i>Environmental Development</i> , Volume 20, Pages 3-14	water allocation for human basic needs and ecosystem integrity. Most often, new ideas and innovative concepts constitute new challenges towards their implementation. This paper examines drivers and barriers towards more sustainable and integrated governance and management practices from the perspective of ecosystem services in the Olifants-Doorn Water Management Area (WMA). Results obtained from a literature search and qualitative interviews indicate that the environmental awareness of stakeholders about their natural resources and related ecosystem services increased over the last years. Furthermore, we observed that the establishment of new policies became a key driver towards increased sustainability within the Olifants-Doorn WMA. Nonetheless, ensuring coherence between sectors and actors when considering natural resource governance remains a major challenge. For future sustainable developments, decentralized and localized management structures as well as the establishment of strong leadership should be emphasized in the Olifants-Doorn WMA. Further, sufficient water and land monitoring systems are necessary for decision makers, farmers and local water suppliers in order to maintain ecosystem services and their values for human well-being.
77	South Africa	Kotzee, I., Reyers, B. (2016) Piloting a social-ecological index for measuring flood resilience: A composite index approach. <i>Ecological Indicators</i> , Volume 60, Pages 45-53	Global increases in the magnitude and frequency of flood events have raised concerns that traditional flood management approaches may not be sufficient to deal with future uncertainties. There is a need to move towards approaches that manage the resilience of the system to floods by understanding and managing drivers of vulnerability and adaptive capacity. Here we pilot an approach to measure the resilience of a system to a flood. A method is presented in which indicators are used to measure and map the spatial distribution of the levels of flood resilience across a landscape. Using three flood affected municipalities in South Africa, 24 resilience indicators related to floods and its relevant social, ecological, infrastructural and economic

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			aspects are selected, and integrated into a composite index using a principal component analysis (PCA). A fifth component of institutional resilience is used to explore levels of disaster planning, mitigation and public awareness capacities and where these can be increased. The PCA transformed the 24 variables into four main components, the first of which was strongly correlated with underlying social variables, while the second and third correlated well with economic and ecological variables respectively. Distinct spatial variation of flood resilience was found across the study area, with highest flood resilience in main cities, and lowest in wards located on the periphery of cities often the location of peri-urban informal settlements. The disaggregation of underlying indicators showed wards with lowest flood resilience also had the lowest social, economic and ecological resilience. The flood resilience index was sensitive to the exclusion of all three components highlighting the importance of capturing the multidimensionality of flood resilience. The approach allows for a simple, yet robust index able to include an array of datasets generally available in flood prone areas with potential to disaggregate and trace variables for management and decision making.
78	Uganda and Ghana	Kyazze, F., Naab, J., Neelormi, S., Kinyangi, J., Zougmore, R. (2016). Understanding gender dimensions of agriculture and climate change in smallholder farming communities. <i>Climate and Development</i> , Volume 10, 2018 - Issue 4	In Uganda, Ghana and Bangladesh, participatory tools were used for a socio-economic and gender analysis of three topics: climate-smart agriculture (CSA), climate analogue approaches, and climate and weather forecasting. Policy and programme-relevant results were obtained. Smallholders are changing agricultural practices due to observations of climatic and environmental change. Women appear to be less adaptive because of financial or resource constraints, because of male domination in receiving information and extension services and because available adaptation strategies tend to create higher labour loads for women. The climate analogue approach (identifying places resembling your future climate so as to identify potential

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			adaptations) is a promising tool for increasing farmer-to-farmer learning, where a high degree of climatic variability means that analogue villages that have successfully adopted new CSA practices exist nearby. Institutional issues related to forecast production limit their credibility and salience, particularly in terms of women's ability to access and understand them. The participatory tools used in this study provided some insights into women's adaptive capacity in the villages studied, but not to the depth necessary to address women's specific vulnerabilities in CSA programmes. Further research is necessary to move the discourse related to gender and climate change beyond the conceptualization of women as a homogenously vulnerable group in CSA programmes.
79	Kenya	Kyra, B., & Gupta, J. (2016) Inclusive development, oil extraction and climate change: a multilevel analysis of Kenya. <i>International Journal of Sustainable Development &amp; World Ecology</i> , Volume 23, 2016 - Issue 6	There has been considerable research on North–South issues on climate change; however, little work has been done on how the recent discovery of oil in some developing countries could affect North–South relations, the prospects for development for the South, climate change and local socio-environmental issues. Using the theory of inclusive development, the concept of the Right to Development, and their relation to stranded assets, this paper addresses the question: what does inclusive development imply at the national and global level in dealing with oil extraction in the context of climate change?
80	Global	Lähtinen, K., Guan, Y., Li, N., & Toppinen, A. (2016). Biodiversity and ecosystem services in supply chain management in the global forest industry. <i>Ecosystem Services</i> , 21, 130–140. <a href="https://doi.org/10.1016/j.ecoser.2016.07.006">https://doi.org/10.1016/j.ecoser.2016.07.006</a>	The paper recognized the risks and opportunities that businesses pose to biodiversity and ecosystem services and therefore the need to identify, measure, monitor these changing trends to develop management approaches to meet the various stakeholder needs. They focus on how the global forest industry companies address the business ecosystem service supply chain management through corporate responsibility reporting practices in relation to key environmental performance indicators contained in the global reporting initiative guidelines. The paper identified information content of the Global Reporting

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			Initiative (GRI) to help assess the direct and indirect impacts of companies operation on biodiversity and ecosystem services, environmental strategies of companies in relation to minimizing impacts on biodiversity and ecosystem services in the supply chain management and the needs and possibilities of indicator development. It became clear that companies tend to disclose indirect impacts over direct impacts, emphasize their achievement over negative consequences and focus more on the upstream supply chain rather than the downstream activities. This calls for effective enforcement and regulatory sanctions on companies without clear cut strategies to protecting the environment.
81	Africa	Larsen, A.T., Hoffmann, S., Luthi, C., Truffer, B., Maurer, M. (2016). Emerging solutions to water challenges of an urbanizing world. <i>Science</i> , 352(6288), 928-933	The top priorities of the world's forest disturbances regimes have intensified recently, and future climatic changes are expected to amplify this development further in the coming decades. This change are increasingly challenging the main objectives of the forest ecosystem management, which are to provide ecosystem services sustainably to society and maintain biological diversity in the forests. Yet, a comprehensive understanding of how disturbances affect these primary goals of ecosystem management is still lacking. The authors conducted a global literature review on three of the most important disturbances on ecosystem services and explore some ecosystem-based approaches to address these disturbances.
82	Northern Africa	Lelieveld, J., Proestos, Y., Hadjinicolaou, P., Tanarhte, M., Tyrllis, E., & Zittis, G. (2016). Strongly increasing heat extremes in the Middle East and North Africa (MENA) in the 21st century. <i>Climatic Change</i> , 137(1-2), 245-260.	The ensemble results of CMIP5 climate models that applied the RCP4.5 and RCP8.5 scenarios have been used to investigate climate change and temperature extremes in the Middle East and North Africa (MENA). Uncertainty evaluation of climate projections indicates good model agreement for temperature but much less for precipitation. Results imply that climate warming in the MENA is strongest in summer while elsewhere it is typically stronger in winter. This has important consequences for human health and society.



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83	Somalia	Liao, C., Ruelle, M. L., & Kassam, K. A. S. (2016). Indigenous ecological knowledge as the basis for adaptive environmental management: Evidence from pastoralist communities in the Horn of Africa. <i>Journal of Environmental Management</i> , 182, 70–79. <a href="https://doi.org/10.1016/j.jenvman.2016.07.032">https://doi.org/10.1016/j.jenvman.2016.07.032</a>	This article investigates the role of indigenous ecological knowledge as basis for adaptive environmental management drawing evidence from pastoralist communities in Africa. The author noted that the proliferation of woody plants has been observed on rangelands globally and has impacts on subsistence livestock production. However, they identified certain gap that adaptation strategies to environmental changes remain largely unexamined and therefore the focus of this paper. Rangeland vegetation shifts, reshaping herd composition are key to ensuring resilience of livestock production in the environmental changes. These however will require indigenous knowledge-based agencies actions to ensure adaptive environmental management
84	Ghana	Limantol, A. M., Keith, B.E., Azabre, A.B., Lennartz, B. (2016). Farmers’ perception and adaptation practice to climate variability and change: a case study of the Veia catchment in Ghana. <i>Springerplus</i> , 6; 5(1): 830.	Rain-fed agriculture remains the source of employment for a majority of Ghana’s population, particularly in northern Ghana where annual rainfall is low. This paper examined farmers’ perceptions and adaptation practices to climate change and variability in accordance with actual recorded weather data of the Veia catchment in Upper East Region of northern Ghana during the time interval from 1972 to 2012. The paper showed that, Farmers using rain-fed practices adjust to climate variability by varying crop types via rotation without fertilizer while farmers employing irrigation practices are more likely to offset climate variability with a greater use of fertilizer application. The Veia catchment faces rising temperature and evapotranspiration trends. Farmers are aware of these climatic changes and are adapting strategies to cope with the effects.
85	Africa	Lisa, M., Harrington, B. (2016). Sustainability Theory and Conceptual Considerations: A Review of Key Ideas for Sustainability, and the Rural Context. <i>Papers in Applied Geography</i> , Volume 2, 2016 - Issue 4	Sustainability and sustainable development have become important concepts and goals across science and society. Sustainability, connected to desirable long-term conditions, is an inherently applied pursuit in geography and other fields. An integrative statement of essential concepts on which sustainability studies and applications are being built has been lacking, however. Based on the literature, several

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			key ideas or theoretical concepts are discussed here, including the importance of choice, place, scale, systems, limits, change, connected concepts, and the identity of sustainability. The rural context is used to present examples illustrating key ideas for sustainability, but the concepts apply broadly to applications and research related to improving the directions of environmental and social changes within local, regional, and global systems under the influence of human actions.
86	South Africa	Lo, V. (2016). <i>Synthesis report on experiences with ecosystem-based approaches to climate change adaptation and disaster risk reduction</i> . Technical Series No.85. Secretariat of the Convention on Biological Diversity, Montreal, 106 pages.	This report responds to decision XII/20 of the Conference of the Parties, and aims to address the knowledge gaps in EbA and Eco-DRR in the following ways by: (1) Compiling country experiences, activities and targets related to EbA and Eco-DRR through a review of fifth national reports to the Convention, national biodiversity strategies and action plans (NBSAPs), projects supported by the Global Environment Facility (GEF), other information submitted by Parties and organizations, input received at the CBD technical workshop on EbA and Eco-DRR. Secondly (2), Providing an analysis and synthesis of information on EbA, and on Eco-DRR, bringing together research, theory and practice in the fields of EbA and Eco-DRR. Via case studies from the compilation and a broader literature review, this report presents examples of how both EbA and Eco-DRR are being addressed nationally, regionally and globally, drawing from a wide variety of contexts (environment, conservation, humanitarian and rural and urban development). It draws on information from several comprehensive studies, compilations, frameworks and syntheses of EbA and Eco-DRR experiences. In addition to EbA and Eco-DRR, several related approaches share the same underlying rationale of working with nature for people. These include green infrastructure (GI), nature-based solutions, natural water retention measures, ecological infrastructure, ecosystem infrastructure, natural

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			infrastructure, or building with nature. These terms have often evolved independently in different policy fields.
87	Angola	Lockerbie, E. M., Shannon, L. J., & Jarre, A. (2016). The use of ecological, fishing and environmental indicators in support of decision making in southern Benguela fisheries. <i>Ecological Indicators</i> , 69, 473–487. <a href="https://doi.org/10.1016/j.ecolind.2016.04.035">https://doi.org/10.1016/j.ecolind.2016.04.035</a>	This article examines the use of ecological fishing and environmental indicators in support of decision making in the southern Benguela fisheries. The study indicated that trends in ecological, fishing and environmental indicators can be utilized in a way that allows an overall ecosystem trend to be determined. This is useful for management decisions and implementation. Some of the indicators used in the study include; mean fish length, man lifespan. Survey biomass, proportion of predators, fishing pressure, landing, marine trophic index.
88	South Africa	Lugen M. (2016), <i>The role of climate services for adaptation to climate change in developing countries, with a case study from South Africa</i> , KLIMOS Working Paper n°10, KLIMOSACROPOLIS, Brussels, Belgium.	Adaptation to climate change is a major issue of the 21st century, as already observed and projected impacts of climate change are expected to threaten human societies and ecosystems. Amongst them, smallholder farmers in developing countries are especially concerned. Within the adaptation agenda, the question of knowledge and of its practical use by decision-makers is regularly raised. Indeed, the lack of relevant and timely climate information is highlighted as representing a barrier to adaptation. Climate services, defined as weather or climate information delivered in a way that assists decision-making at different levels, receive growing attention in this context. If they are properly used, they appear as a means to reduce vulnerability to climate change, limit the risks caused by climate hazards and extremes and develop appropriate mitigation and adaptation strategies. This paper aims to present the role of climate services in developing countries, especially in Africa, and what can be expected from them. The authors also pointed at opportunities that climate services represent for smallholder farmers and implications for development agencies. Concrete examples are provided, and a specific case of climate services is investigated: the Climate System

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			Analysis Group, from the University of Cape Town (Western Cape, South Africa).
89	Africa	Maass, M. P., Balvanera, P., Bourgeron, M., Equihua, J., Baudry, J., Dick, M., Forsius, L., Halada, K., Krauze, M., Nakaoka, D. E., Orenstein, T. W., Parr, C. L., Redman, R., Rozzi, M., Santos-Reis, A. M., Swemmer, A., and Vădineanu. A. (2016). Changes in biodiversity and trade-offs among ecosystem services, stakeholders, and components of well-being: the contribution of the International Long-Term Ecological Research network (ILTER) to Programme on Ecosystem Change and Society (PECS). <i>Ecology and Society</i> , 21(3):31.	The International Long-Term Ecological Research (ILTER) network comprises > 600 scientific groups conducting sitebased research within 40 countries. Its mission includes improving the understanding of global ecosystems and informs solutions to current and future environmental problems at the global scales. The ILTER network covers a wide range of social-ecological conditions and is aligned with the Programme on Ecosystem Change and Society (PECS) goals and approach. Our aim is to examine and develop the conceptual basis for proposed collaboration between ILTER and PECS. This paper describes how a coordinated effort of several contrasting LTER site-based research groups contributes to the understanding of how policies and technologies drive either toward or away from the sustainable delivery of ecosystem services. This effort is based on three tenets: transdisciplinary research; cross-scale interactions and subsequent dynamics; and an ecological stewardship orientation.
90	Zimbabwe	Makate, C., Wang, R., Makate, M., & Mango, N. (2016). Crop diversification and livelihoods of smallholder farmers in Zimbabwe: Adaptive management for environmental change. <i>Springer Plus</i> , 5, 2–18.	This paper demonstrates how crop diversification impacts on two outcomes of climate smart agriculture; increased productivity (legume and cereal crop productivity) and enhanced resilience (household income, food security, and nutrition) in rural Zimbabwe. Using data from over 500 smallholder farmers, we jointly estimate crop diversification and each of the outcome variables within a conditional (recursive) mixed process framework that corrects for selectivity bias arising due to the voluntary nature of crop diversification. We find that crop diversification depends on the land size, farming experience, asset wealth, location, access to agricultural extension services, information on output prices, low transportation costs and general information access. Our results also indicate that an increase in the rate of adoption improves crop productivity, income, food security and nutrition at household level. Overall, our results are indicative of

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			the importance of crop diversification as a viable climate smart agriculture practice that significantly enhances crop productivity and consequently resilience in rural smallholder farming systems. We, therefore, recommend wider adoption of diversified cropping systems notably those currently less diversified for greater adaptation to the ever-changing climate.
91	Zimbabwe (Southern Africa)	Mapfumo, P., Mtambanengwe, F., Chikowo, R. (2016). Building on indigenous knowledge to strengthen the capacity of smallholder farming communities to adapt to climate change and variability in southern Africa. <i>South African Journal of Plant and Soil</i> , Volume 32, 2015 - Issue 4.	A study was conducted in Makoni and Hwedza smallholder farming areas in eastern Zimbabwe to investigate local perceptions of the impacts of climate change and variability, and how indigenous knowledge may enable farmers to construct appropriate responses to these impacts and make key agricultural decisions. The study revealed evidence of increased climate variability and heightening vulnerability in farming systems. Rainfall seasons have shortened by up to four weeks, impacting on food sources and ecosystem services, and increasing pressure on women and children as traditional roles change. Communities depended primarily on indigenous knowledge and local biological and geographical indicators of seasonal forecasts in making major strategic, tactical and operational decisions on crop production, including management of food stocks and social safety nets. In providing climate and technical production information, researchers and development practitioners will therefore need to fit in with farmers' local decision-making frameworks. However, it should be recognized that some of the indicators (e.g. biological) on which this indigenous knowledge is traditionally based are also adversely affected by increased climate variability, placing limits on its scope as a basis for decision-making. Despite this, efforts to build the adaptive capacity of these farming communities should still consider the current indigenous knowledge base as an entry point.
92	Africa	Marshall, K. A., & Gonzalez-Meler, M. A. (2016). Can ecosystem services be part of the solution to environmental justice? <i>Ecosystem</i>	The papers focus on how the use of ecosystem services can be a potential or in some cases an impediment in addressing environmental justices. The authors proposed that ecosystem services approaches

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		Services, 22(October), 202–203. <a href="https://doi.org/10.1016/j.ecoser.2016.10.008">https://doi.org/10.1016/j.ecoser.2016.10.008</a>	that seek to ensure environmental justice should be spatially explicit and tend to offer immediate health benefits. This they noted is relevant especially in urban areas because ecosystem services can have direct impact on the health, well-being and quality of life of the urban communities. A notable ecosystem-based approach highlighted in the paper include green infrastructure example urban gardens, lawns. The focus of this the paper was therefore aimed at how to place green infrastructure into a justice framework that takes into consideration the sociocultural-ecological tradeoffs and feedbacks useful for decision making at the environmentally degraded community in urban centers.
93	Africa	Martin, S. (2016). <i>EbA Revisited, Part 1: Disentangling misconceptions about nature and adaptation</i> . ClimatePrep: Adaptation stories, lessons, and explorations. Blog. <a href="http://www.climateprep.org/stories/2016/6/14/eba-revisited-part-1-disentanglingmisconceptions-about-nature-and-adaptation">http://www.climateprep.org/stories/2016/6/14/eba-revisited-part-1-disentanglingmisconceptions-about-nature-and-adaptation</a>	This paper provides a clear definition for Ecosystem based approaches and identify four key concepts to be included in the definition of Ecosystem based approaches. These concepts are; the use of biodiversity and ecosystem services, to help people, adapt to the adverse effects of climate change, as part of an overall strategy
94	Africa	Maupin, A. (2016). The SDG13 to combat climate change: an opportunity for Africa to become a trailblazer? <i>African Geographical Review</i> , Volume 36, 2017 - Issue 2	The proposed thirteenth Sustainable Development Goal (SDG13) invites the world ‘to take urgent action to combat climate change and its impacts,’ while recognizing that the UNFCCC is the primary forum for negotiating a global response to climate change. This SDG13 offers an opportunity to combine multi-leveled actions toward climate change with development objectives. Climate change impacts spare no country but strike unequally developed and developing countries, which raises the question of how adequately the African continent is equipped to respond to climate change challenges, particularly considering Africa’s diverse development needs. Given that African countries present remarkably different contexts, this paper explores climate policies in Africa and discusses opportunities to address

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			concurrently climate change and development challenges on this continent.
95	Ethiopia	Melese, S. (2016). Importance of non-timber forest production in unsustainable forest management, and its implication on carbon storage and biodiversity conservation in Ethiopia. <i>International Journal of Biodiversity</i> , 269-277.	The aim of this study was to know the importance of non-timber forest production in sustainable forest management and the importance of non-timber forest product for carbon storage and biodiversity conservation. Non-timber forest products (NTFPs) are any biological resources collected from wild by rural people for direct consumption/income generation on a small scale such as wild edible foods, medicinal plants, floral greenery, horticultural stock, fiber of plants, fungi, resins, fuel wood, etc. the study reviewed literature on the role of NTFPs in sustainable forest management including sociological approach, economic approach, ecosystem approach, technological approach and its related services. based on the review, management approaches and practices of NTFPs in sustainable forest managements need to be adapted to local ecological, economic and social political circumstances. Responsibility of NTFPs management for forest sustainability should not be given only to an expert but also inclusion of traditional knowledge through involvement of stakeholders in management of forest resource is vital. NTFPs is one option for slowing the rise of GHGs concentrations in atmosphere which aims to increase the amount of carbon remove and what is stored in forests.
96	Ghana	Mensah, A., Anderson, K., & Nelson, W. (2016) <i>Review of Adaptation Related Policies in Ghana</i> . DECCMA Working Paper, Deltas, Vulnerability and Climate Change: Migration and Adaptation, IDRC Project Number 107642.	Ghana, as a signatory to international requirements of the United Nations Framework Convention on Climate Change (UNFCCC) and the Kyoto Protocol, has recognized the risks of global warming to its economy and has committed to take appropriate responsive actions through national policies and plans. In addition to its two key adaptation policy documents, National Climate Change Adaptation Strategy (NCCAS), 2012, and the National Climate Change Policy, 2014, there are a number of other national documents that provide complementary adaptive actions for prioritized sectors. This study



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			provides a critical review of identified national policies and plans that are relevant for responding to climate change.
97	Ghana	Ministry of Environment, Science, Technology and Innovation. (2016). <i>National Climate Change and Green Economy Learning Strategy</i> . Ghana.	This paper stipulates the united nations framework for sustainable development which acknowledges that, to sustain the climate action in the medium to long term, Parties to the convention need to develop and implement country-driven and result oriented strategies on climate change education, training, and public awareness on the effects of climate change and how to effectively address them. This paper addresses Ghana response to climate change and identify ecosystem-based strategies which would be needed by the Ghanaian economy to address climate change. The strategies identified includes; Capacity building, skills development and education on climate change and green economy.
98		Ministry of State for Environmental Affairs. (2016). <i>Egypt Third National Communication under the United Nations Framework Convention on Climate Change</i> . UNFCCC.	The key for Egypt to mitigation of climate change is to lay a sound foundation for further evolution to zero- and low-carbon energy supply technologies, with substantial reductions in energy intensity along with comprehensive mitigation efforts covering all major emitters and technology and financial transfers from industrialized countries to support decarbonization, Most policies that aim at a more sustainable development rest upon four main pillars: more efficient use of energy, especially at the point of end use; increased utilization of renewable energy as a substitute for non-renewable energy sources; accelerated development and deployment of new energy technologies – particularly next-generation fossil fuel technologies that produce near-zero harmful emissions and open up opportunities for CO2 sequestration, in addition to the new generations of nuclear power; and bio sequestration of carbon in terrestrial ecosystems, including soils and biota. Several efforts have been undertaken by the Government of Egypt to achieve the objectives of the convention. They included Technology Cooperation Agreement Pilot Project (TCAPP), promotion of wind energy for electricity generation, fuel

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			cell bus demonstration project, hybrid-electric bus technology, natural gas motorcycles, methane recovery from landfills, integrated solar thermal/natural gas power plant at Kuraymat, energy efficiency improvement and emissions reduction project as well as fuel switching. Other measures taken by Egypt included observations, networking, research and technology development, education, training and raising of public awareness.
99	SSA	Mitchell, J. (2016). The Extractive Industries and Society Pulling the rug out from under: The land tenure dynamics of mining concessions in sub-Saharan Africa. <i>The Extractive Industries and Society</i> , 3(4), 1117–1129. <a href="https://doi.org/10.1016/j.exis.2016.10.003">https://doi.org/10.1016/j.exis.2016.10.003</a>	This article examined the land tenure dynamics of mining concessions in sub Saharan Africa. They argue that their significant overlaps between mining concessions and pre-existing forms of land tenure with the aid of GIS mapping yet limited research that analyses the impact of these overlaps on relevant development still persist. To fill this gap, this article reviews existing research on the sub Saharan Africa region to contend that these overlaps can push pre-existing land users to margins of land access. The outcome of the review argued that mining concessions are effectively pulling the rug out from under from many rural sub Saharan Africans by undermining their tenure status, unleashing increased competition for resources and degrading wide expanses of the environment.
100		Modica, M.; Zoboli, R. (2016), Vulnerability, resilience, hazard, risk, damage, and loss: A socio-ecological framework for natural disaster analysis. <i>Web Ecol.</i> 16, 59–62.	Evaluating socio-economic losses due to natural disasters is a challenging task because of the combined complexity of the social and ecological systems affected. However, also under pressure from the expected effects of climate change, evaluating the socio-economic costs of natural catastrophes has become a vital need for policy makers, urban planners, and private agents (such as insurance companies and banks). This paper suggests a general framework encompassing all the important concepts which should be considered by the above agents in the assessment of natural disasters. In particular, the authors propose a simple and consistent set of relationships among vulnerability, resilience, hazard, risk, damage, and loss which can guide socio-economic assessment.

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101	DR Congo	Moonen, P. C. J., Verbist, B., Schaeffer, J., Bwama Meyi, M., Van Rompaey, A., & Muys, B. (2016). Actor-based identification of deforestation drivers paves the road to effective REDD+ in DR Congo. <i>Land Use Policy</i> +, 58, 123–132. <a href="https://doi.org/10.1016/j.landusepol.2016.07.019">https://doi.org/10.1016/j.landusepol.2016.07.019</a>	The paper use actor-based identification of deforestation drivers to pave way for the effective REDD+ implementation in the context of DR Congo. The author argued that the effective implementation of REDD+ would require understanding the functioning of the local social –ecological systems and the modulation of actions considering actors or stakeholders characteristics and motivations in at the implementation areas. The identification of the drivers of deforestation are critical for appropriate intervention and redressing their underlying causes. These include small scale market integrated farms, poverty, larger household size, ethnicity and cultural behaviors. These are increasingly complex and that no one size fits all policy can address this challenge. Therefore, the need for actor-based policies that will lead to more effective, efficient and equitable REDD+ outcomes.
102	Niger	Moussa, B., Nkonya, E., Meyer, S., Kato, E., Johnson, T., & Hawkins, J. (2016). Economics of land degradation and improvement in Niger. In Economics of Land Degradation and Improvement—A Global Assessment for Sustainable Development <i>Springer Cham</i> , pp. 499-539.	The study estimated the cost of land degradation, ground-truthing of satellite data and drivers of adoption of sustainable land management practices. Land use/cover change (LUCC) analysis shows that a total of 6.12 million ha experienced LUCC and shrublands and grassland accounted for the largest change. The cost of land degradation due to LUCC is about 2007 US\$0.75 billion, which is 11 % of the 2007 GDP of US\$6.773 billion and 1 % of the 2001 value of ecosystem services (ES) in Niger. Every US dollar invested in taking action returns about \$6—a level that is quite attractive. Communities also reported that tree planting and protection were the most common actions against land degradation. Tree planting was done mainly on bare lands to fix sand dunes. This study shows that severe land degradation and the consequent negative impacts on human welfare is a low-hanging fruit that needs to be utilized by countries as they address land degradation. This implies that instead of abandoning severely degraded lands, strategies should be used to rehabilitate such lands using low-cost organic soil fertility management practices and progressively

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			followed by using high cost inputs as soil fertility improves. Improvement of access to rural services and facilitation of non-farm activities will also lead to faster and greater impacts on adoption of SLM practices and increasing resilience to agricultural production shocks in Niger
103	Africa	Mugagga, F., Nabaasa, B.B. (2016). The centrality of water resources to the realization of Sustainable Development Goals (SDG). A review of potentials and constraints on the African continent. <i>International Soil and Water Conservation Research</i> , Volume 4, Issue 3, Pages 215-223	Africa is endowed with vast water resources including but not limited to lakes, rivers, swamps and underground aquifers. However, the way of life in Africa does not reflect this kind of wealth owing majorly to degradation and underutilization of these water resources. This review discusses the centrality of water resources in Africa's pursuit of the Sustainable Development Goals (SDGs). Following the Sustainable Development Model, the paper thematically examines and synthesizes the importance and potentials of water resources to Africa's development through exploring their contributions and limitations to the various economic sectors namely; agricultural and livestock production, energy, manufacturing and processing, tourism, health, fisheries, trade and other institutional mechanisms such as payment for ecosystem services (PES), mutual cooperation and economic cooperation. Data were collected by review of online peer-reviewed and grey literature published between the year 2000 and 2015. It is observed that sustainable management of water and sanitation for all (SDG 6) will be central to the attainment of all the other SDGs (particularly SDG 1 (No poverty), 2 (No hunger), 3 (Good health), 14 (life below water) and 15 (life on land)) across Africa. African states should therefore increase their commitment to water conservation and management as this will significantly decide Africa's future development paths.
104	Zimbabwe	Mujeyi, A. (2018). Policy and Institutional Dimensions in Climate-Smart Agriculture Adoption: Case of Rural Communities in	Southern Africa is among the most vulnerable regions to climate change, and in Zimbabwe it is manifested in droughts and varying rainfall patterns. Several climate-smart agriculture (CSA) projects have been promoted in rural communities in order to reduce the

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		Zimbabwe. <i>Handbook of Climate Change Resilience</i> , 1-15.	negative impacts. This paper reviews the role of policies and institutions in Goromonzi, Murehwa, Mutoko, and Uzumba Maramba Pfungwe districts in enabling adoption of CSA by farmers and ensuring that they reap benefits. It looks at institutions and organizations that have been involved and policies that have been put in place to support CSA adoption and explores how they can improve and ensure higher adoption rates. Results of the analysis revealed that the Ministry of Environment and Climate Change has developed a clear strategy document of action plans needed within the field of agriculture. Key challenges to effective climate change policy implementation in the sector of agriculture nonetheless include the limited finances to reach out to large population, overreliance on funding from the international community, and limited involvement of stakeholders at policy formulation, yet implementation is expected from a wide range of actors along commodity value chains. The study recommends financing of CSA initiatives to be diverse including use of national budgets and active engagement of development organizations in policy formulation and out-scaling any successful, scientifically tested technologies among communities.
105	Africa	Mulongoy, K.J. (2016). <i>Regional strategy and policy recommendations for the planning and management of protected areas in the face of climate change</i> . UNEP-WCM Technical Report.	The development of a regional strategy and policy recommendations for the best approaches to the planning and management of protected area systems resilient to climate change was one of the final outputs of the PARCC West Africa project. This regional document should serve as an authoritative point of reference and ensure coherence, coordination and networking in the implementation of national strategies. The document facilitates: the harmonization in national legislations, the mobilization of financial resources, the implementation of human and Technological capacity building programs, and communication and reporting processes.
106	Africa	Munang, R., Mgendi, R. (2016). <i>A Strategic Approach and Business Model for Scaling Up</i>	Ecosystem-based adaptation (EbA) is a known strategy for building climate resilience and enhancing the ecosystems that underpin the

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		<i>Ecosystem Based Adaptation for Sustainable Development in Africa</i> . ReSAKSS Annual Trends and Outlook Report. Pp 137-145	productivity of key socioeconomic sectors in Africa. EbA for agriculture is an approach used to build climate-resilient food systems; it encompasses climate-smart agriculture (CSA) and a broad range of other techniques. Considering mounting climate impacts and escalating degradation of ecosystems, the urgent need to scale up such climateresilient approaches as EbA and CSA and safeguard future food systems cannot be overstated. This paper addresses ecosystem-based adaptation in the agricultural sector.
107	Tanzania	Mushi, V.A., Makauki, A.F. (2016). Climate Change Adaptation Strategies and Gender Inequality Among Pastoralists in Tanzania. Beyond Agricultural Impacts. <i>Multiple Perspectives on Climate Change and Agriculture in Africa</i> , Pages 147-168	Climate change (CC) consequences in Tanzania have taken a gender dimension, in which women are seen to be more vulnerable than men. Although several studies have been conducted on gender and CC, information on gender inequality and CC adaptation strategies, particularly in Tanzania, is still limited. This chapter aims to first, identify CC adaptation strategies in the study area; second, examine gender inequality in terms of division of labor, resource ownership, and decision-making; and third, determine how gender inequality affects CC adaptation strategies. The chapter is based on a study conducted in Kilosa District in Tanzania, which adopted a cross-sectional research design. Primary data were collected from 50 respondents using a structured questionnaire and a checklist of questions for focus group discussions. Desk review of various documents was employed in collecting secondary data. It was found that various adaptation strategies were used by the pastoralists to adapt to CC impacts. It was also found that gender inequality in the study area made it difficult to implement various CC adaptation measures. It is recommended that gender-sensitive policies and strategies on household division of labor, resource ownership, and decision-making are required to enhance women's CC adaptive capacity.
108	Zimbabwe	Muzari, W., Nyamushamba, G., & Soropa, G. (2016). Climate Change Adaptation in Zimbabwe's Agricultural Sector. <i>International</i>	This paper discussed the options, potential and constraints to climate change adaptation in Zimbabwe's agricultural sector in July 2014. Zimbabwe is particularly susceptible to climate change because the

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		<i>Journal of Science and Research (IJSR)</i> , 1762-1768.	livelihoods of the majority of its residents are dependent on rain-fed agriculture. Household level vulnerability in Zimbabwe is influenced by conflict and insecurity, inequitable land distribution, low education, poor infrastructure, gender inequality, dependence on climate-sensitive resources, poor health status, and HIV/AIDS. A multipronged approach was adopted to identify relevant literature. A web- and e-mail-based search for documentation and a desktop review of printed literature was used to enable analysis of secondary data on adaptation to climate change in the agricultural sector. The results showed that there is no comprehensive, specific national policy and legislative framework for climate change adaptation. Instead, legislative and programmatic adaptation responses are found in a plethora of development policies, strategies and action plans of various government sectors. They also realized that adaptation strategies are inherent in policy documents, but without much coordination. As such some of the policies and programmes in Zimbabwe actually constrain climate change adaptation. They recommended the need to harmonize uncoordinated and fragmented pieces of legislation and strategies aimed at enabling and enhancing an adaptive response to climate change.
109	Malawi	Nagoli, J. (2016). <i>A lake without water. Livelihood coping strategies during the lake Chilwa water recessions in Malawi</i> . Doctoral thesis submitted to the Faculty of natural resources and Agricultural Sciences, Swedish University of Agricultural Sciences, Uppsala.	This thesis explores the human-environment interaction within the climate-sensitive socio-ecological system of Lake Chilwa in Malawi. It uses the livelihoods framework to analyse various coping strategies to resource scarcity due to lake recessions. The main aim is to understand the processes by which decision-making takes place and the influence of various agents of change on coping with environmental shocks, i.e. water recessions. Lake Chilwa undergoes periodic water recessions with up to twelve incidents recorded between 1900 and 2012. While the lake and its wetland is an economic aquatic agriculture system in between recessions, it is unclear how households around the system survive during the periods of water



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			<p>recessions. Qualitative and quantitative studies were conducted between March 2012 and December 2013 on Chisi Island of Lake Chilwa to evaluate the coping strategies and their major drivers in responding to the periodic lake recessions. Using interpretive analysis, the findings show that people from the Lake Chilwa socio-ecological system have lived in anticipation of periodic environmental shocks due to their deep historical knowledge of the lake level and its fluctuations. This knowledge has been passed from generation to generation. Results further show that the main coping strategies that have stood the test of time for every recession are based on reciprocity and redistribution. These include sharing through kinship ties, hunting wild birds and farming. In many cases coping strategies for each specific recession are driven by political, social and economic factors prevailing at that particular period. Given these conditions, different agents (individuals or communities) make choices designed to maximise their own interests as they scramble to access scarce resources. Although natural resources in these systems are fundamental assets in rural livelihoods, accessing them in times of scarcity requires better governance systems that consider social, political and economic contexts.</p>
110	South Africa	Naidoo, G (2016). The mangroves of South Africa: An ecophysiological review. <i>South African Journal of Botany</i> , Volume 107 Pages 101-113	<p>Mangroves are unique, highly productive forests that interface between marine and terrestrial environments in protected and sheltered habitats of tropical and temperate regions. In Africa, mangroves reach their southern distributional limit in the warm temperate zone at Nahoon Estuary (32°56' S) in South Africa. Temperate mangroves are less diverse, slower growing and of smaller stature than those in the tropics. This review gives an overview of mangrove distribution in South Africa and factors that constrain their spread. This is followed by an ecophysiological overview of mangrove adaptations to survive in an intertidal environment characterized by heterogeneous salinity, waterlogging and low</p>

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			nutrients. These adaptations play critical roles in salt exclusion, maintenance of low tissue water potentials and conservative water and nutrient use. Adaptations range from macro to micro levels and include root, stem and leaf morphology. It also discusses characteristics of mangroves at higher latitudes that distinguish them from their tropical equivalents. The effects of anthropogenic pollution, climate change and sea level rise, as well as local threats in South Africa are also discussed. This review also includes a detailed list of research conducted on South African mangroves and makes suggestions for future work.
111		Nalau, J., Becken, S., & Mackey, B. (2016). Ecosystem-based Adaptation: A review of the constraints. <i>Environmental Science &amp; Policy</i> . 89. 10.1016/j.envsci.2018.08.014.	In the international climate policy arena, Ecosystem-based Adaptation (EbA) has become the preferred adaptation approach to climate change in the least developed and developing countries. Its perceived strength lies in the premise that adaptation strategies need to address both ecosystems and livelihoods simultaneously, given these are crucially intertwined and both under a threat from climate change. While EbA has certainly made progress as an adaptation approach, a lack of understanding still exists how EbA approaches contribute to 'effective' adaptation, including the circumstances where they face constraints and limits. Furthermore, implementation of EbA approaches ideally requires a level of understanding about ecosystem structure, productivity and dynamics, and how these are affected by climate change and other direct anthropogenic stressors, that are rarely available in developing countries. This paper aimed to synthesise the current knowledge in the emerging body of EbA specific literature on the kinds of constraints that hamper the use of EbA.
112	Ghana	Ndamani, F., & Watanabe, T. (2016). Determinants of farmers' adaptation to climate change: A micro level analysis in Ghana. <i>Scientia Agricola</i> , 73(3), 201-208.	This study analyzed socio-economic factors that influence farmers' adaptation to climate change in agriculture. Perceptions regarding long-term changes in climate variables and the rate of occurrence of weather extremes were also investigated. Additionally, farmers' perceived barriers to the use of adaptation practices were identified

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			and ranked. A total of 100 farm-households were randomly selected from four communities in the Lawra district of Ghana and data were collected through semi-structured questionnaires, focused group discussions and field observations. A logistic regression model and weighted average index were used to analyze the data. The results showed that 87 % of respondents perceived a decrease in rainfall amount, while 82 % perceived an increase in temperature over the past 10 years. Results of the weighted average index indicate that dry spell and drought have a higher annual rate of occurrence than flood. Empirical results of the logistic regression model showed that education, household size, annual household income, access to information, credit and membership of farmer-based organization are the most important factors that influence farmers' adaptation to climate change. The main constraints on adaptation include unpredictability of weather, high farm input cost, lack of access to timely weather information and water resources. The policy implication of this study is that governments should mainstream barriers to, and choice factors of, adaptation practices to climate change related projects and programs.
113	Madagascar	Neugarten, R. A.; Honza A. k, M.; Carret, P.; Koenig, K.; Andriamaro, L.; Cano, C. A.; Grantham, H. S.; Hole, D.; Juhn, D.; McKinnon, M.; Rasolohery, A.; Steininger, M.; Wright, T. M. and Turner, W. R. (2016) Rapid Assessment of Ecosystem Service Co-Benefits of Biodiversity Priority Areas in Madagascar, <i>PLoS ONE</i> , 11(12): e0168575.doi:10.1371/journal.pone.0168575	The article assessed key provisioning (fisheries, hunting and non-timber forest products, and water for domestic use, agriculture, and hydropower), regulating (climate mitigation, flood risk reduction and coastal protection), and cultural (nature tourism) ecosystem services (ES) provided by biodiversity priority areas in Madagascar in order to understand the potential co-benefits of conservation investments. The objective was to identify the ES co-benefits of biodiversity priority areas in Madagascar in order to guide an investment strategy. The authors developed a framework for rapid spatial assessment of ecosystem services (ES) to rapidly identify sites providing multiple benefits. The article indicated that virtually all forested biodiversity priority sites (KBAs) of Madagascar's (180 out of 221 total KBAs)

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			contain relatively high levels of biomass carbon stock. However, over half (92 of 180) of the forested KBAs experienced deforestation. The article emphasized that if future deforestation is stopped, these sites have the highest potential for avoiding future emissions from deforestation. The authors pointed that although existing rapid approaches to ES assessment are not usually tailored to the specific links between nature and people in a given context, they focused on developing an approach to ES assessment that strikes a balance between the inherent complexity of ES and the need for practical approaches. This article has the potential to quickly guide conservation planning and investment decisions
114	Africa	Nhamo, G., & Nhamo, S. (2016). Paris (COP21) Agreement: Loss and damage, adaptation and climate finance issues. International. <i>Journal of African Renaissance Studies-Multi-, Inter-and Transdisciplinarity</i> , 11(2), 118-138.	Climate policy documents are more interesting for what they leave out than what they contain. Using the COP21 negotiating texts, this article analyses the Paris Agreement to determine the good, the bad and the ugly of this ‘landmark’ document regarding loss and damage (L&D), adaptation and finance. The article establishes that among the good is that we have a universal deal in place that speaks to L&D and adaptation. the bad remains that developing and weaker nations are still vulnerable, in negotiations and to climate change. Among the ugly is the emerging unholy alliance between the referees (national governments) and key players (business and industry) that resulted in a quasi-legally binding deal. Furthermore, we continue to have endless financial promises. Since Gleneagles in 2005, when \$50 billion in aid was promised by the G8, \$100 billion per annum was promised from Copenhagen’s COP15 in 2009, to the scale-up promises of \$100 billion annually from 2015 – developing countries are still waiting for these promises to be met. Drawing from Africa’s adaptation funding needs of \$15 billion annually, as estimated by the United Nations Environment Programme to 2020, and the \$50+ billion annually thereafter to 2050, the article concludes that the global adaptation funding gap remains huge. The therefore

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			recommend that domestic mobilisation of financial and other resources remain a viable option.
115	Africa	Nkhata, B., & Breen, C. (2016). Assessing and measuring adaptive capacity: the experiences of African countries in developing meaningful metrics for water management. <i>Current Opinion in Environmental Sustainability</i> , 21, 9–14. <a href="https://doi.org/10.1016/j.cosust.2016.10.008">https://doi.org/10.1016/j.cosust.2016.10.008</a>	<p>This paper presents a review of recent literature published on a range of issues in relation to assessment of adaptive capacity of sub-Saharan Countries in effective water management. The paper argue that the region is the one with the greatest water deficit and in term of adaptive capacity is also the lowest. Water management is therefore deemed more critical for the region making agencies and institution under pressure to cope with the situation. The Millennium Ecosystem Assessment and the Livelihoods Framework has been pointed out as the frameworks that has been pioneers in the ecosystem assessments in the literature yet account less for the context of adaptive capacity in the context of developing countries. Therefore, they contended that the other two categories of assessments that have influenced a lot of discussions around adaptive capacity. These include technical and market-based assessment systems. Examples of technical assessments include water quality monitoring schemes, hydrological modelling tools, water balance calculation, stream assessment scoring systems and adaptive river management regimes.</p> <p>On the other hand, the Market based assessments include the payment for ecosystem services, clean development mechanism, carbon markets projects, REDD+ programs.</p>
116	Kenya	Ochenje, I. M., Ritho, C. N., Guthiga, P. M., & Mbatia, O. L. E. (2016). <i>Assessment of Farmers' Perception to the Effects of Climate Change on Water Resources at Farm Level: The Case of Kakamega County, Kenya</i> . Invited poster presented at the 5th International Conference of the African Association of Agricultural Economists.	In the face of climate change, a number of climate variables such as temperature, precipitation, wind speed, humidity and solar radiation tend to affect water resources. This has led to changes in soil moisture, reduced stream run off, reduced ground water recharge and increased transpiration which ultimately causes deterioration of on-farm water resources. Deteriorating water resources at farm level as a result of climate change has led to decreased crop yields in sub Saharan Africa and threatens food security, livelihoods as wells as water security.

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			Understanding factors affecting farmers' perception of climate change effects on water resources is key in informing policies that can transform smallholder agriculture in Africa to be more resilient to the effects of climate change. This study assesses farmers' climate change perceptions on water resources at farm-level in Kakamega County, Kenya. Using data collected from 159 farm households in Kakamega County, ordered probit was employed to assess factors affecting farmers' perception of climate change based on water resources. The results indicate that gender, farm size, distance to the main water source, extension services, access to climate change information through radio and wealth status significantly explained levels of farmers' perception of climate change based on water resources. The findings inform policies aimed at increasing awareness of climate change effects on on-farm water resources and consequently enhance adaptive water management strategies among smallholder farmers.
117	Kenya	Ochieng, J., Kirimi, L., Mathenge, M. (2016) Effects of climate variability and change on agricultural production: The case of small-scale farmers in Kenya. <i>NJAS - Wageningen Journal of Life Sciences</i> , Volume 77, June 2016, Pages 71-78	Agriculture is the mainstay of the Kenyan economy, contributing to food security and employment of rural households. Climate variability and change have adversely affected this sector and the situation is expected to worsen in the future. We estimate the effect of climate variability and change on revenue from all crops, maize and tea separately, using a household fixed effects estimator. We find that climate variability and change affect agricultural production but effects differ across crops. Temperature has a negative effect on crop and maize revenues but a positive one on tea, while rainfall has a negative effect on tea. We find that tea relies on stable temperatures and consistent rainfall patterns and any excess would negatively affect production. Temperature has a greater impact on crop production than rainfall. Climate change will adversely affect agriculture in 2020, 2030 and 2040 with greater effects in the tea sector. Therefore, rethinking the likely harmful effects of rising temperatures and increasing rainfall uncertainty should be a priority in Kenya.

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			Implementing adaptation measures at national, county and farm levels as well as putting in place policies that prevent destruction of the natural environment will assist to address the challenges posed by climate variability and change.
118	Nigeria	Olutegbe, N., & Fadairo, O. (2016). Correlates and determinants of climate change adaptation strategies of food crop farmers in Oke-Ogun area of South-western Nigeria. <i>Journal of Agricultural Extension and Rural Development</i> , 8(7), 122-129.	Information on determinants of climate change adaptation strategies in Oke-ogun area, the food basket of South western Nigeria is scarce. Determinants of adaptation strategies to climate change among food crop farmers in Oke-Ogun area of Oyo State were therefore assessed. Multistage sampling procedure was used to select 160 food crop farmers, and data were collected through a well-structured interview schedule. Chi-square, Pearson Product Moment Correlation (PPMC), and Multiple Linear Regression were used in data analysis. Mono-cropping practices ( $\chi^2 = 14.213$ ), access to extension services ( $\chi^2 = 6.201$ ) and credit facilities ( $\chi^2 = 8.077$ ) had significant relationship with respondents' level of climate change adaptation strategies. Farm size ( $r = 0.232$ ), level of awareness ( $r = 0.199$ ), information exposure ( $r = 0.205$ ) constraints to climate change adaptation strategies ( $r = -0.228$ ) and perception ( $r = 0.319$ ) also had significant relationship with level of adaptation strategies. Farm size ( $\beta = 0.259$ ), perception of climate and effects ( $\beta = 0.257$ ), constraints to adaptation to climate change effects ( $\beta = -0.118$ ) were the three most important determinants of climate change adaptation strategies of food crop farmers. Agricultural extension activities should intensify awareness creation, while it also provides solutions to all climate change adaptation related constraints
119	Nigeria	Onu F. M., Alaribe M. O. & Ikehi M. E. (2016). Coping measures required by farmers in managing climate change stress for effective agricultural crop production: Case study of Abia State, Nigeria. <i>African Journal of Agricultural</i>	This study was carried out to identify coping measures required by farmers in managing climate change stress for effective agricultural production in Abia State, Nigeria. Design of the study was descriptive survey. The study was carried out in Abia State. Two research questions guided the study while two null hypotheses were formulated and tested. Population for the study was 1,009 made up of 768 farmers



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		<i>Research</i> ; 11(16), 1463- 1468. <a href="http://dx.doi.org/10.5897/AJAR2015.10773">http://dx.doi.org/10.5897/AJAR2015.10773</a>	and 241 extension agents in Abia State. Sample for the study was 302 made up of 230 farmers and 72 extension agents obtained through proportionate (30%) stratified random sampling technique. A 30-item questionnaire was developed and used to collect data for the study. Data obtained were analyzed using mean and standard deviation to answer the research questions while t-test statistic was used to test the hypotheses at probability level of 0.05. It was found by the study that crop farmers require the 30 coping measures identified in managing climate change stress among which include; use of high yielding and tolerant crop varieties, harvesting of water for irrigation and advertising agricultural produce. It was therefore recommended that the identified coping measures be packaged into a training programme by relevant stakeholders for training or retraining of farmers through seminars or workshops to enable them manage climate change stress for effective agricultural crop production in Abia State, Nigeria.
120	Nigeria	Onu, F., & Ikehi, M. E. (2016). Mitigation and Adaptation Strategies to the Effects of Climate Change on the Environment and Agriculture in Nigeria. <i>Journal of Agriculture and Veterinary Science</i> , 9(4), 26-29.	Climate change has been threatening the global environment, in particular agricultural sustainability in Nigeria and other vulnerable regions of the world. Climate change affects not only agricultural production and prices, trade and food sufficiency but also environmental conditions like water resources and coastal infrastructure. Addressing climate change issues and promote sustainability in agricultural sector and the environment requires tangible progress in implementing mitigation and adaptation strategies in the environment and agricultural sector. This short note relied on literature and participant observation to highlight the various efforts to combat the effects of climate change on the environment and agriculture.
121	Nigeria	Otitoju, M.A., Enete, A.A. (2016). Climate change adaptation: Uncovering constraints to the use of adaptation strategies among food crop farmers in South-west, Nigeria using principal	This study focused on the constraints to the use of climate variability/change adaptation strategies in South-west Nigeria. The PCA result showed that the principal constraints that the farmers faced in climate change adaptation were public, institutional and labor constraint; land,

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		component analysis (PCA), <i>Cogent Food &amp; Agriculture</i> , 2: 1178692	neighborhood norms and religious beliefs constraint; high cost of inputs, technological and information constraint; farm distance, access to climate information, off-farm job and credit constraint; and poor agricultural programs and service delivery constraint. These findings pointed out the need for both the government and nongovernment organizations to intensify efforts on institutional, technological and farmers' friendly land tenure and information systems as effective measures to guide inclusive climate change adaptation policies and development in South-west Nigeria.
122	Africa	Pandeyaa, B., Buytaerta, B, W., Zulkafli, Z., Karpouzoglou, T., Maoe, F., Hannahe, D.M (2016). A comparative analysis of ecosystem services valuation approaches for application at the local scale and in data scarce regions. <i>Ecosystem Services</i> 22 (2016) 250–259	Despite significant advances in the development of the ecosystem services concept across the science and policy arenas, the valuation of ecosystem services to guide sustainable development remains challenging, especially at a local scale and in data scarce regions. In this paper, the authors review and compare major past and current valuation approaches and discuss their key strengths and weaknesses for guiding policy decisions.
123	Ethiopia	Paul, C. J., Weinthal, E. S., Bellemare, M. F., & Jeuland, M. A. (2016). Social capital, trust, and adaptation to climate change: Evidence from rural Ethiopia. <i>Global Environmental Change</i> , 36, 124-138.	Climate change is expected to have particularly severe effects on poor agrarian populations. Rural households in developing countries adapt to the risks and impacts of climate change both individually and collectively. Empirical research has shown that access to capital—financial, human, physical, and social—is critical for building resilience and fostering adaptation to environmental stresses. Little attention, however, has been paid to how social capital generally might facilitate adaptation through trust and cooperation, particularly among rural households and communities. This paper addresses the question of how social capital affects adaptation to climate change by rural households by focusing on the relationship of household and collective adaptation behaviors. A mixed-methods approach allows us to better account for the complexity of social institutions—at the household, community, and government levels—which drive climate adaptation outcomes. We use data from interviews, household

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			surveys, and field experiments conducted in 20 communities with 400 households in the Rift Valley of Ethiopia. Our results suggest that qualitative measures of trust predict contributions to public goods, a result that is consistent with the theorized role of social capital in collective action. Yet qualitative trust is negatively related to private household-level adaptation behaviors, which raises the possibility that social capital may, paradoxically, be detrimental to private adaptation. Policymakers should account for the potential difference in public and private adaptation behaviors in relation to trust and social capital when designing interventions for climate adaptation.
124	Africa	Polak J. & Snowball J. (2016). Towards a framework for assessing the sustainability of local economic development based on natural resources: honeybush tea in the Eastern Cape Province of South Africa. <i>Local Environment</i> , Volume 22, 2017 - Issue 3	Despite the popularity of local economic development (LED) as a job creation and economic growth strategy in South Africa, many LED projects have not proved to be sustainable in the long-run, especially where human systems interact with biological ones. This article examines the relationship between sustainability and LED within the context of the emerging honeybush tea industry in the Eastern Cape. Data were gathered from provincial as well as local government policy documents and reports, and via key informant interviews. The data were analysed using Connelly's [(2007). Mapping sustainable development as a contested concept. Three-pronged approach to sustainable development as a lens through which to view the local industry. Findings showed that the industry offers many opportunities for development, including job creation in poorer, rural households; sustainable wild harvesting using a permit system; commercial cultivation; potential to develop social capital; potential for community-based LED; and product diversification. However, there are also corresponding challenges: There is currently no reliable data on the maximum sustainable yield, which is needed to guide quota allocations for entrepreneurial harvesters harvesting from wild stocks; possible biodiversity loss; and enforcing the permit scheme is proving difficult in remote rural areas.

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125	North Africa	Radhouane, L. (2016). Climate change impacts on North African countries and on some Tunisian economic sectors. <i>Journal of Agriculture and Environment for International Development</i> (JAEID), 107(1), 101-113.	The article examines Climate change impacts on water resources and agriculture in North African regions and especially on Tunisia country. North Africa is vulnerable to climate change impacts. Scenarios predict an average rise in annual temperatures, higher than the average expected for the planet. Heat waves would then be more numerous, longer and more intense. North Africa would be particularly affected by droughts that would be more frequent, more intense and longer-lasting. Many Mediterranean regions would then run a major risk of being submerged and eroded. In North Africa, rising temperatures associated with climate change are expected to decrease the land areas suitable for agriculture, shorten the length of growing seasons and reduce crop yields. The African countries face numerous environmental challenges and have to reconcile many conflicting priorities, from promoting economic diversification, ensuring water supply and food security, and furthering environmental protection and conservation to adapting to the impacts of global warming.
126	South Africa	Rasch, S., Heckelei, T., & Johannes Oomen, R. (2016). Reorganizing resource use in a communal livestock production socio-ecological system in South Africa. <i>Land Use Policy</i> , 52, 221–231. <a href="https://doi.org/10.1016/j.landusepol.2015.12.026">https://doi.org/10.1016/j.landusepol.2015.12.026</a>	The paper discusses how reorganizing resource use in a communal livestock production socio-ecological system could contribute to the livelihoods of households in south Africa. The author criticized the top down approach to management that often ignore specific socio-ecological contexts that affects effective outcomes and does not being equity. They call for rangeland management system that is context specific and usually agreed upon base on recommendation from multiple stakeholders which does not exist. The study used a socio-ecological simulation model to assess the socio-ecological effects of rotational vs continuous grazing under conservative and opportunistic stocking rates. The results indicated that the later led to more favorable outcomes from the social and ecological perspectives.
127	Africa	Reed, J., Vianen, J.V., Deakin, E.L., Barloe, J., Sunderland, T. (2016). Integrated landscape	Poverty, food insecurity, climate change and biodiversity loss continue to persist as the primary environmental and social challenges

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		approaches to managing social and environmental issues in the tropics: learning from past to guide the future. <i>Global change biology</i> , 22(7), 2540-2554.	faced by the global community. As such, there is a growing acknowledgement that conventional sectorial approaches to address often interconnected social, environmental, economic and political challenges are proving insufficient. An alternative is to focus on integrated solutions at landscape scale or landscape approaches. This paper conducted a literature review on the use of landscape approach and provide a recommendation on how the landscape approach can contribute toward the fulfillment of goals of international policy process.
128	Africa	Reid, H. (2016). Ecosystem- and community-based adaptation: learning from community-based natural resource management. <i>Climate and Development</i> , 8:1, 4-9, DOI: 10	Ecosystem-based adaptation (EbA) and its sister community-based adaptation (CBA) have gained traction over recent years, and policy-makers and planners are increasingly promoting ‘integrated’ EbA and CBA approaches. Improved learning from older natural resource management disciplines such as community-based natural resource management (CBNRM), however, could help inform EbA and CBA practice and policy-making. This viewpoint describes key lessons from CBNRM that EbA and CBA should address as they mature, including the need for EbA and CBA to ensure: communities are central to planning; the institutional, governance and policy context of initiatives is addressed; and, incentives and the need for better evidence of effectiveness is considered.
129	Africa	Reid, R.S., Nkedianye, D., Said, M.Y., Kaelo, D., Neselle, M., Makui, O., Onetu, L., Kiruswa, S., Ole Kamuaro, N., Kristjanson, P., Ogutu, J., BurnSilver, S.B., Goldman, M.J., Boone, R.B., Galvin, K.A., Dickson, N.M., Clark. W.C. (2016). Evolution of models to support community and policy action with science: Balancing pastoral livelihoods and wildlife conservation in savannas of East Africa. <i>Proceedings of national academy</i>	The authors developed a “continual engagement” model to better integrate knowledge from policy makers, communities, and researchers with the goal of promoting more effective action to balance poverty alleviation and wildlife conservation in 4 pastoral ecosystems of East Africa. The model involved the creation of a core boundary-spanning team, including community facilitators, a policy facilitator, and transdisciplinary researchers, responsible for linking with a wide range of actors from local to global scales. Collaborative researcher–facilitator community teams integrated local and scientific knowledge to help communities and policy makers improve herd

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		<i>of sciences of the uniyed states</i> , Volume 113, Issue 17, pp: 4576-4584.	quality and health, expand biodiversity payment schemes, develop land-use plans, and fully engage together in pastoral and wildlife policy development. This model focused on the creation of hybrid scientific–local knowledge highly relevant to community and policy maker needs.
130	North Africa	Roson, R., & Sartori, M. (2016). Climate change, tourism and water resources in the Mediterranean: A general equilibrium analysis. <i>International Journal of Climate Change Strategies and Management</i> , 6(2), 212-228.	The paper aims to present and discuss some quantitative results obtained in assessing the economic impact of variations in tourism flows, induced by climate change, for some Mediterranean countries. Estimates by a regional climate model are used to build a tourism climate index, which indicates the suitability of climate, in certain locations, for general outdoor activities. As climate change is expected to affect a number of variables like temperature, wind and precipitation, it will have consequences on the degree of attractiveness of touristic destinations. It estimates the macroeconomic consequences of changing tourism flows by means of a computable general equilibrium model.
131	Nigeria	Salako, G.A., Adebayo, H., Sawyerr, A. & Umar, A.J. (2016). Application of Remote Sensing/GIS in Monitoring Typha spp. Invasion and Challenges of Wetlands Ecosystems Services in Dry Environment of Hadejia Nguru Wetland System Nigeria. <i>Environment and natural resource journal</i> , Volume 14, No. 2.	Although, the threat posed by Typha invasion to wetland utilization has been widely acknowledged in the Hadejia Nguru wetlands, yet little or no monitoring has been done to quantify the extent and time analysis of the threat. Remote sensing and GIS techniques were used in this study to monitor the Spatio-temporal dynamics of Typha spp. invasion in the dry environment of the Hadejia Nguru Wetlands of NE Nigeria. Satellite images of Band 1, 2, 3, and 4 from Landsat ETM+ were acquired between 2003 and 2015 and natural color from GeoEye-1 in 2016 where image classification, change detection and spatial statistics were performed. To evaluate the impact of Typha grass on the livelihood of the people, a field investigation involving administration of 200 questionnaires was conducted among the two major wetland users: the farmers and the fishermen. The result from the RS/GIS revealed that Typha grass recorded an astronomical growth of 1013% between 2003 and 2009 and another incremental of

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			32% in 2015. The ANOVA test on land cover change in 2003, 2009 and 2015 showed a significant variation in land cover and use changes at $p < 0.05$ . The findings from field survey showed that Typha grass accounted for 70% decrease in land available for farmland and subsequent reduction in crop output by 90%. It also accounted for 80% reduction in total fish caught as compared to non Typha infested land and open water. Strategic and selective weeding by mechanical and manual techniques was therefore suggested as control measures to save the wetland ecosystem and wetland users' livelihood.
132		Sam, K., Coulon, F., & Prpich, G. (2016). Working towards an integrated land contamination management framework for Nigeria. <i>Science of the Total Environment</i> , 571, 916–925. <a href="https://doi.org/10.1016/j.scitotenv.2016.07.075">https://doi.org/10.1016/j.scitotenv.2016.07.075</a>	The paper proposes working towards an integrated land contamination management framework for Nigeria to argument existing frameworks and interventions in dealing with land contamination and degradation over the years. the basis of their argument is that Nigeria existing framework for land management are based on ad hoc without integration of scientific information. Therefore, this article is work in progress to ensure the scientific integration to address environmental, economic, and social values in the management of the land resources. Several integrated approaches such as sustainability appraisal, liability regimes, funding mechanism, and technological demonstration are proposed to be adopted as used in other parts of the world in the US, UK, Netherlands and Australia. However, care must be taken into consideration on the local conditions and demands.
133	Africa	Satia, B. P. (2016). An overview of the large marine ecosystem programs at work in Africa today. <i>Environmental Development</i> , 17, 11–19. <a href="https://doi.org/10.1016/j.envdev.2015.06.007">https://doi.org/10.1016/j.envdev.2015.06.007</a>	This paper highlighted some of the efforts of African countries in the management of marine ecosystems through the adoption of science driven ecosystem-based approaches to ocean governance and management. A paradigm shift was the focus to ensure that conventional approaches were moved toward embracing a more inclusive ecosystem-based practices. These included among others the following; management of ecosystems instead of single species, management that embraced multiple scales other than small spatial



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			scales, long term perspectives to short term perspective approaches, management with focus on human integration as part than being independent of the ecosystems and management approaches are adaptive in nature as against those that does not seek to evolve with new research.
134	South Africa	Scharler, U. M., van Ballegooyen, R. C., & Ayers, M. J. (2016). A system-level modelling perspective of the KwaZulu-Natal Bight ecosystem, eastern South Africa. <i>African Journal of Marine Science</i> , 38(sup1), S205-S216.	The KwaZulu-Natal Bight comprises the only sizeable shelf region on the eastern coast of South Africa and is influenced by both the Agulhas Current on its seaward side and rivers and estuaries on its landward side. Established knowledge of the effect of the Agulhas Current includes the influence on nutrient concentrations in the bight of a semi-permanent upwelling cell at its northern border (St Lucia) and, to a much lesser extent, of a semi-permanent eddy feature at its southern extremity. Current modelling efforts, however, point to a very important role of land-derived nutrients, which supplement the productivity of food webs of the bight. This connectivity of the bight to its adjacent ecosystems has various implications. First, its productivity has traditionally been viewed via phytoplankton growth, whereas ecosystem modelling efforts point to a very high reliance on imported detritus (mainly land-derived) in order to sustain especially the rich benthic food web. The benthos in the bight dominates the food web and is in marked contrast to the upwelling system of the west coast of South Africa (Atlantic Ocean) where water-column productivity dominates. Second, the importance of the connectivity of the Thukela Bank prawn-trawling ground to estuarine nursery areas, which has been modelled quantitatively, highlights the significance of this ecosystem connectivity for fisheries and also for the Thukela Bank food web. Heterogeneity across the bight is apparent for nutrient turnover rates (carbon, nitrogen, phosphorus), CNP content and stoichiometry, whereas nitrogen is a limiting nutrient across the entire bight. The food web near the Thukela River is richer in nutrient content and more active (higher turnover rates) compared to the

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			northern and southern parts of the bight. This environmental heterogeneity was also apparent from the CNP content and stoichiometry of the various species and species groups in the bight. Requirements to take the hydrodynamic, biogeochemical and first ecosystem modelling efforts towards a meaningful predictive capability are discussed. The importance of adopting a system-level view of the bight and its connected systems for realistic exploration of global change scenarios is highlighted.
135	Morocco	Schilling, J., Freier, K. P., Hertig, E., & Scheffran, J. (2016). Climate change, vulnerability and adaptation in North Africa with focus on Morocco. <i>Agriculture, Ecosystems &amp; Environment</i> , 156, 12-26.	The study links environmental impacts of climate change to major socio-economic and agricultural developments in North Africa. We jointly investigate climate projections, vulnerability, impacts, and options for adaptation. The combination of decreasing supply and strong population growth aggravates the stressed water situation in the region. It further compares the vulnerabilities, adaptive capacities and conflict implications of climate change in Algeria, Egypt, Libya, Morocco, and Tunisia. To increase resilience against climate change, agricultural policies should shift from maximizing agricultural output to stabilizing it. A bio-economic model results further suggest a considerable potential of replacing firewood by electric energy to sustain pastoral productivity.
136	Africa	Schleussner, C.F., Lissner, T.K., Fischer, E.M., Wohland, J., Perrette, M., Golly, A., Rogelj, J., Childers, K. (2016). Differential climate impacts for policy-relevant limits to global warming: the case of 1.5°C and 2°C. <i>Earth System Dynamics</i> , 7: 327-351.	Robust appraisals of climate impacts at different levels of global-mean temperature increase are vital to guide assessments of dangerous anthropogenic interference with the climate system. The 2015 Paris Agreement includes a two-headed temperature goal: “holding the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C”. Despite the prominence of these two temperature limits, a comprehensive overview of the differences in climate impacts at these levels is still missing. Here we provide an assessment of key impacts of climate change at warming levels of 1.5°C and 2°C, including extreme weather events, water availability, agricultural

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			<p>yields, sea-level rise and risk of coral reef loss. Our results reveal substantial differences in impacts between a 1.5°C and 2°C warming that are highly relevant for the assessment of dangerous anthropogenic interference with the climate system. For heat-related extremes, the additional 0.5°C increase in global-mean temperature marks the difference between events at the upper limit of present-day natural variability and a new climate regime, particularly in tropical regions. Similarly, this warming difference is likely to be decisive for the future of tropical coral reefs. In a scenario with an end-of-century warming of 2°C, virtually all tropical coral reefs are projected to be at risk of severe degradation due to temperature-induced bleaching from 2050 onwards. This fraction is reduced to about 90% in 2050 and projected to decline to 70% by 2100 for a 1.5°C scenario. Analyses of precipitation-related impacts reveal distinct regional differences and hot-spots of change emerge. Regional reduction in median water availability for the Mediterranean is found to nearly double from 9% to 17% between 1.5°C and 2°C, and the projected lengthening of regional dry spells increases from 7 to 11 %. Projections for agricultural yields differ between crop types as well as world regions. While some (in particular high-latitude) regions may benefit, tropical regions like West Africa, South-East Asia, as well as Central and northern South America are projected to face substantial local yield reductions, particularly for wheat and maize. Best estimate sea-level rise projections based on two illustrative scenarios indicate a 50 cm rise by 2100 relative to year 2000-levels for a 2°C scenario, and about 10 cm lower levels for a 1.5°C scenario. In a 1.5°C scenario, the rate of sea-level rise in 2100 would be reduced by about 30% compared to a 2°C scenario. Our findings highlight the importance of regional differentiation to assess both future climate risks and different vulnerabilities to incremental increases in global mean temperature. The article provides a consistent and comprehensive assessment of</p>

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			existing projections and a good basis for future work on refining our understanding of the difference between impacts at 1.5°C and 2°C warming.
137	Ethiopia	Schmidt, M., & Pearson, O. (2016). Pastoral livelihoods under pressure: Ecological, political and socioeconomic transitions in Afar (Ethiopia). <i>Journal of Arid Environments</i> , 124, 22-30.	The Afar pastoralists that reside in arid and semi-arid regions of Ethiopia have fallen under increasing pressure as rangelands and natural resources are affected by recurrent droughts, overgrazing, erosion processes, alien plant invasion and governmental land policies. This paper investigates the impact of these environmental, institutional and cultural changes on natural resource management strategies, using empirical research undertaken in four villages of western Afar (Ethiopia) to assess the related challenges to local livelihoods. Qualitative interviews with various stakeholders reveal that the authority and use of traditional common property regimes have been considerably diminished and traditional livelihood practices threatened. Many pastoralists have adopted agriculture in a move away from pure pastoralism to agro-pastoralism, a transition exaggerated by changing property rights and the Federal Government's sedentarisation program, which is presented as a means of reducing poverty. On-going land privatisation and an increased government presence in the region weaken indigenous institutions and cultural practices, with no clear local understanding of the impact on future generations and Afar identity.
138		Schmiedel, U., M. Kruspe, L. Kayser and N. Oettlé (2016) 'The ecological and financial impact of soil erosion and its control – a case study from the semiarid Northern Cape Province, South Africa.' <i>Land Degradation and Development</i> , 28(1).	The authors analysed the extent of ecological damage of gully and inter-gully erosion in a sub-catchment situated in the drylands of the winter rainfall area of South Africa where small-stock farming on rangeland is the main source of income. They applied low-cost measures to revegetate the bare sites of the inter-gully erosion and stabilised gully erosion by loosening soil surfaces and applying geotextile and constructing check dams to reverse gully erosion. They compared vegetation cover, silt accumulation and penetration resistance of the soil upslope of the check dams with the situation

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			downslope of the check dams and untreated gullies as controls. For the treated bare patches, they compared penetration resistance and vegetation cover with untreated controls. Two years after implementation, the restoration measures resulted in increased soil depth and vegetation cover upslope of the check dams and increased vegetation cover on the treated bare patches. They calculated the net present value of the restoration measures based on the financial benefit that a landowner can realistically expect under current economic and governance conditions.
139	Angola	Schneibel, A., Stellme, M., Röder, A., Finckh, M., Reverman, R., Frantz, D., Hill, J. (2016). Evaluating the trade-off between food and timber resulting from the conversion of Miombo forests to agricultural land in Angola using multi-temporal Landsat data. <i>Science of The Total Environment</i> , Volumes 548–549, Pages 390-401	<p>The repopulation of abandoned areas in Angola after 27 years of civil war led to a fast and extensive expansion of agricultural fields to meet the rising food demand. Yet, the increase in crop production at the expense of natural resources carries an inherent potential for conflicts since the demand for timber and wood extraction are also supposed to rise.</p> <p>We use the concept of ecosystem services to evaluate the trade-off between food and woody biomass. Our study area is in central Angola, in the highlands of the upper Okavango catchment. We used Landsat data (spatial resolution: 30 × 30 m) with a bi-temporal and multi-seasonal change detection approach for five-time steps between 1989 and 2013 to estimate the conversion area from woodland to agriculture. Overall accuracy is 95%, user's accuracy varies from 89–95% and producer's accuracy ranges between 92–99%. To quantify the trade-off between woody biomass and the amount of food, this information was combined with indicator values and we furthermore assessed biomass regrowth on fallows.</p> <p>Our results reveal a constant rise in agricultural expansion from 1989–2013 with the mean annual deforestation rate increasing from roughly 5300 ha up to about 12,000 ha. Overall, 5.6% of the forested areas were converted to agriculture, whereas the FAO states a national deforestation rate for Angola of 5% from 1990–2010 (FAO, 2010). In</p>

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			the last time step 961,000 t per year of woodland were cleared to potentially produce 1240 t per year of maize. Current global agro-economical projections forecast increasing pressure on tropical dry forests from large-scale agriculture schemes (Gasparri et al., 2015; Searchinger and Heimlich, 2015). Our study underlines the importance of considering subsistence-related change processes, which may contribute significantly to negative effects associated with deforestation and degradation of these forest ecosystems.
140	West Africa	Schroth, G., Läderach, P., Martinez-Valle, A. I., Bunn, C., & Jassogne, L. (2016). Vulnerability to climate change of cocoa in West Africa: Patterns, opportunities and limits to adaptation. <i>Science of the Total Environment</i> , 556, 231-241.	The study analyze cocoa's vulnerability to climate change in the West African cocoa belt, based on climate projections for the 2050s of 19 Global Circulation Models under the Intergovernmental Panel on Climate Change intermediate emissions scenario RCP 6.0..A key conclusion of the research is thus that adaptation measures for cocoa in the West Africa cocoa belt are needed at several levels: at the crop level by selecting cocoa varieties and companion trees and crops that are tolerant to high maximum temperatures in addition to drought and diseases; at the farm level by increasing shade to protect the sensitive cocoa trees against increasing dry season temperatures and to diversify farmers' incomes as a buffer against market and environmental risks; and at the national and regional policy level by implementing agricultural and forest policies that encourage the intensification of existing cocoa farms where climatic conditions permit and the siting of new cocoa plantings on previously deforested land, and that create incentives for farmers to retain and plant native trees in their farms.
141	Africa	Seddon, N., Hou-Jones, X., Pye, T., Reid, H., Roe, D., Mountain, M., and Rizvi, A. R. (2016) <i>Ecosystem based adaptation: a win-win formula for sustainability in a warming world?</i> Briefing paper. IIED, London.	Many national and international environmental agreements acknowledge that the impoverishment of ecosystems is limiting the world's capacity to adapt to climate change and that ecosystem-based adaptation (EbA) approaches should be harnessed as a priority. EbA has the potential to increase adaptive capacity and social and ecological resilience to climate change in both developed and

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			developing countries. Whilst only 23 of the 162 Intended Nationally Determined Contributions (covering 189 countries) submitted to the United Nations refer explicitly to EbA, 109 indicate ecosystem-orientated visions for adaptation. These, however, rarely translate into robust targets or involve local communities. This briefing highlights actions that need to be taken to increase the uptake of EbA in national action plans and ensure its proper implementation.
142	Morocco	Seif-Ennasr, M., Zaaboul, R., Hirich, A., Caroletti, G. N., Bouchaou, L., El Morjani, Z. E. A. & Choukr-Allah, R. (2016). Climate change and adaptive water management measures in Chtouka Aït Baha region (Morocco). <i>Science of the Total Environment</i> , 573, 862-875.	This study evaluates the effect on the availability of water resources for agriculture of expected future changes in precipitation and temperature distributions in north-western Africa. It also puts forward some locally derived adaptation strategies to climate change that can have a positive impact on water resources in the Chtouka Aït Baha region. The study presents an assessment of 38 climate change adaptation measures according to several criteria. The evaluation shows that measures affecting the management of water resources have the highest benefit-to-efforts ratio, which indicates that decision makers and stakeholders should increasingly focus their efforts on management measures.
143	South Africa	Shackleton, R. T., Le, D. C., Wilgen, B. W. V., & Richardson, D. M. (2016). Identifying barriers to effective management of widespread invasive alien trees: Prosopis species (mesquite) in South Africa as a case study. <i>Global Environmental Change</i> , 38, 183–194. <a href="https://doi.org/10.1016/j.gloenvcha.2016.03.012">https://doi.org/10.1016/j.gloenvcha.2016.03.012</a>	This paper looks at identifying barriers to effective management of widespread invasive alien trees prosopis species in south Africa as a case study. This is because biological invasions are a major challenge of ecological and social change globally. Therefore, the purpose of this study was to assess the barriers that hinder the effective management of the widespread tree invasion. They used a questionnaire surveys and focus groups discussions to identify these barriers and the some of the adaptation responses in four key stakeholder groups involved in the management. Some of the key barriers include limited knowledge, insufficient funds, conflict of interests, the ecology and nature if invaded land, poor planning, coordination and cooperation and lack of prioritization. Several suggestions were proposed to overcome those barriers including,



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			awareness creation and capacity building, government support in terms of funds and encouragement of private landowners to control invasion.
144	South Africa	Shisany, S., Mafongoya, P. (2016). <i>Adaptation to climate change and the impacts on household food security among rural farmers in uMzinyathi District of Kwazulu-Natal</i> , South Africa.	It is anticipated that smallholder subsistence farmers will face severe negative impacts from climate change, with household food security being seriously affected. This paper examines the methods of adaptation to climate change used by smallholder farmers and their impacts on household food security. The necessity to adapt to climate change is caused by a combination of sensitivity and exposure and the success in doing so depends on adaptive capacity. Household food security was determined using the Household Food Insecurity Access Scale (HFIAS). Of the surveyed households, 95 % were aware that climate is changing and expected severe impacts on their crop production systems. Households undertake crop and soil management practices in order to respond to the changing climate. About 83 % of households anticipated that they would alter their livelihoods systems in response to climate change, with 59 % of households indicating that government grants would play an important role in this. Of those assessed, 97 % were severely food insecure and the remaining 3 % were moderately food insecure. Householders were worried about the negative impacts of climate change which included droughts, floods and soil erosion. Householders who were vulnerable to climate change recorded high levels of food insecurity. Decline in prices of farm products, increases in costs of farm inputs and anxiety over occurrence of livestock diseases exacerbated household food insecurity. Information will play a critical role in mitigating the impacts of climate change on household food security, but farmers should also be assisted with appropriate input packages, such as seeds and fertilizers that can help them adapt effectively.
145	Burkina Faso	Sinare, H., Gordon, L. J., & Enfors Kautsky, E. (2016). Assessment of ecosystem services and	The article discussed an assessment of ecosystem services and the benefits associated with village landscape drawing the evidence from

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		benefits in village landscapes – A case study from Burkina Faso. <i>Ecosystem Services</i> , 21, 141–152. <a href="https://doi.org/10.1016/j.ecoser.2016.08.004">https://doi.org/10.1016/j.ecoser.2016.08.004</a>	Burkina Faso. They use primary data to capture the vast range of ecosystem services that people obtained from different landscapes for their livelihoods which often lacks in most research that rely on secondary data as criticized in this article. They presented a new model for classifying village landscape into socioecological patches using participatory approaches and satellite images analysis. The results from the assessment indicate a significant contribution of diverse landscapes to the livelihoods from provisioning ecosystem services that serve as sources of income, food, and medicine and fuel energy especially during crop failure.
146	South Africa	Sitas, N., Reyers, B., Cundill, G., Prozesky, H.E., Nel, J.L., Esler, J.K. (2016). Fostering collaboration for knowledge and action in disaster management in South Africa. <i>Current Opinion in Environmental Sustainability</i> , Volume 19, Pages 94-102	Engaging diverse stakeholders in collaborative processes to integrate environmental information into decision making is important but challenging. It requires working at and across the boundaries between knowledge types — a complex milieu of different value systems, norms, and mental models — and multiple stakeholder-engagement processes which facilitate knowledge exchange and co-production. Using a qualitative, inductive approach, we analysed perceptions and outputs of a transdisciplinary project which aimed to generate new knowledge, awareness and action for ecosystem-based disaster management in South Africa. Several obstacles that could potentially undermine the project's objectives were identified, including: preconceived assumptions; entrenched disciplinary thinking; and confusing terminology. Enabling factors included efforts to ensure project co-creation and the use of knowledge brokers in promoting systems thinking that is grounded in practice.
147	South Africa	Sithole, N. J., Magwaza, L. S., & Mafongoya, P. L. (2016). Conservation agriculture and its impact on soil quality and maize yield: A South African perspective. <i>Soil and Tillage Research</i> , 162, 55–67. <a href="https://doi.org/10.1016/j.still.2016.04.014">https://doi.org/10.1016/j.still.2016.04.014</a>	This paper investigated conservation agriculture and its impacts on soil quality and maize yield from the context of south African perspective. The focus of the article is on conservation agriculture which include minimum soil disturbance or reduce tillage, permanent soil cover by organic residues and diversified crop rotation. These are basically ecosystem-based approaches with the potential of

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			minimizing evaporation and ensuring conservation of soil nutrients and water for improve crop yield and sustainable livelihoods. This practice has also the potential of restoring some of the negative impacts of conventional tillage, fertilizers applications, done to the environment.
148	Africa	Smith, A., Schoeman, M. C., Keith, M., Erasmus, B. F. N., Monadjem, A., Moilanen, A., & Di Minin, E. (2016). Synergistic effects of climate and land-use change on representation of African bats in priority conservation areas. <i>Ecological Indicators</i> , 69, 276–283. <a href="https://doi.org/10.1016/j.ecolind.2016.04.039">https://doi.org/10.1016/j.ecolind.2016.04.039</a>	The objective of this paper was to use a spatial conservation prioritization framework in order to determine future shifts in the priority areas for the conservation of bat species across Africa under projected climate and land use change scenarios. This was against the background that individual and combined effects of climate change and land use change on the future conservation of bat species is lacking. The findings of the study indicated that bats species representation within already existing protected areas in Africa are low. These are likely to be further impacted under future climate change and habitat fragmentation.
149	South Africa	Sunday, Y.H., Cishe, E.N., & Luswazi, P. (2016) Vulnerability to Climate Change in the Eastern Cape Province of South Africa: What Does the Future Holds for Smallholder Crop Farmers? <i>Agrekon</i> , Volume 55, 2016 - Issue 1-2.	Assessment of the level of smallholders' vulnerability to climate variability and the adaptive capacity will provide information required for adequate policy formulation for the adaptation and improvement of food security among poor farming households. This article utilised data from a survey of 223 small farming households in the Eastern Cape province, one of the poorest agrarian provinces in South Africa, to explore the exposure of smallholder farmers to climate change, their adaptive capacity and their vulnerability to climate shock across major agro-ecological zones. Both institutional and infrastructural support in the form of access to credit and irrigation facilities are recommended for adequate adaptation to future climate change impact, climate volatility, which was not taken into account in our yield projections.
150	South Africa	Sutherland, C., Sim, V., Buthelezi, S., & Khumalo, D. (2016). Social constructions of environmental services in a rapidly densifying	the rapid densification that is taking place in the 'rural periphery' of the city is impacting significantly on the integrity of ecosystems, which provide valuable ecosystem services. It is also changing the

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		peri-urban area under dual governance in Durban, South Africa. <i>Bothalia-African Biodiversity &amp; Conservation</i> , 46(2), 1-18.	relations between people and the environment. Mzinyathi and eSkebhini, in the north-west of Durban, are peri-urban areas located on Ingonyama Trust land and hence they are governed by both the traditional authority and the eThekweni Municipality. The settlement pattern is changing rapidly here as middle- and upper-income residents move into the area, changing the way of life from being rural and 'traditional' to urban and 'modern'. This paper focused on the nexus of rapid urban growth, dual governance systems, biodiversity loss and cultural change in these two areas. It adopted a qualitative methodology and social constructivist approach. Data on the value of environmental services in the area was collected through interviewing the traditional authority, provincial and municipal planners and environmentalists, and household members.
151	West Africa	Sylla, M. B., Nikiema, P. M., Gibba, P., Kebe, I., Klutse, N.A.B. (2016). <i>Climate Change over West Africa: Recent Trends and Future Projections</i> . doi 10.1007/978-3-319-31499-0_3.	The West African climate has evolved in recent decades to respond to elevated anthropogenic greenhouse gas (GHG) forcing. An assessment of its recent trends and future changes is presented here based on various data sources (observations and models), along with an extensive review of recent literature including the latest Intergovernmental Panel on Climate Change report. A gradual warming spatially variable reaching 0.5 °C per decade in recent years is observed. In addition, the Sahel has recovered from the previous drought episodes (i.e., 1970s and 1980s); however, the precipitation amount is not at the level of the pre-drought period. Although these features are common across the different data sources, their magnitudes differ from one source to the other due to a lack of reliable observation systems. Projected climate change indicates continuous and stronger warming (1.5–6.5 °C) and a wider range of precipitation uncertainty (roughly between –30 and 30 %) larger in the Sahel and increasing in the farther future. However, the spatial distribution unveils significant precipitation decrease confined to the westernmost Sahel and becoming greater and more extensive in the high level GHG

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			forcing scenario by the end of the 21st century. This coexists with a substantial increase in both dry spell length and extreme precipitation intensity. West Sahel is thus the most sensitive region to anthropogenic climate change. The rest of West Africa also experiences more intense extremes in future climate but to a lesser extent. It is also reported from other previous studies that the projected rainy season and the growing season will become shorter while the torrid, arid and semi-arid climate conditions will substantially extend. It is thus evident that in a “business as usual” World, most countries in West Africa will have to cope with shorter rainy seasons, generalized torrid, arid and semi-arid conditions, longer dry spells and more intense extreme precipitations. Such conditions can produce significant stresses on agricultural activities, water resources management, ecosystem services and urban areas planning. However, some GHG mitigation (i.e., a mid-level forcing) could help to reduce the stress.
152	West Africa	Sylla, M.B., Elguindi, N., Giorgi, F., Wisser, D. (2016) Projected robust shift of climate zones over West Africa in response to anthropogenic climate change for the late 21st century. <i>Climatic Change</i> 134(1-2)	The response of West African climate zones to anthropogenic climate change during the late 21st century is investigated using the revised Thornthwaite climate classification applied to ensembles of CMIP5, CORDEX, and higher-resolution RegCM4 experiments (HIRES). The ensembles reproduce well the observed climate zones, although with some notable discrepancies. CORDEX and HIRES provide realistic fine-scale information which enhances that from the coarser-scale CMIP5, especially in the Gulf of Guinea encompassing marked landcover and topography gradients. The late 21st century projections reveal an extension of torrid climates throughout West Africa. In addition, the Sahel, predominantly semi-arid in present-day conditions, is projected to face moderately persistent future arid climate. Similarly, the Gulf of Guinea shows a tendency in the future to experience highly seasonal semi-arid conditions. Finally, wet and moist regions with an extreme seasonality around orographic zones

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			become less extensive under future climate change. Consequently, West Africa evolves towards increasingly torrid, arid and semi-arid regimes with the recession of moist and wet zones mostly because of the temperature forcing, although precipitation can be locally an important factor. These features are common to all multimodel ensembles, a sign of robustness, with few disagreements in their areal extents, and with more pronounced changes in the higher-resolution RCM projections. Such changes point towards an increased risk of water stress for managed and unmanaged ecosystems, and thus add an element of vulnerability to future anthropogenic climate change for West African water management, ecosystem services and agricultural activities.
153	Ghana	Tambo, J. A. (2016). Adaptation and resilience to climate change and variability in north-east Ghana. <i>International journal of disaster risk reduction</i> , 17, 85-94.	This paper assesses the capacity of farm households to deal with climate-related risks. Results from an indicator-based climate resilience assessment indicate that female-headed households and households located in Bongo district are less resilient to climate change and variability. To enhance resilience to climate change and variability, households have mostly adopted a combination of autonomous adaptation measures, such as altering the timing of planting, use of drought tolerant and early maturing crop varieties, and switching to crops that are less sensitive to climate stress. Employing Poisson and multivariate probit regression models, it was found that increasing farmers' knowledge of climate change as well as building the capacity of extension agents to deliver information on climate change and appropriate adaptation measures are key to successful adaptation in the study region
154	Ethiopia	Tesfaye, A., Wolanios, N., & Brouwer, R. (2016). Estimation of the economic value of the ecosystem services provided by the Blue Nile Basin in Ethiopia. <i>Ecosystem Services</i> , 17, 268–277. <a href="https://doi.org/10.1016/j.ecoser.2015.10.008">https://doi.org/10.1016/j.ecoser.2015.10.008</a>	This paper examines the estimation of the economic value of ecosystem service provided by the Blue Nile Basin in Ethiopia. The values of the Blue Nile water resources in based on the major activities taking place in the basin including irrigated agriculture, hydropower generation, commercial navigation and fisheries. By exploring a

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			valuation approach. The outcome of this investigation shows that the estimated annual contribution of the provisioning and regulating services of the freshwater ecosystem to national economy was 52 million USD IN 2011. The findings clearing indicate the economy value of the basin and therefore the need for an integrated water resources management policy and improved institutional economic set up to maximize these services for sustainable development.
155	southern Africa	Thierfelder, C., Matemba-Mutasa, R., Bunderson, W. T., Mutenje, M., Nyagumbo, I., & Mupangwa, W. (2016). Evaluating manual conservation agriculture systems in southern Africa. <i>Agriculture, Ecosystems and Environment</i> , 222, 112–124. <a href="https://doi.org/10.1016/j.agee.2016.02.009">https://doi.org/10.1016/j.agee.2016.02.009</a>	The research was carried out to evaluate manual conservation agriculture systems in southern Africa. The authors claimed that manual systems of conservation agriculture based on seedling into planting basins or direct techniques have received attention over the past decade. However, the pros and cons of the different manual seedling systems under different agro-ecological zones has been lacking. Therefore, the overall aim of this paper was to analyze the different seedling systems in areas extending from central Mozambique to central Malawi. The findings indicated that the conservation agriculture performed differently in different ecological environments with direct seeded treatments having greater maize yield and conventional tillage practices by an average of 12-27% and outperformed the conventional practice in nine out of fourteen yield comparisons. However, adoption to different ecological environments must be made based on context specific requirements in order to avoid underperformance.
156	Gambia	United Nations Environment Programme. (2016). <i>Large-scale Ecosystem-based Adaptation in the Gambia River Basin: developing a climate resilient, natural resource-based economy</i> . United Nations Environment Program (UNEP). Gambia.	According to the paper, Poverty and environmental degradation are resulting in intensely negative socio-economic effects in The Gambia. Climate variability and change are exacerbating these effects. Droughts and floods are, for example, increasingly severe, resulting in reduced agricultural production and unsustainable extraction of resources from forest ecosystems by rural households. The objective of the project is consequently to build the climate-resilience of rural Gambian communities and facilitate the development of a sustainable



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			natural resource-based (green) economy by implementing large-scale EbA within and adjacent to agricultural areas, community-managed forest reserves and wildlife conservation areas. This will entail: restoring degraded forests and agricultural landscapes with climate-resilient plant species that provide goods for consumption or sale; and facilitating the establishment of commercially viable natural resource-based businesses to be managed by community-based organizations.
157	Worldwide	United Nations Framework Convention on Climate Change [UNFCCC]. (2016). Human settlements and adaptation planning processes: overview, good practices and lessons learned.	This synopsis provides a brief overview of the impacts of climate change on water resources and highlights the good practices and lessons learned in adaptation planning processes addressing water resources at all levels.
158		United Nations Framework Convention on Climate Change [UNFCCC]. (2016). <i>Opportunities and options for enhancing adaptation actions and supporting their implementation: reducing vulnerability and mainstreaming adaptation</i> . Chapter III, pp. 19-29.	The objective of this technical paper is to provide an initial exploration of opportunities and options for reducing vulnerability to climate change impacts and mainstreaming adaptation. It also draws on the associated discussions, relevant submissions from Parties and other relevant sources of information.
159	South Africa	Upadhyaya, P. (2016). Aligning Climate Policy with National Interest: Disengagements with Nationally Appropriate Mitigation Actions in South Africa. <i>Journal of Environmental Policy &amp; Planning</i> , Volume 18, 2016 - Issue 4	Nationally Appropriate Mitigation Actions (NAMAs) were proposed as a policy framework that could provide middle ground for meeting both the development and mitigation objectives in developing countries. While South Africa engaged actively with the NAMA terminology in the United Nations Framework Convention on Climate Change negotiations, its engagement at the domestic level has been rather lacklustre. This presents an interesting paradox. The paper studies the interplay of international norms embodied in NAMAs with South Africa's domestic policy process.
160	Africa	Van-Ginneken, V., & De-Vries, E. (2016). Towards a Seaweed Based Economy": The Global Ten Billion People Issue at the Midst of the 21st Century. <i>Journal of Fisheries Sciences</i> , 10(2), 1.	This article has demonstrated that all ingredients for a global booming seaweed industry are available in some African countries. For instance, there is more than abundant solar energy; fertilizer in our eutrophic oceans; suitable seaweed strains for culture were selected by front runner China with a booming seaweed industry developed

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			<p>after the midst of the 20th century yielding presently amounts <math>\approx 10.25</math> billion kg of seaweed or green biomass/dry matter/annum. In the commentary, the discussion of the reasons for the failure of terrestrial agricultural and the argument for moving towards seaweed cultivation (and finally to a new seaweed-based economy) is quite informative, regarding this interdisciplinary commentary which is a blending of a many multidisciplinary reviews, of state-of-the-art technologies and policy discussions. This is a compelling and urgent work that traces the related histories of population growth during the 20th century, the so called “Green Revolution, which was based on massive and collective input of fossil energy into processes related to terrestrial food production; so, these prices are closely correlated. The central theme of this commentary is that our global primary production (green biomass) must grow with 70% to provide an unfettered growing world population - estimated around 10 billion people at the midst of the 21st century - with their primary needs. Major solution of this commentary - reviewing on a global scale following the nexus: sustainable food production=&gt; environment friendly=&gt;health promoting, which is a smart innovative Blue Green Technologies approach (<a href="http://www.bluegreentechnologies.nl">www.bluegreentechnologies.nl</a>). This can be accomplished by exploiting our oceans - which cover around three-quarters of our globe-by culture of seaweeds the “unforeseen crop of the future” as primary producers because abundant solar energy is available at our planet. This scenario will permit humanity the 21st century a smooth transition to a green energy future avoiding global warming and ocean acidification. According to the authors, in addition, a seaweed economy with a plethora of applications (medicine, biotechnology, energy, food etc.) can have a spin off to local economics at the remote areas of our planet where the poorest of the poorest presently live, in this way meeting the 8 Millennium Goals.</p>

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161	South Africa	Van-Wilgen, B. W., & Wannenburgh, A. (2016). Co-facilitating invasive species control, water conservation and poverty relief: Achievements and challenges in South Africa's Working for Water programme. <i>Current Opinion in Environmental Sustainability</i> , 19, 7–17. <a href="https://doi.org/10.1016/j.cosust.2015.08.012">https://doi.org/10.1016/j.cosust.2015.08.012</a>	The focus of this paper is a review of achievements and challenges in south Africa African working for water program in co-facilitating invasive species control, water conservation and poverty relief. They traced the history of this program and review some of the factors that underpinned its success. Some if the principal activities identified in the program that are considered ecosystem based in nature include the following; control of invasive plants in terrestrial habitats, biosecurity, control of aquatic weeds, rehabilitation of abandoned forestry plantations, awareness creation on water ecosystem services and threats among others. These sought to ensure eradication and control of invasive plants, prevention of erosion, restoring od ecosystem services, biodiversity and ecological integrity.
162	Tunisia	Vendeville, P., Fadhel, H., Magraoui, A., & Sacchi, J. (2016). Restoring the ecosystem creates wealth. The case of the Northern coast of Tunisia's deep-water rose shrimp trawl fishery. <i>Fisheries Research</i> , 183, 55–73. <a href="https://doi.org/10.1016/j.fishres.2016.04.019">https://doi.org/10.1016/j.fishres.2016.04.019</a>	This focus of this article centers on the benefits of restoring the ecosystem to creation of wealth using the case of Northern coast of Tunisia's deep water rose shrimp trawl fishery. They employed a bio-economic model to test management measures through scenarios that ran over eleven years to estimate the viability of the fishery in terms of biological and economic outputs. The study show that the most beneficial scenario was the combination of several management measures including temporal closures of two months, replacement of 40mm diamond mesh coded with 40mm square mesh, removal of both biological recovery tax and fuel subsidizes and 83% reduction in fishing capacity. The results indicated that there was an increase in annual profit by 6.9M USD than that of 2008 with economic rent being 9.9 M USD than by the end of the projected period. This means that there is huge potential in improving ecosystem using ecosystem based approached for improve individual and collective wealth by integrating various regulatory measures
163	South Africa	Vogel, C. D., Culwick, S.C.E., & Sutherland, C. (2016). Environmental problem-solving in South Africa: harnessing creative imaginaries to address	The world is confronting a range of 'wicked problems' that defy simple, linear solutions. Increasingly, the range of challenges including poverty, climate change and environmental degradation

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		‘wicked’ challenges and opportunities. <i>South African Geographical Journal</i> , Volume 98, 2016 - Issue 3	require solutions that cannot be drawn from a single knowledge base. Although excellent environmental legislation exists in South Africa (including that relating to climate change), it alone is not sufficient to solve the challenges the country faces. Rather, science that builds knowledge through engagement with a variety of actors, their views, expertise and perspectives, including mutual and transgressive learning, is required. This paper presents three South African case studies that reflect on the value of adopting transdisciplinary (TD) and co-production of knowledge (CPK) approaches to environmental problem-solving. Although not without their challenges, TD and CPK are inclusive approaches which usually enable a wider framing of environmental challenges and their ownership by various publics and pave the way for effective implementation of solutions and actions.
164	Africa	Waha, K., Zipf, B., Kurukulasuriya, P., & Hassan, R. M. (2016). An agricultural survey for more than 9,500 African households. <i>Scientific data</i> , 3, 160020.	Surveys more than 9,500 households were conducted in the growing seasons 2002/2003 or 2003/2004 in eleven African countries: Burkina Faso, Cameroon, Ghana, Niger and Senegal in western Africa; Egypt in northern Africa; Ethiopia and Kenya in eastern Africa; South Africa, Zambia and Zimbabwe in southern Africa. Households were chosen randomly in districts that are representative for key agro-climatic zones and farming systems. The data set specifies farming systems characteristics that can help inform about the importance of each system for a country’s agricultural production and its ability to cope with short- and long-term climate changes or extreme weather events. Further it informs about the location of smallholders and vulnerable systems and permits benchmarking agricultural systems characteristics.
165	Africa	Ward, R. D., Friess, A. D., Day R. H., Mackenzie, R.A. (2016) Impacts of climate change on mangrove ecosystems: a region by region overview. <i>Ecosystem health and sustainability</i> , 2(4):e01211. doi:10.1002/ehs2.1211	Inter-related and spatially variable climate change factors including sea level rise, increased storminess, altered precipitation regime and increasing temperature are impacting mangroves at regional scales. This review highlights extreme regional variation in climate change threats and impacts, and how these factors impact the structure of

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			mangrove communities, their biodiversity and geomorphological setting. All these factors interplay to determine spatially variable resiliency to climate change impacts, and because mangroves are varied in type and geographical location, these systems are good models for understanding such interactions at different scales. Sea level rise is likely to influence mangroves in all regions although local impacts are likely to be more varied. Changes in the frequency and intensity of storminess are likely to have a greater impact on N and Central America, Asia, Australia, and East Africa than West Africa and S. America. This review also highlights the numerous geographical knowledge gaps of climate change impacts, with some regions particularly understudied (e.g., Africa and the Middle East). While there has been a recent drive to address these knowledge gaps especially in South America and Asia, further research is required to allow researchers to tease apart the processes that influence both vulnerability and resilience to climate change. A more globally representative view of mangroves would allow us to better understand the importance of mangrove type and landscape setting in determining system resiliency to future climate change.
166	North Africa	Wasimi, S. A. (2016). Climate change in the Middle East and North Africa (MENA) region and implications for water resources project planning and management. <i>International Journal of Climate Change Strategies and Management</i> , 2(3), 297-320.	The purpose of the paper is to assess the extent of climate change likely to be manifested in the MENA region using statistical tools as well as outputs from physics-based General Circulation Models (GCMs). Atmospheric temperature and precipitation primarily capture climate change features and are considered the drivers of other manifestations of climate change such as rises in sea-level, tropical cyclone intensities, severe floods, prolonged droughts, and retreating ice. Data on atmospheric temperature and precipitation have been statistically analysed for trend, distribution and variability in this study. Long-range prediction is then made using time series analysis. Long-range projections have also been made by many investigators

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			using physics-based GCMs and the Fourth Assessment Report of IPCC provides a summary
167	Africa	Watkiss, P., Cimato, F. (2016). <i>The economics of adaptation and climate resilient development: lessons from projects for key adaptation challenges</i> . Grantham Research Institute on Climate Change and the Environment Working Paper No. 235. Review of the Economics of Adaptation and Climate-Resilient Development	This working paper aims to inform the development community about the current state-of-knowledge and emerging thinking on the economics of adaptation and the application to development. The paper explores a number of key challenges on the economics of adaptation and investigates examples of how these are being addressed in practical case studies. The case studies are drawn from the portfolio of the International Development Research Centre (IDRC) and the wider literature. The key areas of focus have been to assess: adaptation into development planning. The analysis and appraisal of building (adaptive) capacity and non-technical adaptation. The consideration of distributional effects. The phasing and prioritisation of adaptation and the application of light-touch approaches for decision making under uncertainty.
168	Ethiopia	Yalew, A.W. (2016) Economy-wide Effects of Climate Change in Ethiopia. <i>EcoMod</i> , 9750	Climate change has turned to be a major economic threat in many developing countries. In this paper, we assess the economy-wide effects of climate change induced productivity and labor supply shocks in agriculture in Ethiopia. Overall, we find falling agricultural output but increasing prices for agricultural commodities. The net effect is declining real consumption by households. The larger is the proportion of subsistence consumption expenditure, the higher is the welfare loss due to climate change. This substantiates the argument that climate change severely affects poor households in a given country and low-income countries in general. Therefore, climate change and its likely impacts shall be accounted along with proactive measures in national economic plans of the country.
169	Senegal	Zamudio, A. N., and Terton, A. (2016). <i>Review of current and planned adaptation action in Senegal</i> . CARIAA Working Paper no. 18. International Development Research Centre,	Senegal has experienced droughts on a recurrent basis since the 1960s, which has compromised food security and played a role in the migration of farmers to coastal cities, such as the capital city, Dakar. These changes have been accompanied by other risks, such as floods,

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		Ottawa, Canada and UK Aid, London, United Kingdom.	coastal erosion, and sea level rise. The latter affects many of Senegal's cities, including Dakar, as most of the population lives along the country's coast. The country's important tourism sector has also been adversely affected. This paper provides a snapshot of Senegals action and proposed plan towards adaptation to these climatic changes
170	Nigeria	Zhang, W., Kato, E., Bhandary, P., Nkonya, E., Ibrahim, H. I., Agbonlahor, M. Cox, C. (2016). Awareness and perceptions of ecosystem services in relation to land use types: Evidence from rural communities in Nigeria. <i>Ecosystem Services</i> , 22(November), 150–160. <a href="https://doi.org/10.1016/j.ecoser.2016.10.011">https://doi.org/10.1016/j.ecoser.2016.10.011</a>	In this article, the focus was on the awareness and perceptions of a communities in rural Nigeria about ecosystem service in relation to land use types. This is was so because the authors argue that for ecosystem service to be relevant to policy and decision making, it is important for integrating local residents' awareness and their perception of ecosystem services. A survey of 102 villages across different landscapes of Nigeria was conducted to participate in the study. The findings of the study revealed that, most respondents were collectively aware of a wide range of provisioning services such as crops, biofuels, freshwater, medicine, and wildlife as well as several cultural services. Awareness for Supporting and regulating services were however low. Factoring including ethnicity, education, and age among others were identified to affect the level of awareness and perceptions on ecosystem services. This understanding can be used to design appropriate land use and natural resources policies to ensure conservation of ecosystems for sustainable ecosystem services provision to promote sustainable livelihoods.
171	West Africa	Zougmore, R., Partey, S., Ouédraogo, M., Omitoyin, B., Thomas, T., Ayantunde, A., Ericksen, P, Said M., Jalloh A. (2016). Toward climate-smart agriculture in West Africa: a review of climate change impacts, adaptation strategies and policy developments for the livestock, fishery and crop production sectors. <i>Agriculture &amp; Food Security</i> , 20165:26. <a href="https://doi.org/10.1186/s40066-016-0075-3">https://doi.org/10.1186/s40066-016-0075-3</a>	Many projections of the impact of climate change on the crop, livestock and fishery production sectors of African agriculture are reported in the literature. However, they may be arguably too general to understand the magnitude of impact and to inform adaptation strategies and policy development efforts that are tailored to promoting climate-smart agriculture in the West African region alone. This paper was synthesized from several scholarly literature and aimed at providing up-to-date information on climate change impacts, adaptation strategies, policies and institutional mechanisms that each



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			<p>agriculture subsector had put in place in dealing with climate change and its related issues in West Africa. For each subsector (crop, fishery and livestock), the current status, climate change impacts, mitigation and adaption strategies have been analyzed. In addition, we reviewed recent policy initiatives in the region that foster the development and adoption of climate-smart agricultural options to improve resilience of farming systems and livelihoods of smallholder farmers to climate change risks. From community to national and regional levels, various strategies and policies are also being taken to guide actions and investment for climate-smart agriculture in West Africa.</p>

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1	North Africa region	Abbass, R. A., Kumar, P., & El-Gendy, A. (2017). An overview of monitoring and reduction strategies for health and climate change related emissions in the Middle East and North Africa region, <i>Atmospheric Environment</i> , 175, 33-43	This review assesses the current state of air pollution in the Middle East and North Africa (MENA) region. Emission types and sources in the region are identified and quantified to understand the monitoring, legislative and reduction needs through a systematic review of available literature. It is found that both health (e.g., particulate matter, PM; and heavy metals) and climate change (e.g., carbon dioxide and methane) emissions are increasing with the time. Regarding health emissions, over 99% of the MENA population is exposed to PM levels that exceed the standards set by the World Health Organization (WHO). The dominant source of climate change emissions is the energy sector contributing ~38% of CO2 emissions, followed by the transport sector at ~25%. Numerous studies have been carried out on air pollution in the region, however, there is a lack of comprehensive regional studies that would provide a holistic assessment. Most countries have air quality monitoring systems in place, however, the data is not effectively evaluated to devise pollution reduction strategies.
2	Ghana	Abdul-Razak, M. and Kruse, S. (2017). The adaptive capacity of smallholder farmers to climate change in the Northern Region of Ghana, <i>Climate Risk Management</i> , 17, 104-122	The article indicated that agriculture sector of the Northern Region of Ghana is largely rain-fed and dominated by smallholder farmers with minimal livelihood alternatives. It proposed an indicator-based framework for assessing the adaptive capacity of smallholder farmers in the Region along six main determinants of adaptive capacity: economic resources, social capital, awareness and training, technology, infrastructure and institutions. The authors indicated that economic resources, awareness and training as well as technological capacities were most relevant for smallholder farmers' adaptive capacity. However, women farmer showed lower capacities in fields of economic resources, technology and

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			knowledge and awareness. The article can inform policy development and interventions on climate change adaptation. It recommended resilience building interventions that target individuals with low adaptive capacities, especially women and farmers without formal education.
3	Africa	Adenle, A. A., Ford, J. D., Morton, J., Twomlow, S., Alverson, K., Cattaneo, A., Cervigni, R., Kurukulasuriya, P., Huq, S., Helfgott, A., Ebinger, J. O. (2017). Managing Climate Change Risks in Africa - A Global Perspective, <i>Ecological Economics</i> , 141, 190-201	The article documents and examines the challenges facing adaptation in Africa, drawing upon semi-structured interviews with stakeholders including high-level stakeholders, continent-wide and across scales: in national government and UN agencies, academia, donors, non-governmental organizations, farmers and extension officers. The authors pointed out four key concerns about adaptation which were: i) Climate data, scenarios and impacts models were insufficient for supporting adaptation, particularly as they related to food systems and rural livelihoods; ii) The adaptation response was limited, fragmented, divorced from national planning processes, and with limited engagement with local expertise; iii) Adaptation policies and programs were too narrowly focused on explicit responses to climate change rather than responses to climate variability or broader development issues; and iv) Adaptation finance was insufficient, and procedures for accessing it presented challenges to governments capacities. As a response to these concerns, the authors proposed the 4-Cs framework which places adaptation for Africa at the center of climate projections, climate education, climate governance and climate finance, with corresponding responsibilities for government and non-government actors.
4	Benin	Adegbola, Y P, Ahoyo-Adjovi, N R, Hessavi P, Kouton-Bognon B, Montcho D and Mensah S. E. (2017). Impact of Climate Change	The study analyzed the economic and environmental impacts of the adoption of climate change adaptation strategies on farm management in Benin. It showed that the adaptation strategies allowed producers to adapt to climate change and to improve their

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		Adaptation Strategies on Farm Yields and Income in Benin, <i>FARA Research Results</i> , 1(7), 58.	yield and revenue but did not help them to reduce the emissions of greenhouse gases at farm level. The study revealed that the endogenous strategies used relied on rain makers and sacrifices. The main exogenous strategies used were short-cycle varieties of rice and maize, and mulching using plant residues. Estimation of the Marginal Treatment Effect (MTE) indicated that the utilization of short-cycle maize varieties increased yield by 490.43 kg/ha. Mulching using plant residues increased maize yield by 404.29 kg/ha in the sub-population of potential users. Regarding utilisation of short-cycle rice varieties for adaptation to climate change, the impact was 1432.22 kg/ha in the sub-population of the potential users. The results also revealed that utilisation of short-cycle maize varieties increased the maize net revenue by FCFA 138,480 per hectare while the impact of using short-cycle rice varieties on the net revenue was FCFA 351,940 per hectare in the sub-population of the potential users. The authors recommend that the use of chemical fertilisers be regulated to limit their contributions to emission of greenhouse gases
5	Nigeria	Adewale, T. A., Fregene, B. T. and Adelekan, I. O. (2017) Vulnerability and Adaptation Strategies of Fishers to Climate Change: Effects on Livelihoods in Fishing Communities in Lagos State, Nigeria. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) <i>Climate Change Adaptation in Africa</i> . In <i>Climate Change Management</i> (pp. 747-757). Springer, Cham	The paper examined the factors that predispose fishermen to vulnerability and assesses the various adaptive strategies used by fisheries-based livelihoods to cope with the impact of climate variability and change in Lagos State, Nigeria. It showed that fishermen encountered several forms of vulnerability due to climate change, such as seasonality in fishing, loss of fishing inputs and family members to natural disasters/accidents. Others include hostility by members of host communities to migrants, injury and breakdown of health as well as susceptibility to STDs and HIV/AIDS. Some of the preferred adaptive strategies were timely access to information on climate change, alternative businesses, and saving for the future.

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6	Ghana	Adiku, S. G. K., Debrah-Afanyede, E., Greatrex, H., Zougmore, R., MacCarthy, D. S. (2017) Weather-Index Based Crop Insurance as a Social Adaptation to Climate Change and Variability in the Upper West Region of Ghana: Developing a participatory approach. CCAFS Working Paper no. 189. Copenhagen, Denmark: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS).	The article points to climate change and variability as major challenges to rain-fed crop production in Africa. It presents a report on a pilot project to test a concept for operationalizing weather-index crop insurance as a social adaptation to the climate change and variability problem in the Upper West Region of Ghana. The weather-index based crop insurance concept sought to link various agricultural stakeholders such as weather technical persons, farmers, agricultural extension officer, input dealers and other aggregators, and financial institutions as well as the insurance industry and focused on a participatory farmer led approach. The authors attested that climate change and variability challenges cannot be addressed with only indigenous knowledge of farmers. The article highlighted the complexity and the institutional structures required to implement an effective insurance; and the high spatial variability of rainfall in the Upper West region of Ghana, showing the necessity of satellite-derived rainfall products. The article can be useful in establishing sustainable insurance schemes relating to climate change and variability.
7	Ghana	Antwi-Agyei, P., Dougill, A. J., Stringer, L. C., and Codjoe, S. N. A. (2017). Adaptation opportunities and maladaptive outcomes in climate vulnerability hotspots of northern Ghana. <i>Climate Risk Management</i> , 19, 83-93.	How climate change adaptation practices can constrain development and deliver maladaptive outcomes in vulnerability hotspots is yet to be explored in-depth using case study analyses. This paper explores the effects of climate change coping and adaptation responses in three case study villages across the Central Gonja district of northern Ghana. The study addresses the following research questions: i) What are the key climatic and non-climatic stressors confronting households in northern Ghanaian communities? ii) How are households adapting to climatic and non-climatic stressors? and iii) What are the outcomes of these coping and adaptation responses on development? The study employs a mixed-method approach including key informant interviews, focus group discussions and

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			household questionnaire surveys. Data identified socioeconomic stressors including a lack of access to (and high cost of) farm inputs, labour shortages and population growth. Climatic stressors include erratic rainfall, high temperature, droughts and floods. Climatic and non-climatic stressors interact to affect agricultural practices and related livelihoods. The study identified various adaptation measures including extensification and intensification of agriculture, temporary migration, planting of drought resistant varieties, irrigation, and livelihood diversification. We show that many coping measures (e.g. livelihood diversifications activities such as selling of firewood and charcoal production) and adaptation responses (including intensification, extensification and irrigation) currently deliver maladaptive outcomes, resulting in lock-ins that could exacerbate future climate vulnerabilities. The paper contributes to the growing literature on adaptation and climate risk management by providing empirical evidence showing how coping and adaptations measures can deliver maladaptive outcomes in vulnerable communities.
8	Ghana	Antwi-Agyei, P., Quinn, C. H., Adiku, S. G. K., Codjoe, S. N. A., Dougill, A. J., Lamboll, R. and Dovie, D. B. K. (2017) Perceived stressors of climate vulnerability across scales in the Savannah zone of Ghana: A participatory approach, <i>Regional Environmental Change</i> , 17, (1), pp 213–227	The article explored how non-climatic stressors interact with climatic stressors at multiple scales to affect food security and livelihoods. The authors were of the view that focusing only on climatic factors restrict understanding of the combinations of stressors that exacerbate the vulnerability of farming households and hampers the development of holistic climate change adaptation policies. They adopted a multi-scale approach to understand how climatic and non-climatic stressors vary and interact, across three spatial scales (household, community and district levels) to influence livelihood vulnerability of smallholder farming households in the Savannah zone of northern Ghana. The article points to a mismatch between local and district level priorities that

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			have implications for policy and development of agricultural and related livelihoods in rural communities. The article can inform policy makers to take a holistic approach that integrates both climatic and non-climatic factors to ensure policy coherence between national climate adaptation plans and District development plans.
9	Ethiopia	Amare, A. and Simane, B. (2017) Convenient Solution for Convenient Truth: Adoption of Soil and Water Conservation Measures for Climate Change and Variability in Kuyu District, Ethiopia. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) Climate Change Adaptation in Africa, <i>Climate Change Management</i> , Springer, Cham	The paper explored major soil and water conservation measures smallholder farmers used as adaptation strategies in response to climate change. It showed that the common climate adaptation strategies to mitigate the effect of flooding among the farmers were stone bund, soil bund, check dam and hillside terracing. The paper revealed that farm size, family size, education, perception of soil erosion problem, slope of the plot, and training on soil and water conservation positively and significantly influenced farmers' decision to invest in stone bund to combat soil erosion caused by climate change and variability. It however indicated that age of the household head, number of livestock, and distance of the plot had negative and significant effect on adoption of introduced stone bunds. The authors suggested the need for increased knowledge on soil and water conservation measures, strengthening agricultural extension services to make farmers more informed and knowledgeable about climate change impact, and conservation efforts to target steep slopes where farmers think soil erosion problem is high. The paper can be beneficial to farmers experiencing soil erosion resulting from erratic and erosive rainfall, and in steep terrains. It can also inform policy makers to help combat soil erosion caused by climate change and variability.
10	Ethiopia	Amenu, B. T., Amamo, B. A., & Borko, T. T. (2017). Review on Climate Change Adaptation and	The aim of this study was to examine the social, economic and environmental impacts of climate change based on their degree of existence and trends the impacts, to identify the adaptation strategies



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		Mitigation Mechanisms in Ethiopia, <i>International Journal of Scientific Research in Civil Engineering</i> , 2, 2, ISSN: 2456-6667	and mitigation measures and to find out the challenges to the adoption of those coping mechanisms. The paper further discusses the causes of vulnerability to climate conditions in Ethiopia, climate change adaptation in the context of agricultural sectors, development and rural livelihoods and climate change mitigation through forestry. In conclusion the authors say, the more mitigation there is, the less will be the impacts of which adaptations will have to be made and the less the risks for which humanity will have to prepare. The authors recommend practicing conservation agriculture, developing more diversified livelihood practices, developing community based integrated watershed management practices, experience sharing of best practices through community participation, civil society engagement, and the participation of academic and research institutions, with regular monitoring to identify promising practices for scaling up.
11	Libya	Ahmad, N. S. M., & Ishwerf, A. I. (2017). Forces and Obstacles for Corporate Environmental Disclosure (CED) in Libya: Perspective of Stakeholders. <i>Review of Integrative Business and Economics Research</i> , 3(1), 65.	The paper aims to investigate why companies make or do not make Corporate Environmental Disclosure (CED) and whether stakeholder theory can explain voluntary CED practices in Libya. Evidence is collected from in-depth interviews with thirty interviewees from six groups of stakeholders of Ahlia Cement Company (ACC) namely: regulators and policy makers; local governments; managers; employees; shareholders and financial institutions. The findings suggest that there is a strong consensus between the six groups surveyed on several Obstacles for CED. However, there is no consensus between these groups of the forces for CED. More perceptions of stakeholders of other Libyan companies is needed.
12	Ethiopia	Ayal, D. Y., Abshare, M. W., Desta, S. and Leal Filho, W. (2017)	This paper explores adaptations and the perceived responses of success to the effects of climate variability on agricultural

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		Pastoralists and Farmers Coping and Adaptation Strategies to Climate Variability and Their Perceived Success in Ethiopia. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) Climate Change Adaptation in Africa. <i>Climate Change Management</i> . Springer, Cham	production in selected highland and lowland areas of Ethiopia. It shows how pastoralists and farmers are employing agricultural and non-agricultural responses at various levels to climate variability. The authors indicated that female-headed households showed more adaptive response options than their male counterparts who suffered from cultural prejudice. Also, highland farmers' have more coping and adaptation options both in agricultural and non-agricultural livelihood practices. In addition, differences in age, income, gender and education played significant role in determining pastoralists and farmers perceived adaptation success to climate variability. The article can be useful to farmers, policy makers, and all stakeholders adapting strategies for climate change scenarios.
13	Ethiopia	Alemayehu, A. and Bewket, W. (2017) Smallholder farmers' coping and adaptation strategies to climate change and variability in the central highlands of Ethiopia, <i>The International Journal of Justice and Sustainability</i> , 22, 7, pp 825-839	The article described the different coping and adaptation strategies used by smallholder farmers to mitigate the adverse impacts of climate change and variability in the central highlands of Ethiopia. A distinction was made between coping and adaptation strategies. The article showed that farmers used different strategies to mitigate the adverse effects of climate change and variability with respect to changes in rainfall and drought. Coping strategies included selling livestock and changing consumption pattern while adaptation strategies included changing crop planting dates and irrigation. However, the authors pointed to shortage of water for irrigation and shortage of money to buy necessary inputs as major barriers to effective adaptation to climate change and variability. They recommended that adaptation policy should build on existing coping and adaptation strategies and focus on addressing barriers to the adoption of coping and adaptation measures at different scales.
14	Africa	Alemaw, B. F., & Sebusang, N. M. (2017). Climate change and adaptation-induced engineering	This paper presents a framework for the best practice for incorporating climate change and adaptation in Africa from mainly water resources design and management perspectives to develop

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		design and innovations in water development projects in Africa. <i>African Journal of Science, Technology, Innovation and Development</i> , pp 1-13.	systematically ways of incorporating climate change in engineering design of water development projects. The authors believe this will enable engineers to address the challenges of Africa's vulnerability to climate change which has direct impacts on water availability, access and use which is the source of food and livelihood security for millions of the continent's populations. The study makes use of case studies and outlines adaptation strategies to be adopted using an integrated approach in an integrated approach.
15	Africa	Altieri, M. A. and Nicholls, C.I. (2017) The adaptation and mitigation potential of traditional agriculture in a changing climate, <i>Climatic Change</i> , 140, 1, pp 33–45	The paper explores several ways in which key traditional agro-ecological strategies such as biodiversification, soil management and water harvesting can be implemented in the design and management of agro-ecosystems to allow farmers adopt a strategy that both increases resilience and provides economic benefits, including mitigation of global warming. It points out that combining traditional management systems with agro-ecologically based management strategies can increase productivity, sustainability and resilience of peasant-based agricultural production under predicted climate scenarios. The article shows how resiliency to climate disasters is closely linked to the high level of on-farm biodiversity which is a typical feature of traditional farming systems. The article can help farmers to adopt to changes in climatic variables that can compromise food security.
16	Ethiopia	Abate, E., Semie, N. and Ayenew, B. (2017) Climate Change Adaptation Activities for Agricultural Development in Ethiopia: A Review of Potentials. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) <i>Climate Change Adaptation in</i>	The article explains how Ethiopia can be resilient to climate change while enhancing agriculture to provided adequate food security and economic well-being of Ethiopians. It points to inadequate agricultural technology generation and delivery systems, poor rural infrastructure, inadequate irrigation, and limited use of agricultural inputs, environmental degradation and most importantly climate change as the contributing factors to inadequate performance within the agriculture sector. It emphasized that sustained agricultural

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		Africa. <i>Climate Change Management</i> . Springer, Cham	growth can be achieved in Ethiopia through improvement in infrastructure and soil and water management and conservation, enhanced input supply and distribution systems, strengthening of agricultural research and extension, investing on clean and renewable energy sources, introducing a variety of drought tolerant crops and livestock, protecting and re-establishing forests, improving crop and livestock production practices, developing capacities to better analyze and anticipate climate change risks, and enhancing indigenous climate change coping mechanisms.
17	Nigeria	Akerele, O. (2017). Climate Change Vulnerability and Adaptation in the city of Lagos, Nigeria, Faculty of Environmental Studies, York University	This study uses concepts of vulnerability, resilience, adaptation and adaptive capacity of communities to analyze adaptation strategies. The researcher makes use of a mixed method approach to analyse and propose solutions aimed at helping and improving the city of Lagos' adaptive capacity and governmental policy framework particularly regarding flooding prevention and erosion solutions. In the paper the author analyzes the strategies of the coastal cities that results to adaptation, such as New Orleans, Amsterdam and Dhaka in Bangladesh all of which share similar problems with Lagos but are developing interesting solutions in terms of infrastructure, planning, and resilient policy frameworks.
18	Ethiopia	Alemu, T., & Mengistu, A. (2017). 2. Impacts of Climate Change on Food Security and its Adaptation and Mitigation Options in Ethiopia: A Review. <i>Impact of El Niño on Biodiversity, Agriculture, and Food Security 23-24 February 2017 Haramaya University, Ethiopia</i> , 75.	This paper discusses the impact of climate change on agriculture in Ethiopia and the need to mainstream climate change issues towards efficient adaptation and mitigation. The paper discusses efforts being made by Ethiopia to salvage the impacts of climate change on the sensitive backbone sector of the country's economy (agriculture). These include Ethiopia's programme of adaptation to climate change (EPACC) and Climate resilient green economy (CRGE). Climate smart agriculture (CSA) is also discussed in this paper and acknowledged as important in building resilience to climate change. The authors conclude that, with the right site-

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			specific practices, policies and investments, the agriculture sector can move on to climate smart agriculture pathways resulting in improved food security and decrease in poverty in the short term while contributing to reducing climate change as a threat to food security over a longer term.
19	Ethiopia	Asrat, P. and Simane, B. (2017) Adaptation Benefits of Climate-Smart Agricultural Practices in the Blue Nile Basin: Empirical Evidence from North-West Ethiopia. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) <i>Climate Change Adaptation in Africa. Climate Change Management</i> . Springer, Cham	The article examines the impacts associated with expanding farmers' adoption of climate-smart agricultural practices. Although agriculture, especially as practiced by smallholder farmers in Ethiopia is particularly vulnerable to climate change, the authors pointed out that adopting climate-smart agricultural practices reduce risk from climate change events, contribute to enhanced productivity and enable sustained investment in adaptation technologies. The article reveals that farmers' decision to use climate-smart agricultural practices is influenced by agro-ecology, specifically physical, natural and social factors and the adoption led to higher productivity, thereby reducing climate related risks that lead to yield variability. Because the practices are knowledge-intensive, scaling up adaptation benefits requires public investment to raise awareness and provide technological support. The article is useful for farmers and decision makers.
20	Ghana	Atanga, R. A., Inkoom, D. K., and Derbile, E. K. (2017). Mainstreaming Climate Change Adaptation into Development Planning in Ghana, <i>Ghana Journal of Development Studies</i> , 14(2), 209-230.	This paper argues that sustainable development outcomes under climate change are the products of planned adaptation processes involving mainstreaming. The paper examines the extent to which climate change adaptation has been mainstreamed into development planning at the local level in Ghana. Ubiquitous drought and flood disasters in many areas in Ghana are manifestations that climate change can undermine or even reverse the success and sustainability of development interventions. Projections show that the frequency and severity of climate change induced disasters in Ghana will increase overtime. Apparently, the need to mainstream climate

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			change adaptation into development planning at the national and sub-national levels cannot be ignored. In this vein, using the qualitative research approach involving the use of in-depth interviews, focus group discussions and content analysis of district development plans and annual reports, the study found that the mainstreaming of climate change at the district level in Ghana was at the elementary stage, which constitutes awareness creation. As a result, district development plans failed to address climate change adaptation adequately. The paper concludes that there is the need to raise awareness and build local institutional capacities for mainstreaming climate change adaptation for sustainable development in Ghana.
21	Africa	Atlin, G. N., Cairns, J. E. and Das, B. (2017) Rapid breeding and varietal replacement are critical to adaptation of cropping systems in the developing world to climate change, <i>Global Food Security, Elsevier, Volume 12, Pages 31-37</i>	The article focused on the improved cultivar development and dissemination systems that are needed to quickly develop and deliver the shorter-duration, stress-tolerant, market-demanded, higher-yielding varieties demanded by small-holder farmers who are intensifying production in the face of a rapidly changing climate. It argued that plant breeding is a key mechanism for adaptation of cropping systems to climate change and adaptation would mainly result from continually adjusting allele frequencies at many loci through rapid-cycle breeding that delivers a steady stream of incrementally improved cultivars. The authors listed four key elements of cropping system adaptation to climate change which included: (i) access to elite germplasm from other regions that currently experience conditions likely to occur in the target region as a result of climate change; (ii) rapid breeding cycles that provide farmers with a steady stream of new cultivars developed in and for the current climate; (iii) evaluation of potential new cultivars under the full range of climate conditions they are likely to encounter over their commercial life; and (iv) seed systems that deliver new

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			varieties to farmers quickly, and then just as quickly replace them, keeping pace with the changing climate. The article emphasized the need for strengthening and modernizing the key components of climate-adaptive breeding systems in crop improvement organizations serving farmers in the developing countries as in Africa; a change in the mindset; organization of seed systems to emphasize rapid and continual varietal replacement; and enhancing the effectiveness of platforms for international germplasm exchange and regional testing, with the support of national governments, charitable foundations, and the private sector. Governments need to incentivize varietal release and dissemination systems to continuously replace obsolete varieties.
22	Africa	Awad, A. and Abugamos, H. (2017). Income-carbon emissions nexus for middle East and North Africa countries: A semi-parametric approach. <i>International Journal of Energy Economics and Policy</i> , 7(2). <a href="https://doi.org/http://www.econjournals.com/index.php/ijeeep/article/view/4010/2740">https://doi.org/http://www.econjournals.com/index.php/ijeeep/article/view/4010/2740</a>	It is widely accepted that Middle East and North Africa (MENA) region is significantly impacted by climate change. Evidence suggests that the region is positioned at the second place after North America in carbon emission. This study examined the impacts of income on carbon emissions in MENA region through investigation of the existence of an environmental Kuznets curve. These findings suggest that environmental degradation may be reversible and environmental quality may be recoverable alongside the economic growth process in the region.
23	Africa	Awojob, O., & Tetteh, J. (2017). The impacts of climate change In africa: a review of the scientific literature. <i>Journal of International Academic Research for Multidisciplinary</i> , 5(11), 39-59.	Africa is considered as the most vulnerable continent to climate change in the world. This study assesses the impacts of climate change on the African continent using a qualitative approach. Evidence from the sample studies selected for this study reveals climate change affects infrastructure, human health, the ecosystem in Africa. In addition, climate change has led to the displacement of inhabitants of most affected regions. Most common climate events in Africa are drought, flooding, desertification and land degradation. While efforts by the African governments and international



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			organizations have been intensified in reducing the impacts of climate change, there are still some barrier and limitation to adaptation.
24	Africa	Awojobi, O. (2017). What do we know about adaptation to climate change in Africa? A review of grey literature. <i>International Journal of Environmental &amp; Agriculture Research</i> , 4(2), 14-18.	Africa is one of the regions that the impacts of climate change will be felt so much due to poor adaptive capacity and the reliance on agricultural production for human sustainability. While climate change is real in Africa, the continent has been building resilience through adaptation strategies. Climate change has mostly affected the agricultural sector thereby reducing agricultural production. This has led to the introduction and implantation of adaptation policies and strategies on the African continent. However, there are barriers militating against adaptation measures. In building resilience, some adaptation policies and strategies have been initiated mostly at the local levels with the financial support from donor agencies.
25	Africa	Axelsson, J., Franke, U., Carlson, J., Sentilles, S., & Cicchetti, A. (2017). Towards the architecture of a decision support ecosystem for system component selection. In <i>11th Annual IEEE International Systems Conference, SysCon 2017 - Proceedings. Institute of Electrical and Electronics Engineers Inc.</i> <a href="https://doi.org/10.1109/SYSCON.2017.7934757">https://doi.org/10.1109/SYSCON.2017.7934757</a>	When developing complex software-intensive systems, it is nowadays common practice to base the solution partly on existing software components. This paper discusses how a decision support system for this problem could benefit from a software ecosystem approach, where participants share knowledge across organizations both through reuse of analysis models, and through partially disclosed past decision cases.
26	Africa	Balehegn, M. (2017) Silvopasture Using Indigenous Fodder Trees and Shrubs: The Underexploited Synergy Between Climate Change Adaptation	The article is focused on silvopasture, a tree-based livestock production system where trees and shrubs planted on pasturelands, backyards, and farmlands provide fodder as well as other multiple benefits. The article shows that silvopastoral systems are more

No	Region	Citation	Annotation
		and Mitigation in the Livestock Sector. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) <i>Climate Change Adaptation in Africa. Climate Change Management</i> . Springer, Cham	adapted to changing climate and weather, as foliage production from trees and shrubs is less affected by such changes than grasses. Moreover, unlike conventional grass-based pastures, which contribute to green house gas emissions through land conversions and increased enteric methane production from livestock, silvopastoral systems contribute towards mitigation of green house gases through direct sequestration of atmospheric carbon and reduction of enteric methane production. Similarly, trees and shrubs in silvopastoral systems contribute to general ecological integrity through improvement of soil fertility, soil and water conservation and farm and pastureland productivities. The author argued that locally adaptable species selected by local farmers such as <i>F. thonningii</i> more efficient in improving the productivity of livestock in drylands while at the same time increasing their capacity to adapt to recurrent drought or changing climate. Therefore, increased intervention and investment aimed at identification, promotion and implementation of indigenous species for silvopastoral system-based practices is recommended for achieving climate resilience and increased productivity in the livestock sector of the dry lands.
27	Ethiopia	Belay, A., Recha, J. W., Woldeamanuel, T., & Morton, J. F. (2017). Smallholder farmers' adaptation to climate change and determinants of their adaptation decisions in the Central Rift Valley of Ethiopia. <i>Agriculture &amp; Food Security</i> , 6(1), 24.	The article examines how smallholder farmers perceived the impacts of climate change. It identifies adaptation practices and investigates the factors that influence the choice of adaptation strategies in the central rift valley of Ethiopia. The article indicated that smallholder farmers used practices such as crop diversification, planting date adjustment, soil and water conservation and management, increasing the intensity of input use, integrating crop with livestock, and tree planting to adapt to climate-related risks such as water stress and increased incidences of pest and diseases. In addition, it pointed to education, family size, gender, age, livestock ownership, farming experience, frequency of contact with

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			extension agents, farm size, access to market, access to climate information and income as the key factors determining farmers' choice of adaptation practice. The article can serve as a guide to stakeholders who want to support the indigenous adaptation strategies of smallholder farmers with institutional, policy and technology support, giving attention to smaller, poorer or female-headed households.
28	Africa	Barnes, J. (2017) The future of the Nile: climate change, land use, infrastructure management, and treaty negotiations in a transboundary river basin, <i>WIREs climate change</i> , 2017, 8: e449. doi: 10.1002/wcc.449	The article reviews the multidisciplinary literature on the Nile to understand more about the outlook for this geopolitically significant river basin. It synthesizes key results from recent climate change modeling studies; explores how different actors within the Nile Basin are perceiving and responding to climate change; the significance of land use, both to basin hydrology and as a driver of water demand with highlight on contemporary land use changes that could impact flows within the Nile Basin; and the role of infrastructure in influencing the magnitude and temporality of flows along the river. The author also considered the geopolitical context of the basin, ongoing conflict over water sharing agreements and the political issues it has raised. In bringing together these diverse literatures, the article offers a timely and multifaceted insight into the varied factors that will shape the future of the Nile.
29	North africa	Ben Mariem, H., & Chaieb, M. (2017). Climate change impacts on the distribution of stipa tenacissima l. Ecosystems in north african arid zone – A case study in tunisia. <i>Applied Ecology and Environmental Research</i> , 15(3), 67–82. <a href="https://doi.org/10.15666/aeer/1503_067082">https://doi.org/10.15666/aeer/1503_067082</a>	<i>Stipa tenacissima</i> L. (Alfa grass) is an important perennial grass species in Tunisia and Northern Africa which dominates wide arid ecosystems offering multiple services. The focus of this study was to explore how the distribution of suitable habitat for <i>Stipa tenacissima</i> , might shift under climate change. Results of the analysis showed a negative impact of climate change on the <i>S. tenacissima</i> ecosystem. Across space, when projecting model into the future, the area of predicted suitable habitat of Tunisian alfa

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			grass would dramatically reduce in the central area and disappear from the Southern area.
30	Kenya	Bedelian, C., & Ogutu, J. O. (2017). Trade-offs for climate-resilient pastoral livelihoods in wildlife conservancies in the Mara ecosystem, Kenya. <i>Pastoralism</i> , 7(1), 10.	The authors examine how conservancies contribute to and integrate with pastoral livelihoods. The article explores trade-offs to understand how conservation and tourism may be enhancing or restricting climate resilient pastoral livelihoods. It looked at the ability of wildlife conservancies in the Mara, Kenya, to act as an alternative livelihood opportunity for pastoralists that mitigates risk and maintains resilience in a changing climate. It pointed that conservancies can retain grass banks during the dry season and provide opportunities for pastoralists to access good-quality forage. This article can be helpful to pastoralists, especially in the arid and semi-arid lands, to adapt to the variability in rangeland resources and manage climate variability through mobility and risk-spreading strategies.
31	Africa	Berbés-Blázquez, M., Mitchell, C. L., Burch, S.L. and Wandel, J. (2017) Understanding climate change and resilience: assessing strengths and opportunities for adaptation in the Global South, <i>Climatic Change, Springer, 141</i> , (2), pp 227–241	The article showed how integration of resilience and climate change adaptation can enhance climate change adaptation and contribute to broader sustainable development goals by helping to build climate-resilient development. It distilled nine principles from the resilience literature to build a framework to assess 224 climate change adaptation strategies proposed by researchers and practitioners in Africa, Asia, and Latin America. It pointed out that the adaptation strategies emphasized initiatives that increase social and ecological diversity, strengthen learning processes, build functional redundancy, enhance connectivity between social and ecological elements, pay attention to the management of slow variables, and provide mechanisms for increasing participation and polycentric governance. The authors, however, indicated that the adaptation options examined generally lacked a system's perspective, suggesting the need for a climate-resilient development model.

No	Region	Citation	Annotation
32	Ethiopia	Berhe, M., Hoag, D., Tesfay, G., Tadesse, T., Oniki, S., Kagatsume, M. and Keske, C. M. H. (2017) The effects of adaptation to climate change on income of households in rural Ethiopia, <i>Pastoralism</i> , Springer, 7,(7):12	The article identifies how pastoral, semi-pastoral, agro-pastoral and mixed-farming communities in Afar region, Ethiopia, perceive and adapt to climate change and whether these practices have brought about any improvement in farm income. The authors used structured questionnaires to gather a panel data set of five years from a sample of 313 households. The article indicated that household heads pointed out indicators to identify climate-related stress such as erratic rainfall, drought, temperature change, drying of water sources, prevalence of diseases and lack of human and livestock feed. A fixed effects quantitative model on the panel data was estimated to verify the effect of adaptation strategies on income of household heads. The article showed that the main adaptation strategies that significantly influenced household income levels were forage production (hay and straw), access to water sources, livestock diversification and migration. The authors pointed out that integrated approaches comprising adaptation methods and expected benefits are an important way to induce farming communities to address challenges related to climatic change.
33	Africa	Bett, B., Kiunga, P., Gachohi, J., Sindato, C., Mbotha, D., Robinson, T., Lindahl, J. and Grace, D. (2017) Effects of climate change on the occurrence and distribution of livestock diseases, <i>Preventive Veterinary Medicine</i> , Elsevier, 137, Part B, 1 February 2017, Pages 119-129	The article described direct and indirect processes linking climate change and infectious diseases in livestock with reference to specific case studies to show a positive association between temperature and expansion of the geographical ranges of arthropod vectors (e.g. <i>Culicoides imicola</i> , which transmits bluetongue virus) and opposite trend (e.g. tsetseflies that transmit a range of trypanosome parasites in sub-Saharan Africa). The authors described a positive association between extreme events: droughts and El Niño/southern oscillation (ENSO) weather patterns and Rift Valley fever outbreaks in East Africa and some adaptation practices used to mitigate the impacts of climate change that may increase risk of exposure to infectious pathogens. The article outlined mitigation and adaptation measures

No	Region	Citation	Annotation
			that could be used specifically in the livestock sector to minimize the impacts of climate change-associated livestock diseases.
34	South Africa	Chevallier, R. (2017) Integrated Community- and Ecosystem-Based Approaches to Climate Change Adaptation, <i>South African Institute of International Affairs (SAIIA)</i> , policy insights 49	The article is about emerging approaches that build the resilience of socio-economic and ecological systems. It points to an integrated approach to community-based adaptation (CbA) and ecosystem-based adaptation (EbA) which are gaining recognition as viable tools for climate change adaptation and mitigation. It indicated that integrated ecosystem- and community-based solutions to climate adaptation and vulnerability present African decision makers with new opportunities to plan for an uncertain future, using frameworks that include the most vulnerable people and important ecosystems. The author indicates that CbA and EbA encourage participatory, transparent, accountable and culturally appropriate solutions to climate adaptation, while actively embracing equity and gender issues. The article can be useful in promoting resilient ecosystems using nature-based solutions to provide benefits to people, especially the most vulnerable, through community-based sustainable management of natural resources.
35	South Africa	Chu, E., Anguelovski, I., & Roberts, D. (2017). Climate adaptation as strategic urbanism: Assessing opportunities and uncertainties for equity and inclusive development in cities. <i>Cities</i> , 60, 378-387.	The article assesses strategic climate adaptation actions in cities such as Durban (South Africa) and examines different approaches to integrating emerging adaptation priorities into urban plans, programmes, or governance arrangements. It points out that increasing number of cities are recognising the impacts of climate change on their development pathways. The authors highlighted sources of planning tension, particularly between aspects of the planning process and larger urban political economic forces, that reshape how adaptation interventions are framed and implemented. That authors were with the view that although strategic approaches may facilitate coherent policy framings, targeted actor coalitions, and opportunities for collaborative action, such approaches are often

No	Region	Citation	Annotation
			unable to adequately capture the difficult policy trade-offs or contestations that are required to further overall adaptive capacities of cities. In other words, strategic adaptation actions must be considered in relation to the powerful, and often entrenched, political economic interests that constrain urban equity at-large.
36	The Gambia	Ceesay, A., Dibi, H., Njie, E., Wolff, M., & Koné, T. (2017). Mangrove Vegetation Dynamics of the Tanbi Wetland National Park in The Gambia. <i>Environment and Ecology Research</i> , 5, 145 - 160.	The research seeks to understand the long-term changes in the mangrove vegetation in order to strengthen the formulation of sustainable alternative livelihoods and adaptation strategies to climate change. Mangrove vegetation dynamics was assessed by remote sensing, using decadal Landsat images covering 1973 - 2012. Physicochemical parameters were analyzed during the rainy and dry seasons for correlation with climate data. The findings indicated that the long-term changes in salinity (24.5 and 35.8ppt) and water temperature (27.6°C and 30.2°C) during the rainy and dry seasons respectively were retarding mangrove growth. Mangrove vegetation cover declined by 6%, while grassland increased by 56.4%. This research concludes that long-term hyper-salinity is the cause for the stunted vegetation and lack of mangrove rejuvenation in Tanbi Wetland National Park (TWNP). We propose that specialized replanting systems such as the use of saplings be adopted instead of the conventional use of propagules. Alternative livelihoods also need to be diversified to support coastal communities.
37	South Africa	Cumming, T. L., Shackleton, R. T., Förster, J., Dini, J., Khan, A., Gumula, M., & Kubiszewski, I. (2017). Achieving the national development agenda and the Sustainable Development Goals (SDGs) through investment in	Ecological infrastructure (EI) refers to ecosystems that deliver services to society, functioning as a nature-based equivalent of, or complement to, built infrastructure. EI is critical for socio-economic development, supporting a suite of development imperatives at local, national and international scales. This paper presents the myriad of ways that EI supports sustainable development, using South Africa and the South African National Development Plan as

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		ecological infrastructure: A case study of South Africa. <i>Ecosystem Services</i> , 27, 253-260.	a case study, linking to the Sustainable Development Goals on a global level. Opportunities to unlock investment in EI, both internationally and on the national level, are identified. This included leveraging private sector investment into landscape management and integrating the costs of managing EI into public sectors that benefit directly from ecosystem services, such as the water sector and infrastructure development.
38	Sub-Saharan Africa	Davoren, E. (2017). Garden ecosystem services of Sub-Saharan Africa and the role of health clinic gardens as social-ecological systems. <i>Landscape and Urban Planning</i> , 1–14. <a href="https://doi.org/10.1016/j.landurbplan.2017.01.011">https://doi.org/10.1016/j.landurbplan.2017.01.011</a>	In this article, a review on the literature to determine the current status of garden ecosystem services under the main themes of provisioning, regulating, supporting, and cultural services was presented. They further identify some of the challenges in optimizing these services. They argue that this might be critical to promote and enhance their resilience capacity in a changing world. The study emphasized that gardens represent a major portion of the urban green infrastructure which can be brought under intense pressure due to rapid urbanization in Africa cities. Thus, the paper essentially indicates the role of gardens as an ecosystem based approach to provide ecosystem services to urban, Peri-urban communities that enhances their well-being and therefore reduce their vulnerability to present and future social and economic challenges
39	Ethiopia	Dawit, D., & Simane, B. (2017). Community Forest Management for Climate Change Mitigation and Adaptation in Ethiopia: Determinants of Community Participation. In <i>Climate Change Adaptation in Africa</i> (pp. 447-456). Springer, Cham.	In this paper the role of forests is emphasised with the most important forest ecosystem service being a source of carbon sink from the atmosphere during its early growing stage as compared to the late stage. The authors report on studies that reveal that growth of forests have been considered as a climate change adaptation strategy locally and a mitigation strategy globally. However, the authors are of the view that for this strategy to work effectively as an adaptation method there should be effective participation of households on forest ecosystem service provision (FESP) activities.



No	Region	Citation	Annotation
			This study investigates the socio-economic determinants of the household participation on FESP. The results showed that FESP was negatively determined by gender difference, state of agro-ecology/agro-ecosystem, level of annual net benefit, distance to forest site and other source of income whereas the attending of community meeting and literacy level increased level of participation thereby increasing annual return of individual local households.
40	Africa	Debaeke, P., Pellerin, S., & Scopel, E. (2017). Climate-smart cropping systems for temperate and tropical agriculture: mitigation, adaptation and trade-offs. <i>Cahiers Agricultures</i> , 26 (3).	In this article, the authors clearly state that climate -smart cropping systems should be designed with three objectives which are reducing greenhouse gas emissions, adapting to changing climate and environment and securing food production sustainability. In the article it is shown that the most promising options for mitigating CH <sub>4</sub> emissions in paddy fields are based on mid-season drainage or intermittent irrigation. The second option is storing more carbon in soil and biomass by promoting no-tillage (less fuel, crop residues), sowing cover crops, introducing or maintaining grasslands and promoting agroforestry. Moreover, breeding different varieties which better adapt to thermal shocks and drought is mainly suggested as long-term adaptation to climate change. Whereas, short-term strategies have been identified from current practices to take advantage of more favourable growing conditions or to offset negative impacts by shifting sowing dates, changing species, cultivars and crop rotations, modifying soil management and fertilization, introducing or expanding irrigation. The authors acknowledge that there would be a challenge for designing cropping systems in a multifunctional perspective.
41	Ethiopia	Dechassa, C., Simane, B. and Alamirew, B. (2017) Farmers' Livelihoods Vulnerability to Climate	The paper assessed the livelihoods vulnerability of smallholder's farmers in the Didessa basin. It applied the Livelihood Vulnerability Index framed within the LVI-IPCC vulnerability framework

No	Region	Citation	Annotation
		Variability and Change in Didesa Basin Southern Part of Abay Basin, Ethiopia. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) <i>Climate Change Adaptation in Africa. Climate Change Management</i> . Springer, Cham	through cross-sectional household survey. The paper showed that where the lowland agro ecological zone is the most exposed zone, the highland is the most sensitive zone and the midland is the most in adaptive capacity to climate variability and change. It indicated that the lowland was the most vulnerable followed by highland Agro-ecology. Hence, lowland households might be more vulnerable than highland and midland households. The authors pointed out that the paper will have policy relevance in identifying sources and forms of vulnerability for better design of agro-ecological specific adaptation measure thereby strengthen most vulnerable sectors.
42	Ethiopia	Deichert, G., Gedamu, A. and Nemomsa, B. (2017) Role of Sustainable Land Management (SLM) in Adapting to Climate Variability Through Agricultural Practices—Experiences from Ethiopian Highlands. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) <i>Climate Change Adaptation in Africa. Climate Change Management</i> . Springer, Cham	The paper presents a systematic approach of rating agriculture interventions and practices as well as soil and water conservation measures with regard to their adaptation potentials. The authors were of the view that in response to unpredictable climate variability which contributes to low agricultural productivity and production challenges, soil and water conservation has to be combined with sustainable agriculture practices, whereby the latter need a strong focus on strengthening adaptation among smallholding farmers. The adaptation potential is described in a basket-of-options with six sub-parameters and separately for degraded hill sides, communal grazing land, farm land and homesteads. The paper revealed that single measures often show a trade-off between adaptation, mitigation or economic benefits. Therefore, a combination of single measures is recommended to overcome the trade-offs and to optimize the triple win benefits. The basket-of-options provides a helpful tool also to combine measures to strengthen specifically the adaptation benefits of measures.
43	Africa	Déqué, M., Calmanti, S., Christensen, O. B., Aquila, A. D.,	The article examined the impact of a +2 0C global warming on temperature and precipitation over tropical Africa based on an

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		Maule, C. F., Haensler, A., Nikulin, G. and Teichmann, C. (2017) A multi-model climate response over tropical Africa at +2 0C, <i>Climate Services</i> , 7, Pages 87-95	ensemble of 12 regional climate model scenario simulations. The 12 scenarios were re-phased so that they all correspond to the same global warming of 2 0C with respect to pre-industrial conditions. The article indicated that the continental temperature increase was above the global average and the average precipitation did not show significant response, due to model-to-model spread. The authors, however, showed that the number of rain days decreased whereas the precipitation intensity increased, and the rain season occurred later during the year with less precipitation. Simulated daily temperature and precipitation data were combined in two impact models, one for the hydrology of the Nile and Niger basins, and one for the food security of the different countries. They showed that the main feature of the climate change is not a continuous trend signal, but an alternation of dry and wet decadal to multidecadal episodes. The characteristics of climate change underlined the potential role of seasonal-to-decadal predictions in improving the efficiency of midterm adaptation measures.
44	Senegal	Djaman, K., Balde, A. B., Rudnick, D. R., Ndiaye, O., & Irmak, S. (2017). Long-term trend analysis in climate variables and agricultural adaptation strategies to climate change in the Senegal River Basin. <i>International Journal of Climatology</i> , 37(6), 2873-2888.	In this study a trend analysis in rainfall, sunshine duration, wind speed, annual and monthly maximum and minimum temperature and relative humidity were measured. These climatic variables were analysed so as to inform what ecosystem-based adaptation measures could be employed to the Senegal River Basin. The study discovered a significant decreasing trend in rainfall in certain parts of the basin and non-significant decreasing trends in other areas in the basin. Furthermore, the study revealed a significant increase in temperature. According to the authors, the trend analysis in climate variables measured revealed a change in climate that calls for action for resources management sustainability and conservation.
45	Togo	Diwediga, B., Le, Q. B., Agodzo, S., & Wala, K. (2017). Potential	Quantification of carbon and nitrogen in soils in relation to ecological, landform and management factors over river basins is

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		storages and drivers of soil organic carbon and total nitrogen across river basin landscape: The case of Mo river basin (Togo) in West Africa. <i>Ecological Engineering</i> , 99, 298-309.	essential to understand landscape ecosystem functions and efforts to manage land restoration and the reduction of greenhouse gases emissions. herefore, this research aimed at providing distribution of the potential storage in soil organic carbon (SOC) and total nitrogen (TN) within the multifunctional landscapes of the Mo river basin in Togo. The results showed that SOC and TN varied significantly according to land cover types, soil depths, topographical positions and land protection regime.
46	Zimbabwe	Descheemaeker, K., Zijlstra, M., Masikati, P., Crespo, O., & Tui, S. H. K. (2017). Effects of climate change and adaptation on the livestock component of mixed farming systems: A modelling study from semi-arid Zimbabwe. <i>Agricultural Systems</i> , 159, 282-295.	This study addresses the knowledge gap on the uncertainties about the impacts of climate change and adaptation options on livestock component of heterogeneous African farming systems that hamper tailored decision making towards climate smart agriculture (CSA). This was done through the development and use of a dynamic modelling framework integrating climate, crop, pasture and livestock models. The study was conducted in the rural district of Nkayi in natural region IV of Zimbabwe. A number of models were used in this study. On-farm fodder resources and rangeland grass production were simulated with a crop model known as APSIM and a pasture model known as GRASP respectively. Again, the simulated fodder availability was used in a livestock model LIVSIM to generate various production indicators including milk and other. The focus for this study was on the livestock component and its links with the crop and rangeland components of the farming system. Cattle was the only livestock the study focused on. Furthermore, the authors investigated the effects of two adaptation packages targeting soil fertility management and crop diversification and quantified the sensitivity to climate change of both current and improved systems. A sensitivity analysis revealed that livestock productivity was less affected by changes in crop residue than in pasture parameters because of the larger contribution of pasture to annual diet. The

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			authors integrated process-based modelling analysis revealed that the sensitivity to climate change of livestock contributes to vulnerability in mixed systems. In several of the tested climate scenarios, livestock production and net revenues decreased, while at the same time risk increased. Like others highlighted for crops, the authors showed that also for livestock there is considerable uncertainty related to climate projections
47	West Africa	Dwomoh, F. K., & Wimberly, M. C. (2017). Fire regimes and forest resilience: alternative vegetation states in the West African tropics. <i>Landscape Ecology</i> , 32(9), 1849-1865.	Terrestrial ecosystems, including tropical forests, are hypothesized to have tipping points beyond which environmental change triggers rapid and radical shifts to novel alternative states. The study showed that fire-mediated alternative stable states exist in the semi-deciduous tropical forest zone of Ghana, and that increased fire activity has pushed some forests to a new state in which a novel ecosystem with low tree density is maintained by fire. Results from the study showed two of the reserves experienced forest loss, were impacted by frequent fires, and transitioned to a vegetation community dominated by shrubs and grasses, which was maintained by fire–vegetation feedbacks. The other two reserves experienced less fire, retained higher levels of forest cover, and resisted fire encroachment from surrounding agricultural areas.
48	Egypt	El Shaer, H. M. and Al Dakheel, A. J. (2017) Adaptation to Climate Change in Egyptian Marginal Environments Through Sustainable Crop and Livestock Diversification: A Case Study. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) Climate Change Adaptation in	The paper presents a case study as a success story for improvement of livelihood and productivity of poor farmers under marginal (particularly saline soils and water) resources. It identifies the barriers to diversification of farming system and scaling out. The article is useful for farming community composed of traditional small-scale farmers who face challenges such as drought and salinity in water and soils and lack of education and agriculture management skills. It can help them develop more resilient agricultural production systems in an integrated comprehensive approach that can help poor farmers in marginal environments

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		Africa. <i>Climate Change Management</i> . Springer, Cham	achieve better management of their farm resources along the value chain and attain high production and income.
49	North Africa	Eljayash, K. (2017). Environmental disclosure studies in Middle East and Northern Africa in shadow of theoretical context. <i>World Journal of Entrepreneurship, Management and Sustainable Development</i> , 13(4), 334-349.	In the Middle East and North Africa, a substantial number of accounting studies have been undertaken aimed at addressing the environmental disclosure in companies. The paper examines various accounting studies that have been undertaken for addressing the environmental disclosure in companies in the Middle East and North Africa and shows that a difference exists in the theoretical interpretation of the environmental disclosure.
50	South Africa	Elum, Z. A., Modise, D. M., & Marr, A. (2017). Farmer's perception of climate change and responsive strategies in three selected provinces of South Africa. <i>Climate Risk Management</i> , 16, 246-257.	This study aims to examine the trend in climate parameters, farmers' perception of climate change, constraints faced in production and to identify the strategies (if any) that farmers have adopted to cope with the effects of changing climate. In this study, a one-way analysis of variance and Garret ranking technique were applied to primary data collected from farmers with the aid of questionnaires. Weather data obtained during the study revealed that the climate parameters have significantly changed over time and these were substantiated by farmers' experiences. The farmers are engaged in various climate-response strategies, among which, the planting of drought-tolerant varieties is most common. It is thus necessary to enhance farmers' access to improved drought-tolerant seeds and efficient irrigation systems. The authors conclude that there is enough empirical data to support the perceived assertion of climate change and farmers' responses. The authors also agree that South African farmers are already adapting to climate change, although, an integrated approach that addresses multiple stressors and combines indigenous knowledge and experience with scientific insights is required.
51	Africa	Emerton, L. (2017). Valuing the Benefits, Costs and Impacts of Ecosystem-based Adaptation	The book addresses Ecosystem-based Adaptation (EbA) valuation. It provides guidance on how to design, deliver, manage and use valuation studies. The author lays out real-world experiences,

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		Measures: A sourcebook of methods for decision-making, <i>Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH</i> , Bonn	lessons learned and best practices in EbA valuation and assessment. The book consists of a set of 40 case studies on EbA relevant valuations that have been implemented globally, in countries such as Burkina Faso, Ghana, Malawi, Tanzania, Morocco, Niger, South Africa and Uganda. It deals mainly with climate change adaptation activities that are being carried out in support of public interest. The author indicated that efforts to measure, compare and communicate EbA benefits, costs and impacts are key to support better informed planning and decision-making. They help to identify where ecosystem-based approaches can contribute towards more effective, inclusive or sustainable adaptation solutions. The book could serve as a guidance document that could be consulted during the course of designing and delivering EbA valuation studies. It is beneficial to especially those responsible for commissioning, supervising and using the results of such studies to inform and influence decision-making.
52	Global	Enríquez-de-Salamanca, Á., Díaz-Sierra, R., Martín-Aranda, R. M., & Santos, M. J. (2017). Environmental impacts of climate change adaptation. <i>Environmental Impact Assessment Review</i> , 64, 87-96.	Climate change adaptation reduces adverse effects of climate change but may also have undesirable environmental impacts. However, these impacts are yet poorly defined and analysed in the existing literature. To complement this knowledge-gap, this study reviewed the literature to unveil the relationship between climate change adaptation and environmental impact assessment, and the degree to which environmental impacts are included in climate change adaptation theory and practice. Literature review showed that technical, social and economic perspectives on climate change adaptation receive much more attention than the environmental perspective. The scarce interest on the environmental impacts of adaptation may be attributed to (1) an excessive sectoral approach, with dominance of non-environmental perspectives, (2) greater interest in mitigation and direct climate change impacts rather than

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			in adaptation impacts, (3) a tendency to consider adaptation as inherently good, and (4) subjective/preconceived notions on which measures are good or bad, without a comprehensive assessment. Results suggest that there is a need to address adaptation proactively by including it in Environmental Assessment, to update current policy frameworks, and to demand robust and reliable evaluation of alternatives. Only through the full EA of adaptation measures can we improve our understanding of the primary and secondary impacts of adaptation to global environmental change.
53	South Africa	Environmental Affairs, (2017) Guidelines for Ecosystem-Based Adaptation (EbA) in South Africa, South <i>AFRICAN National Biodiversity Institute</i> , Republic of South Africa,	The document is for designing EbA interventions in a South African context and providing a consistent understanding of EbA by policy makers, practitioners and funders. The document identifies four cornerstones of EbA practice and positions them as the fundamental values of the EbA approach. The document points to a set of 7 principles and 11 safeguards that will help to ensure the beneficial outcomes that EbA promises for both people and nature, within the context of climate change adaptation. It presents a monitoring and evaluation framework to support sustainability of EbA projects and build a strong evidence base for the approach. EbA guideline document would allow South Africa to give effect to its EbA strategy and capitalise on the opportunities inherent in its core intentions.
54	Uganda	Epule, T. E., Ford, J. D. and Lwasa, S. (2017). Projections of maize yield vulnerability to droughts and adaptation options in Uganda. <i>Land Use Policy</i> , 65, 154-163.	In this paper, a study on the vulnerability of maize yields to drought in Uganda reveals that the northern sector of the country has higher vulnerability, exposure and lower adaptive capacity. The higher levels of vulnerability and exposure in the northern sector is explained by variations in rainfall, temperature, rich volcanic soils as well as access to rivers and lakes. However, the southern part of Uganda has higher adaptive capacity. Further findings of the study reveal that vulnerability and sensitivity will increase under rising



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			temperature scenarios by the year 2050. It also predicts that levels of exposure and adaptive capacity will be maintained up to the year 2050. The authors recommend an integrated land use policy that incorporates water management, agroforestry, climatic information, diffusion, training and indigenous knowledge so as to serve as an better ecosystem adaptation strategy.
55	Sahel	Epule, T. E., Ford, J. D., Lwasa, S. and Lepage, L. (2017). Climate change adaptation in the Sahel. <i>Environmental Science &amp; Policy</i> , 75, 121-137.	This study examines the status of adaptation in the Sahel by reviewing the primary peer review literature that reports concrete climate change adaptation actions. Based on an analysis of 70 peer review papers that document 414 discrete adaptations, snap shot of adaptations developed between 1975 and 2015 was created, and calculate the percentages of adaptation. The results show that from a country to country perspective, Kenya has the highest number of reported adaptation actions (75 or 18.1%). The percentages indicate that the adaptive capacity of the entire study area is generally low for all the countries being that the highest country-level percentage is recorded in Kenya and it is 18%. Regionally, West Africa has more adaptation actions (261 or 63%) when compared to other regions of the Sahel. Regional level percentages suggest a higher level of adaptation at the regional level being that the percentage falls within the high scale range. The most commonly used adaptation actions reported are income diversification and water harnessing respectively. When categorized, technically related adaptation actions dominate the adaptation charts. The decade 2008–2016 recorded the highest number of adaptations (65.2%). Adaptation actions are also reported to be triggered by climatic and non-climatic drivers which both record high frequencies but the climatic drivers (98%) of adaptation are slightly dominant relative to the non-climatic drivers (95%).

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56	Nigeria	Falola, A., & Achem, B. A. (2017). Perceptions on climate change and adaptation strategies among sweet potato farming households in Kwara State, Northcentral Nigeria. <i>Ceylon Journal of Science</i> , 46 (3), 55-63.	The study presents sweet potato as a food security crop with ease of production and ability to produce relatively good yields even on marginal soils. Despite these potentials, its yields have drastically reduced in recent years relative to what it used to be in the 60's and 90's. This is not unconnected with climate change, among other factors. This study therefore examines the perceptions of sweet potato farming households on climate change, the strategies employed and factors influencing their adaptation to its effects. Data were collected from 170 sweet potato farming households in Kwara State, Nigeria and analyzed with descriptive statistics, index ranking and logistic regression. Results showed that most of the farmers were aware of climate change and use different strategies to combat its deleterious effects. Factors that positively influence the farmers' adaptation status were educational status, farming experience, farm size and access to agricultural extension services while age had a negative influence on their adaptation status (at $p < 0.05$ ). Therefore, policies that will promote literacy and access to extension services among farming households and encourage young people to practice sweet potato farming should be put in place.
57	west-central Africa	Feka, Z. N., & Morrison, I. (2017). Managing mangroves for coastal ecosystems change: A decade and beyond of conservation experiences and lessons for and from west-central Africa. <i>Journal of Ecology and The Natural Environment</i> , 9(6), 99–123. <a href="https://doi.org/10.5897/jene2017.0636">https://doi.org/10.5897/jene2017.0636</a>	Unsustainable human activities and climate change are threatening the sustainability of coastal ecosystems in countries of West-Central Africa. This paper advocated that focusing on mangrove ecosystem management can potentially mitigate these threats by pointing out clues on management orientations and opportunities for other coastal systems. This article used evidence from informal interviews with stakeholders and expert-led literature reviews to assess mangrove conservation interventions implemented between 2000 and 2014 across countries of West Africa and Cameroon. Results showed that many institutions are taking actions in countries of West Africa and Cameroon to conserve and restore mangroves.

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58	Africa	Fankhauser, S. (2017) Adaptation to Climate Change, <i>Annual Review of Resource Economics</i> , 9 (1), pp 209-230	The article identifies the adaptation priorities, including areas where delay might lock in future vulnerability, and outline the decision-making challenges of adapting to an unknown future climate. It reviews the economic and analytical challenges of adaptation to climate change and highlights the strong interlinkages between adaptation and economic development, pointing out that decisions on industrial strategy, urban planning, and infrastructure investment all have a strong bearing on future vulnerability to climate change. The implications of these links for adaptation finance and the balance between adaptation and mitigation were reviewed. The authors showed that adaptation to climate risks requires knowledge, planning, coordination and foresight. They also indicated that there are important knowledge gaps, behavioral barriers, and market failures that hold back effective adaptation and require policy intervention.
59	South Africa	Fill, J. M., Forsyth, G. G., Kritzinger-Klopper, S., Le Maitre, D. C. and van Wilgen, B. W. (2017) An assessment of the effectiveness of a long-term ecosystem restoration project in a fynbos shrubland catchment in South Africa, <i>Journal of Environmental Management</i> , 185, (1) January 2017, pp 1-10	The paper reports on the outcomes of ecosystem restoration following the clearing of alien Pinus plantations and associated alien plant invasions over 13 years from an 8000ha mountain catchment in the Western Cape Province, South Africa. The paper examined the goals, methods and costs of management, and the ecological outcomes in terms of reduced alien plant cover and native vegetation recovery. The goals were implicitly focused on the conservation of water resources, the restoration of biodiversity, and the provision of employment. The authors pointed out that several changes to the management approach would substantially increase the future effectiveness of the project and the sustainability of its outcomes. However, the entire area could revert to a more densely-invaded state in the event of a reduction of funding.
60	Africa	Frelat, R., Lindegren, M., Denker, T. S., Floeter, J., Fock, H. O., Sguotti,	Understanding spatio-temporal dynamics of biotic communities containing large numbers of species is crucial to guide ecosystem

No	Region	Citation	Annotation
		C., Möllmann, C. (2017). Community ecology in 3D: Tensor decomposition reveals spatio-temporal dynamics of large ecological communities. <i>PLoS ONE</i> , 12(11). <a href="https://doi.org/10.1371/journal.pone.0188205">https://doi.org/10.1371/journal.pone.0188205</a>	management and conservation efforts. The study demonstrated and promoted the use of tensor decomposition for disentangling spatio-temporal community dynamics in long-term monitoring data. Results revealed a strong spatial structure in fish assemblages persistent over time and linked to differences in depth, primary production and seasonality. There was also important temporal distribution changes related to the low frequency temperature variability inherent in the Atlantic Multidecadal Oscillation.
61	Africa	Fusi, M., Babbini, S., Giomi, F., Fratini, S., Dahdouh-Guebas, F., Daffonchio, D. and Cannicci, S. (2017). Thermal sensitivity of the crab <i>Neosarmatium africanum</i> in tropical and temperate mangroves on the east coast of Africa. <i>Hydrobiologia</i> , 803(1), 251–263. <a href="https://doi.org/10.1007/s10750-017-3151-1">https://doi.org/10.1007/s10750-017-3151-1</a>	Mangrove forests are amongst the tropical marine ecosystems most severely affected by rapid environmental change, and the activities of key associated macrobenthic species contribute to their ecological resilience. This study was in identifying the sensitivity and vulnerability to global warming of this species is of increasing importance. The results indicated different thermal sensitivities in the physiological responses of <i>N. africanum</i> from tropical and temperate populations, especially during air breathing. The differences observed in the thermal physiology between the two populations suggest that the effect of global warming on this important mangrove species may be different under different climate regimes.
62	Sahel of Africa	Gadzama, N. M. (2017). Attenuation of the effects of desertification through sustainable development of Great Green Wall in the Sahel of Africa. <i>World Journal of Science, Technology and Sustainable Development</i> , 14(4), 279–289. <a href="https://doi.org/10.1108/WJSTSD-02-2016-0021">https://doi.org/10.1108/WJSTSD-02-2016-0021</a>	The purpose of this paper is to develop the Great Green Wall (GGW) Project initially financed by the United Nation's Global Environment Facility Trust Fund, is a Pan African proposal in greening the Sahel of Africa from West (Dakar) to the East (Djibouti). It aims at reducing poverty and soil degradation in this region, taking into account the effects of desertification and climate change on sustainability of livelihoods. These results/activities give evidence of the increased public awareness of environmental degradation due to desertification and climate change in Nigeria; the realization in environmental stabilization needs with ready

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			participation of the communities for improved livelihoods in environmental activities and arid agriculture as supported by the National Great Green Wall (NAGGW) program of the country; resulting in internalization of these projects supporting livelihoods for sustainability in the Sahel of Nigeria.
63	Ethiopia	Garedew, W., Hailu, B. T., Lemessa, F., Pellikka, P. and Pinard, F. (2017) Coffee Shade Tree Management: An Adaptation Option for Climate Change Impact for Small Scale Coffee Growers in South-West Ethiopia. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) <i>Climate Change Adaptation in Africa. Climate Change Management</i> . Springer, Cham	The paper considers the possibility of developing a shade management strategy as an adaptation option to climate change impact on coffee along an altitudinal gradient. The paper characterizes the effects of changes in land use/land cover (LULC) on climate variability in Ethiopia through the use of 30 selected coffee plots along an altitudinal gradient. To determine the effect of shade (trees) on microclimate variability, the authors recorded temperature (°C) under shade and open area using data loggers along the gradient. They identified eight LULC (crop land, pasture land, exotic trees, indigenous trees, river, road, urban and extraction site) in the area. Some of the coffee plots were composed of small areas of trees and large areas of cropland and vice versa. The presence of cropped and pasture land prevented the occurrence of indigenous and exotic trees respectively. The paper indicated that based on LULC, the 30 coffee plots were grouped into three coffee classes (Isolated coffee plots (class 1), patch of coffee plots (class 2) and coffee plots with contiguous forest (class 3). Coffee plots of class 3, characterized by high tree density, has lower mean temperature and high relative humidity and wetness duration both during wet and dry season. During the wet season, there was a maximum temperature difference of 1.21 0C among the coffee classes while in the dry season it was 1.03 0C. Furthermore, a mean temperature difference of about 1 0C was observed between open and under shade conditions. Along the gradient, the variation was similar indicating a possibility of developing a shade management

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			strategy as an adaptation option to climate change impact on coffee along an altitudinal gradient.
64	Ethiopia	Geremeskel, T. and Abera, M. (2017) The Need for Transformation: Local Perception of Climate Change, Vulnerability and Adaptation Versus 'Humanitarian' Response in Afar Region, Ethiopia. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) Climate Change Adaptation in Africa. <i>Climate Change Management</i> . Springer, Cham	The paper examined the ways in which climate change and related concepts are perceived by different local actors and the contribution of humanitarian aid response towards long term adaption of pastoral communities in Ethiopia. The authors indicated that interventions which were intended to bring climate change adaptations did not achieve their purposes due to the ways decisions about interventions were made, among others. The paper explained that while the need at local level is transformation, current interventions focus on maintaining the status quo which is ineffective as there is very limited possibility that status quo can be managed given the dramatic and lasting changes the area is going through in terms of climate requiring bigger transformation.
65	South Africa	Gibson, L., Munch, Z., Palmer, A., & Mantel, S. (2017). GIS approach to land cover change prediction in south african grasslands towards determining the catchment carbon-watersurface energy flux nexus. <i>Procedia Environmental Science, Engineering and Management</i> , 4(4).	The Land Change Modeller (Idrisi Terrset 18.08) and land cover for 2000 and 2014 is used to predict land cover for the S50E catchment in the Eastern Cape Province for the year 2030. and results show that the total change (gain and loss) in the landscape over all land cover classes was 21% for the period between 2000 and 2014 and 23% from 2014 up to the prediction for 2030, with the change intensity remaining constant at 1.5% per year. It was determined that the probability of grasslands persisting is around 80% with the highest probability of grasslands being lost to woody encroachment (~4.5%) and cultivation (~6.6%). Fraction of photosynthetically active radiation (fPAR) and leaf area index (LAI) measured and used in NEE and ET modelling respectively, indicate that both fPAR and LAI are lower for grasslands than for their transition classes. This transition thus represents a gain in both catchment NEE and ET, resulting in increased carbon storage, which from a climate change perspective can be seen as a positive change

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66	Africa	Gizachew, B., Astrup, R., Vedeld, P., Zahabu, E. M., & Duguma, L. A. (2017, May). REDD+ in Africa: contexts and challenges. In <i>Natural Resources Forum</i> (Vol. 41, No. 2, pp. 92-104). Oxford, UK: Blackwell Publishing Ltd.	REDD+, a climate change mitigation mechanism that values carbon in tropical forests, is expected to provide Africa with a range of environmental and socio-economic benefits. Drawing on a vast array of literature and personal experiences, this review analyzed particular features and challenges that REDD+ implementation has faced on the continent. This review contributes to an improved understanding of the contexts and challenges to consider in the capacity and policy development for REDD+ implementation.
67	Africa	Goussard, J. J., & Ducrocq, M. (2017). Facing the future: Conservation as a precursor for building coastal territorial cohesion and resilience. <i>Aquatic Conservation: Marine and Freshwater Ecosystems</i> , 27, 151-161.	On a global scale, most of the coastal zones in the world are undergoing rapid and accelerating changes. This extremely dynamic context calls for an evolution in conservation and spatial planning strategies in order to better anticipate changes that may affect not only the sustainability of both the distribution and health of natural ecosystems, but also the relevance of conservation efforts. This paper highlighted the main factors that characterize current coastal dynamics, and then briefly presents three future-oriented pilot operations, implemented in Western Africa at different scales. The results illustrate how MPAs must become structuring elements for the organization and development of coastal territories if they are to contribute to the resilience of coastal systems and to ensure their own long-term sustainability.
68	Africa	Golam, k., Yousuf, H. A., & Dayanthi, N. (2017). Climate change impacts on tropical and temperate fisheries, aquaculture, and seafood security and implications. A review. <i>Livestock Research for Rural Development</i> , 29(1), 1-29.	To achieve sustainability in fisheries and aquaculture in line with the new global sustainable development goals (2016-2030), it will be essential to identify appropriate adaptation and mitigation measures. Such measures may include promotion of climate-smart fisheries and climate-smart aquaculture, and conservation of seagrass and seaweed beds, salt marshes, and mangroves. Community awareness and education on climate change, an introduction of climate change courses in schools, colleges, and universities and incorporation of climate change risks in all the

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			current and future development projects/plans would be vital to minimise threats and risks of climate change on fisheries, aquaculture, and seafood security. This review reveals that fisheries in the least developed tropical countries/regions such as Bangladesh, the Maldives, the Pacific islands, and parts of Africa would be most vulnerable due to lack or limited resources, capacity and capabilities to adapt to climate change and high dependency on fish, fisheries, fishing and aquaculture as a source of food, animal protein, revenues, and livelihoods.
69	Uganda	Gram, G., Vaast, P., van der Wolf, J., & Jassogne, L. (2017, July 31). Local tree knowledge can fast-track agroforestry recommendations for coffee smallholders along a climate gradient in Mount Elgon, Uganda. <i>Agroforestry Systems</i> , pp. 1–14. Springer Netherlands. <a href="https://doi.org/10.1007/s10457-017-0111-8">https://doi.org/10.1007/s10457-017-0111-8</a>	Arabica coffee ( <i>Coffea arabica</i> ) is economically important for many smallholder farmers in the Mount Elgon region of East Uganda, but its production is increasingly threatened by climate change. The objectives of this research were to develop agroforestry species recommendations and tailor these to the farmers' needs and local context, taking into consideration gender. Farmers had different needs in terms of ES and tree species at different altitudes, e.g. at low altitude they need a relatively larger set of ES to sustain their coffee production and livelihood. Local knowledge is found to be gender blind as no differences were observed in the rankings of species and ES by men and women. Ranking species by ES and ranking ES by preference is a useful method to help scientists and extension agents to use local knowledge for the development of recommendations on companion trees in AFS for smallholder farmers.
70	Sub-Saharan Africa	Gebreyes, M., Zinyengere, N., Theodory, T. F., and Speranza, C. I. (2017). Introduction: Grounding Climate Change, Vulnerability, and Adaptation in Africa. <i>In Beyond Agricultural Impacts</i> pp. 1-11.	In this paper, the authors summarize the importance of agriculture to the Sub Saharan African region. They make mention of the fact that the growth in agriculture is at least two to four times more effective in reducing poverty than in other sectors. The challenges to the growth in agriculture are also outlined and expounded. These include political instability, insecure land rights, disease burden,



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			poor access to markets, fluctuating world market prices and climate change and variability. According to them climate change has exposed agriculture in Sub Saharan Africa to additional stress. The authors of this paper claim that there is no single adaptation strategy that exist to meet the needs of African agricultural systems and contexts. It is concluded in this paper that, adaptation will need to be context-specific and could include the introduction of temperature-sensitive varieties, diversification of production systems and livelihoods, shift to sustainable agricultural intensification, shift to irrigation agriculture, and addressing institutional challenges such as poor physical and social infrastructure, knowledge and information gaps, policy and market imperfections, lack of access to credit, and lack of insurance.
71	Tanzania	Graef, F., Uckert, G., Schindler, J., König, H., Mbwana, H., Fasse, A., Kaburire, L. (2017). Expert-based ex-ante assessments of potential social, ecological, and economic impacts of upgrading strategies for improving food security in rural Tanzania using the ScalA-FS approach, “Food Security: The Science, Sociology and Economics of Food Product”. <i>The International Society for Plant Pathology</i> , 9(6), pp 1255-1270.	Subsistence farmers in sub-Saharan Africa are highly vulnerable to food insecurity given their low adaptive capacity against ecological and socio-economic shocks. Therefore, food security is one of their main challenges. Participatory action research across food value chains (FVCs) can help stabilize and enhance food security by developing upgrading strategies (UPS) that enhance specific aspects of crop production, post-harvest processing, marketing, income generation, and consumption. However, prior to their widespread adoption or upscaling, UPS need holistic understandings of their potential social, ecological, economic, and institutional challenges and opportunities in target areas. This article reports the application of the “ScalA-FS” tool, which assessed the potential success of selected UPS using assessment criteria developed by agricultural scientists and local farmers in a participatory process in Tanzania. This work is embedded in a larger participatory research project conducted in semi-arid and sub-humid ecological settings of the Dodoma and Morogoro regions of Tanzania. Results from the

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			assessment of the potential impact of the UPS differed strongly between the UPS and the social, economic and environmental assessment criteria, but only slightly between semi-arid and sub-humid regions.
72	West Africa	Guan, K., Sultan, B., Biasutti, M., Baron, C., Lobell, D. B. (2017) Assessing climate adaptation options and uncertainties for cereal systems in West Africa, <i>Agricultural and Forest Meteorology</i> , 232 (15) January 2017, pp 291-305	The article argues that successful adaptations of agriculture to climate change should not only help farmers deal with current climate risks, but also reduce negative or enhance positive impacts associated with climate change using robust climate projections. It assesses various possible adaptation options and their uncertainties for the production of staple crop. The authors adopted a new assessment framework to account for both the impacts of proposed adaptation options in the historical climate and their ability to reduce the impacts of future climate change. They analyzed uncertainties arising from crop model differences and various climate model projections. The article pointed out that most proposed adaptation options are not more beneficial in the future than in the historical climate, hence, do not really reduce negative climate change impacts. The article can be useful for climate change adaptation stakeholders as it provides insights on uncertainties for assessing future climate adaptation options.
73	East Africa	Hammond, J., Fraval, S., van Etten, J., Suchini, J. G., Mercado, L., Pagella, T., Frelat, R., Lannerstad, M., Douchamps, S., Teufel, N., Valbuena, D. and van Wijk, M. T. (2017) The Rural Household Multi-Indicator Survey (RHoMIS) for rapid characterization of households to inform climate smart agriculture interventions: Description and	The article is about Rural Household Multi-Indicator Survey (RHoMIS) as a household survey tool designed to rapidly characterise a series of standardised indicators across the spectrum of agricultural production and market integration, nutrition, food security, poverty and greenhouse gas emissions. The tool uses a digital implementation platform linked to a set of automated analysis procedures that enable immediate cross-site bench-marking and intra-site characterization. The authors were of the view that achieving climate smart agriculture (CSA) depends on understanding the links between farming and livelihood practices,

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		applications in East Africa and Central America, <i>Agricultural Systems</i> , 151, pp 225-233	other possible adaptation options, and the effects on farm performance, which is conceptualized by farmers. The article pointed out that the tool rapidly characterised variability between farming systems at landscape scales, identifying key differences across the population of farm households that would be critical for targeting CSA interventions. Strategies that enabled production intensification contributed more towards the goals of climate smart agriculture on smaller farms, whereas increased market orientation was more successful on larger farms
74	Africa	Hassen, A., Talore, D. G., Tesfamariam, E. H., Friend, M. A., & Mpanza, T. D. E. (2017). Potential use of forage-legume intercropping technologies to adapt to climate-change impacts on mixed crop-livestock systems in Africa: a review. <i>Regional environmental change</i> , 17(6), pp 1713-1724.	This paper is a review of studies conducted based on the use of forage – legume intercropping to adapt to climate change impacts. Based on research conducted in various parts of Africa, it is well demonstrated that intercropping forage legumes with cereals improves land intensification and reduces the risk of crop failure due to climate change. The paper discusses the potential benefits of forage legumes intercropping in improved productivity, efficiency of resource use and most of all resilience of the system under climate change. It was evident in the paper that this system of forage legumes intercropping plays crucial role in lowering erosion, reducing nitrogen leaching and carbon losses, promoting carbon sequestration and a reduction in methane emissions per unit of animal product. It was concluded in the paper that future research needs to focus on testing intercrop technologies for each agro-ecological zone across soil types to determine optimum spatial arrangements and geometry of companion crops for efficient utilization of resources and improve adoption of forage-legume intercropping technology by smallholder farmers in Africa.
75	Southern Africa	Jiri, O. and Mafongoya P. (2017) A Synthesis of Smallholder Farmers' Adaptation to Climate Change in	The article examines farmer adaptation strategies to climate change in southern Africa based on a cross-section database of three countries (South Africa, Zambia and Zimbabwe). The authors

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		Southern Africa: Averting Adaptation Vacuum. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) Climate Change Adaptation in Africa. <i>Climate Change Management</i> . Springer, Cham	reviewed the state of knowledge of agricultural vulnerability and responses to predicted climate change and consider adaptation options. The article describes farmer perceptions to changes in long-term temperature and precipitation as well as various farm-level adaptation measures and barriers to adaptation at the farm household level. It also reviews smallholder farmer constraints to autonomous adaptation and implications on adaptation policies. The authors indicated that adaptation measures can offset anticipated agricultural losses, reduce vulnerability and improve resilience to climate change.
76	North Africa	Jaafar, H., & King, C. (2017). Rapid assessment of the water–energy–food–climate nexus in six selected basins of North Africa and West Asia undergoing transitions and scarcity threats. <i>In The Water-Energy-Food Nexus in the Middle East and North Africa</i> pp. 55-71. Routledge.	Existing strategies for management of water scarcity in the Middle East and North Africa negotiate a complex system of trade-offs between water, energy, and food production. The effects of rural households' green water management practices on basin-level water, energy, food and carbon stocks and flows are sketched qualitatively in six basin agro-ecosystems. The case for increased strategic support for green agricultural water management practices appears stronger when weighed from the nexus perspective, rather than purely from the point of view of water balance and food production. Trade-offs under critical transitions affecting agricultural water use are explored, and the scope for quantitative monitoring is discussed.
77	Morocco	Kahime, K., Bounoua, L., Messouli, M., Boussaa, S., & Boumezzough, A. (2017). Eco-Adaptation Strategies of Health to Climate Change: Case of Zoonotic Cutaneous Leishmaniasis (ZCL) as Vulnerability Indicator in Pre-Saharan Region of Morocco. <i>Environmental Change and Human</i>	In this study the vectorial disease known as zoonotic cutaneous leishmaniasis (ZCL) which is predominant in Northern African countries and causing threat to health security in the region is investigated. The study is conducted in the province of Errachidia. The aim of the study was to assess the vulnerability of local populations to ZCL, as influenced by climate change, and identify potential adaptation strategies susceptible to reduce the risk of infection. The authors made use of interviews with local populations about their behaviour and interactions with local environmental

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		<i>Security in Africa and the Middle East pp. 117-131. Springer, Cham.</i>	changes as well as reports from the Moroccan ministry of health on the prevalence of the disease. The risk factors including micro-environmental and socioeconomic aspects that likely condition the resurgence of the disease was investigated. Eco – health-based approaches were thus discussed to determine adaptation procedures able to reduce the sensitivity and exposure of vulnerable populations.
78		Kaky, E., & Gilbert, F. (2017). Predicting the distributions of Egypt's medicinal plants and their potential shifts under future climate change. <i>PLoS ONE</i> , 12(11). <a href="https://doi.org/10.1371/journal.pone.0187714">https://doi.org/10.1371/journal.pone.0187714</a>	Climate change is one of the most difficult of challenges to conserving biodiversity, especially for countries with few data on the distributions of their taxa. Species distribution modelling is a modern approach to the assessment of the potential effects of climate change on biodiversity, with the great advantage of being robust to small amounts of data. To take advantage of a recently validated dataset, medicinal plants of Egypt were identified at hotspots of diversity by predicting the effect of climate change on the pattern of species richness using species distribution modelling. This study assessed how Egypt's current Protected Area network is likely to perform in protecting plants under climate change. The patterns of species richness show that in most cases the A2a 'business as usual' scenario was more harmful than the B2a 'moderate mitigation' scenario. Predicted species richness inside Protected Areas was higher than outside under all scenarios, indicating that Egypt's PAs are well placed to help conserve medicinal plants.
79	Kenya	Karanja, E., Kamau, G., Macoloo, C., Righa, M., van Veldhuizen, L. and Waters-Bayer A. (2017) Supporting Farmer Innovation to Enhance Resilience in the Face of Climate Change in Farming Systems	The paper focuses on local innovative adaptations of farmers to address various challenges such as declining crop and livestock production, poor soil health, water loss, pests and diseases, among other challenges that some farmers perceive as being partly related to climate change. It showed that farmers have developed various innovations related to crops, livestock and natural resource

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		in Machakos and Kitui Counties, Kenya. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) <i>Climate Change Adaptation in Africa. Climate Change Management</i> . Springer, Cham	management (NRM) in responding to irregular rainfall patterns and degradation of natural resources. These include finger millet nurseries, wall terraces for water harvesting, combining rock-hyrax manure with farmyard manure, and determining the sex of chicks before they hatch. The paper presents a new approach to agricultural research and development (ARD) that combine local innovative capacity with scientific research to increase awareness of the important role of farmer local innovation in dealing with climate change and other challenges to improve food security, NRM, the livelihoods of farm families and to benefit the wider community.
80	Kenya	Kimeli, P., Nyasimi, M. and Radeny, M. (2017) Strengthening Farmer Adaptive Capacity Through Farms of the Future Approach in Nyando, Western Kenya. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) <i>Climate Change Adaptation in Africa. Climate Change Management</i> . Springer, Cham	The paper documents the learning experiences of farmers from Nyando, in Western Kenya, who participated in a climate learning journey across other counties in Kenya. The paper also shows how these farmers are planning to use their learning experiences to design local adaptation plans of actions. The authors applied a Climate Analogue tool that connects sites with statistically similar ('analogous') climatic conditions, across space and time. The tool connects farmers and agricultural stakeholders to their plausible future climates through the Farms of the Future (FotF) approach where farmers learn about potential adaptation strategies and institutional innovations through farmer-to-farmer exchanges between analogue sites. The FotF approach can be used together with ongoing support for participatory action research to build reflective capacity and awareness of challenges farmers are likely to face and to identify and develop possible solutions among farmers and other agricultural stakeholders.
81	Ghana	Kumasi, T.C., Antwi-Agyei, P. and Obiri-Danso, K. (2017) Small-holder farmers' climate change adaptation practices in the Upper East Region	The paper assessed the existing adaptation strategies implemented by farmers in the Upper East Region of Ghana to reduce the adverse impacts of climate change and variability. The authors categorized farmers' adaptation to climate change and variability under

No	Region	Citation	Annotation
		of Ghana, <i>Netherlands, Environment, Development and Sustainability</i> , pp 1–18. <a href="https://doi.org/10.1007/s10668-017-0062-2">https://doi.org/10.1007/s10668-017-0062-2</a>	agricultural, water management, communal pooling and livelihood diversification techniques. The article showed that farmers, especially female farmers, were constrained by the lack of property rights of farmlands, lack of credit facilities and lack of access to irrigation facilities, inadequate climate change information and inadequate seeds for planting. The authors recommended that farmers should be encouraged to form farmer-based associations to network socially, access credit facilities, land, insurance products, extension services and training to empower communities and women. Fostering peer exchange of information between communities will ensure best practices, and lessons learnt are shared and scaled-up. The article can help farmers engaged in dryland farming systems to cope with climate change and variability.
82	Benin	Kosmowski, F. and Lalou, R. (2017) The Association of Monetary, Multidimensional and Traditional Poverty with Climate Change Adaptive Capacities in Northern Benin. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) <i>Climate Change Adaptation in Africa. Climate Change Management</i> . Springer, Cham	The article uses a cross-sectional survey to explore the effect of poverty on adaptive capacities in northern Benin. The authors considered the multidimensional nature of poverty and indicated that poverty represents a constraint for a household's adaptive capacities to climate change. The article considers the monetary, multidimensional and traditional indices of poverty along with two proxies of adaptive capacities (crop-related changes and perceived coping strategies). The authors indicated that that in a context of rural poverty, social capital plays an important and potentially compensating role in fostering adaptive capacities. The article will help all climate change adaptation stakeholders to know that a purely economic view, most often relying on a single poverty measure, is insufficient to understand the complexity of the poverty-adaptive capacity nexus.
83	Senegal	Koudahe, K., Djaman, K., Bodian, A., Irmak, S., Sall, M., Diop, L., Balde, A. and Rudnick, D. (2017)	The article considered rainfall and evapotranspiration as vital elements for food production under rainfed agriculture. It examined temporal trends in annual and monthly aridity index, rainfall and

No	Region	Citation	Annotation
		Trend Analysis in Rainfall, Reference Evapotranspiration and Aridity Index in Southern Senegal: Adaptation to the Vulnerability of Rainfed Rice Cultivation to Climate Change. <i>Atmospheric and Climate Sciences</i> , 7, 476-495. doi: 10.4236/acs.2017.74035.	evapotranspiration in the southern Senegal. The authors reveal that the region will be drier with a significant increase in aridity (severity of drought across the region). Climate-smart agriculture management practices were adopted to increase resilience to climate change. Adaptation strategies to the vulnerability of crop production/rainfed rice cultivation to the changes in climate included the adoption of high yielding short to medium duration rice varieties; small-scale water harvesting methods such as terracing, using dams and ditches to channel run-off into fields, creating ponds, tanks and sub-surface storage in sand and soil; conservation tillage; and mulch or residue cover management to reduce soil water evaporation.
84	Nigeria	Kim, I., Elisha, I., Lawrence, E., & Moses, M. (2017). Farmers Adaptation Strategies to the Effect of Climate Variation on Rice Production: Insight from Benue State, Nigeria, <i>Environment and Ecology Research</i> 5(4): 289-301, DOI: 10.13189/eer.2017.050406	The study investigated farmers' adaptation strategies to the effect of climate variation on rice production in Agatu Local Government Area of Benue State. Specifically, the study assessed the socio-economic characteristics of farmers, farmers' climate related constraints, the adaptation strategies employed by farmers and barriers to adaptation practices. Multi-stage sampling technique was used to select two hundred and forty respondents for the study. Data collected through questionnaire were analyzed using frequency counts, percentages, mean distribution and Pearson Product Moment Correlation. Results obtained showed that farmers in the study area were mostly males with a mean age of 42.8 years. Major climate related constraint cited were high rate of weed growth ( $\bar{\chi}=2.8$ ), stunted growth ( $\bar{\chi}=3.2$ ), incidence of flooding ( $\bar{\chi}=2.6$ ) and low rainfall ( $\bar{\chi}=3.4$ ). Pearson product moment correlation indicated that there were significant and positive relationships between perceptions of climate change indicators (increasing flood, increasing hot temperature, unpredictable rain and shorter duration of rain) and adaptation strategies. Therefore, efforts should be



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			geared towards reinforcing farmers' adaptability to climate change through improved rice species that are tolerant to change in climate elements and weather extremes like flood and drought, enhancement of farmers' income through provision of credit facilities and encouragement of irrigation farming as supplements to rain fed agriculture in the study area.
85	North Africa region	Kuper, M., Amichi, H., & Mayaux, P. L. (2017). Groundwater use in North Africa as a cautionary tale for climate change adaptation. <i>Water International</i> , 42(6), 725-740.	The recent history of groundwater use in North Africa provides a cautionary tale for climate change adaptation. Even though the short-term threats of groundwater overexploitation are clear, and territorially bounded, and involve comparatively few players, in recent decades, agricultural intensification has consistently increased pressure on the available resources. Groundwater has been governed through a dynamic interplay between formal rules and informal practices that focused more on maintaining fragile socio-political compromises than on ensuring environmental sustainability. If it is to be effective, climate change adaptation will need to muster the sort of political legitimacy that sustainable groundwater management is currently lacking.
86	East Africa	Lyon, S. W. (2017, April). Developing Eastern Africa's resilience to flood and drought through multi-functional ecosystem-based management strategies. In EGU General Assembly Conference Abstracts 19, pp. 16464.	This study focuses on the conflict of flooding and drought in urban and agricultural areas of Eastern Africa by looking at ecosystem service trade-offs relevant for water-based disasters as populations transition from rural to more intensive agricultural and urban lifestyles. The study highlights on how research being conducted may still provide an improved system understanding of resource flows even when working under less than perfect conditions. Kilombero valley was used as an example of existing nature-based approaches dealing with disaster risk reduction. The authors recognize that there can be transfer of knowledge across borders concerning the kilombero valley. Thus, the main goal of the study is to empower planners and stakeholders throughout the region by

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			helping translate their knowledge into effective adaptation strategies as well as linking experiences through transfer of information.
87	Kenya	López Noriega, I., Dawson, I. K., Vernooy, R., Köhler-Rollefson, I., & Halewood, M. (2017). Agricultural diversification as an adaptation strategy. <i>Agriculture for Development</i> 30:25-28.	This paper focuses and discusses on the utilization of agricultural biodiversity in risk reduction and climate adaptation strategies. The authors recognize and report that despite the ample evidence of the value of agricultural biodiversity in climate change adaptation, the scalability of biodiversity -based measures is limited. Discussed in the paper are the importance of agricultural biodiversity for agricultural production, agricultural biodiversity in climate change adaptation strategies and the role of policies in promoting or hindering the conservation and use of agricultural biodiversity for climate change adaptation. The authors recommend the development of public policies as important in facilitating or hindering the adoption and spread of measures based on agricultural biodiversity.
88	Southern Africa	Makate, C., Makate, M., & Mango, N. (2017). Smallholder farmers' perceptions on climate change and the use of sustainable agricultural practices in the Chinyanja Triangle, Southern Africa. <i>Social Sciences</i> , 6(1), 30.	The paper sought to investigate smallholder farmers' perceptions on climate change and their responses through the use of sustainable agricultural practices (SAPs) as an adaptation strategy in the Chinyanja Triangle, Southern Africa. It points out that farmer's perceptions significantly influence the use of sustainable agricultural practices such as the use of grain legume rotations, inorganic fertilizers, compost, and farmyard manure. The authors are of the view that adaptation and pliability of farmers to the effects of climate change should be a social process involving the collective efforts from various stakeholders. The article can assist policy makers to target climate change adaptation policies at enhancing climatic resilience in smallholder farming communities
89	South Africa	Masipa, T.S., (2017). 'The impact of climate change on food security in South Africa: Current realities and	This article sought to examine the impact of climate change on food security in South Africa. The study established further that the vulnerability of food security to climate change differs from country

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		challenges ahead', Jambá: <i>Journal of Disaster Risk Studies</i> (1), a411.	to country. Thus, in depth literature review is done on the subject matter for different countries in the sub-Saharan Africa region. The main approach or method to achieve the said objective was through a desktop study approach, involving previous studies, reports, surveys and policies on climate change and food security. Analysis from the article reveals that climate change presents a high risk to food security in Sub-Saharan African countries from crop production to food distribution and consumption. After establishing the fact that climate change, particularly global warming affected and continuous to affect food security through food availability, accessibility, utilization and affordability, the author made it clear that South Africa's ability to adopt and protect its food items depends on the understanding of risks and vulnerability of various food items to climate change. He further stated that in order to mitigate these risks, there is the need for an integrated policy approach to protect arable land against global warming. South Africa's ability to understand the risks and vulnerability of various food items to changes in climate was also considered key and very important. This article further suggests that a fight against food insecurity requires not a blanket approach but a multipronged strategy to address other socio-economic challenges.
90	Kenya	Mbuthia, K. W., Kioli, F. N. and Wanjala, K. B. (2017) Environmental Determinants to Household Food Security in Kyangwithya West Location of Kitui County, <i>Journal of Food Security</i> , 2017, 5(4), 129-133	The paper analyzed the environmental determinants to household food security in Kyangwithya West location of Kitui County. The authors pointed to inadequate rainfall, high temperatures, recurrent drought, among others as observed weather changes. The article revealed that majority of the households observed changes in weather patterns although the percentage of food secure was low. Inadequate rainfall was the most observed weather change with the most influence on household food security followed by high temperatures and recurrent droughts. Majority of the households did

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			not cut trees and are more food secure than those that cut trees. As indicated in the article, environmental factors are significant determinants to household food security. The authors recommended that regular updates on weather forecast be made available to households to enable them to make informed plans during planting seasons.
91	Global	McNamara, K. E. and Buggy, L. (2017) Community-based climate change adaptation: a review of academic literature, <i>Local Environment</i> , 22(4), pp 443-460, DOI: 10.1080/13549839.2016.1216954	The paper reviews 128 publications on community-based climate change adaptation identified through a systematic database search. It indicates that community-based adaptation (CBA) is driven by a number of factors such as recognition of the human dimensions of changes; appreciation of the role of local knowledge for strengthening adaptive capacity; and a push to focus on the scale at which impacts are felt. It links these factors with pro-poor development outcomes. It defines key enablers for effective CBA, which included: use participatory approaches; recognise that adaptation is a social process; and support CBA at multiple scales. it shows that there has been a growing emphasis in the literature to re-conceptualise CBA, which will require focusing on innovation, learning and multi-sectoral approaches.
92	Ethiopia	Merid, T., Emirie, G. and Simane, B. (2017) Local Climate Change Perceptions and Adaptation Strategies in East Gojjam Zone, Northwestern Ethiopia: Anthropological Approach. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) Climate Change Adaptation in Africa. <i>Climate Change Management</i> . Springer, Cham	The article, based on anthropological approach, deals with perceptions, indicators and adaptive strategies of climate change. The authors emphasized that local climate change negatively affects the physical environment, thereby affecting the communities' agricultural activity which serve as means of subsistence. The article showed that the communities used different adaptive strategies such as developing positive attitude towards the physical environment through discussion, shifting the time of farm operation, making the working plan flexible in line with rainfall availability, changing crop varieties from traditional seed to improved ones, diversifying the crops, mobilize local labor in the form of exchange and in terms of

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			cash, and participating in environmental rehabilitation program such as watershed management to cope with the effects of climate change.
93	Uganda	Mfitumukiza, D., Barasa, B., & Ntale, E. (2017). Ecosystem-based Adaptation to Drought among Agro-pastoral Farmers: Opportunities and Constraints in Nakasongola District, Central Uganda. <i>Environmental Management and Sustainable Development</i> , 6(2), pp 31-50.	The paper presents an understanding to the context and importance of ecosystem-based adaptation (EbA) by agro-pastoralists is important for building climate resilient social and ecological systems amidst the changing climate. A cross-sectional survey was conducted to examine the EbA to drought by the smallholder farmers in Nakasongola District where a total of 100 respondents were randomly selected and subjected to interviews. To supplement on this information, a land use/cover spatial dataset of 2016 for Uganda was obtained and analysed to characterize and quantify the distribution of ecosystems utilised by the agro-pastoralists in the District. The spatial results revealed that the grassland (1524.6sq.km) and agricultural (agroecosystem) (779.1sq.km) ecosystems were the largest ecosystems followed by the forest/woodland and freshwater ecosystems in terms of coverage. The farmers perceived severe droughts to occur between December to January for the last 30 years with an average of 4 years return period. The agro and grassland ecosystems were the main contributors of drought adaptation opportunities compared to the freshwater and forest/woodland ecosystems. The direct and indirect opportunities involved goods and services such as water provision, mulching materials, food provision, fuelwood, regulation of air quality and water flow. However, the major constraints to EbA included rampant deforestation, limited knowledge on ecosystem conservation and overgrazing. Thus, increasing water supplies for domestic and agricultural production is more likely increase the farmer's adaptation to drought.

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94	Mauritius	Ministry of Agro-Industry and Food Security. (2017) Ecosystem-Based Adaptation strategies for a resilient Mauritian Protected Area Network. Republic of Mauritius.	This paper stipulates the role of healthy ecosystem and its important role in delivering economic, social and environmental services to the Mauritian people and economy. The country's ecosystems of key biodiversity importance include forests that are supportive to both mitigation (net carbon sink) and adaptation (maximising the sustainable use of ecosystem services) strategies. Ecosystem based strategies employed includes; ecotourism, providing initiatives and attracting international donor for carbon sequestration, exploration and implementation of national incentive schemes (payment of ecosystem services, dedicated ecological taxes and biodiversity offset schemes).
95	Africa	Minayeva, T. Y., Bragg, O., & Sirin, A. A. (2017) Towards ecosystem-based restoration of peatland biodiversity. <i>Mires and Peat</i> , 19(1), 1-36. DOI: 10.19189/MaP.2013.OMB.150	The article examines the far-reaching implications for the assessment of peatland biodiversity as well as for the drivers, methods and targets of peatland conservation and restoration initiatives. It indicates that natural peatlands support rich biological diversity at the genetic, species, ecosystem and landscape levels. However, because the character of this diversity differs from that of other ecosystem types, the value of peatlands for biodiversity has often been overlooked. The article stressed that the availability of intact peatlands for staging and feeding on migration routes determines bird population numbers in parts of their ranges that may be distant from their breeding grounds, for example in Africa or central Asia for species that breed in the Arctic. The authors pointed out that peatland ecosystems direct part of the energy captured by primary production into long-term storage within a peat layer, and thus establish a structural and functional basis for biodiversity maintenance that is not found elsewhere. The authors were with the view that a developed robust framework for the management and restoration of peatland biodiversity must be founded in structural-functional ecosystem analysis.

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96	Mauritius	Ministry of Agro-Industry and Food Security (2017c). Ecosystem valuation of catchment from Mare Longue / Mare aux Vacoas to downstream users. Preparatory study for the National Biodiversity Strategy and Action Plan (NBSAP) for the Republic of Mauritius 2017 - 2025.	The Mauritian national biodiversity strategy and action plan (NBSAP); 2017-2025, has been prepared through and iterative process of stakeholder consultation and approval, addressing Mauritian obligations under article 6a of the convention on biological diversity (CBD). This document present the Vision, mission statement, working principles and strategic objectives of NBSAP. Stakeholders are called upon to set up ambitious but realistic national targets taking into consideration the local challenges in terms of financial resource, human capacity and time constraints. The working principles stipulated by the NABSAP are; Integration of the ecological, social and economic values of biodiversity into decision-making; Effective in-situ and ex-situ biodiversity conservation and / or restoration; Minimising the direct and indirect pressures on biodiversity and ecosystem services; Biodiversity mainstreaming in the public and private sectors; Effective information sharing, NBSAP monitoring and delivery; The ecosystem approach.
97	South Africa	Mugambiwa, S. S., and Tirivangasi, H. M. (2017). Climate change: A threat towards achieving'Sustainable Development Goal number two'(end hunger, achieve food security and improved nutrition and promote sustainable agriculture) in South Africa, Jàmbá: <i>Journal of Disaster Risk Studies</i> , 9(1), 1-6.	This article assesses the impacts of climate change towards the achievement of Sustainable Development Goal number two (SDG 2) as well as examining the poverty alleviation strategies by subsistence farmers in South Africa. Widespread hunger and poverty continue to be among the most life-threatening problems confronting mankind. Available statistics show that global poverty remains a serious challenge around the world. Across the globe, one in five people lives on less than \$1 a day and one in seven suffers from chronic hunger. Similarly, the developing world is adversely affected by poverty and hunger. In the sub-Saharan Africa, research has revealed a higher prevalence of hunger, malnutrition, poverty and food insecurity. SDG 2 focuses more on eliminating hunger and promoting sustainable agriculture. The study employed an

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			exploratory design and a qualitative method. Snowball sampling was used in selecting relevant sources which led the researchers to other research work on the same field through keywords and reference lists. The researchers employed discourse analysis to analyse data. The study discovered that there are numerous potential effects climate change could have on agriculture. It affects crop growth and quality and livestock health. Farming practices could also be affected as well as animals that could be raised in particular climatic areas. The impact of climate change as well as the susceptibility of poor communities is very immense. The article concludes that climate change reduces access to drinking water, negatively affects the health of people and poses a serious threat to food security.
98	Egypt	Muñoz-Rojas, M., Abd-Elmabod, S. K., Zavala, L. M., De la Rosa, D. and Jordán, A. (2017) Climate change impacts on soil organic carbon stocks of Mediterranean agricultural areas: A case study in Northern Egypt, <i>Agriculture, Ecosystems &amp; Environment</i> , 238, pp 142-152	The authors applied the CarboSOIL model and global climate models to predict and analyse the effects of short- (2030), medium- (2050) and long-term (2100) climate changes on low soil organic C (SOC) contents at standard soil depths (0–25, 25–50 and 50–75 cm) in a Mediterranean arid area (El Fayoum, Northern Egypt) for different land use types. They demonstrated the importance of assessing SOC contents and dynamics along the soil profile and the potential for soil C sequestration particularly in the subsoil. They indicated that an overall decrease of SOC contents in the topsoil soil layer and increases in the subsoil layers are expected in the short, medium and long term. However, intensity of these changes will depend on the land use type. They showed that agricultural land uses relying on irrigation will be particularly vulnerable to losses of SOC stocks.
99	West Africa	Momodu, A. S. (2017). Energy use: Electricity system in West Africa and climate change impact.	This article investigates a low carbon pathway, the theoretical frame for understanding the tradeoffs between economic development and climate change. These are recommended considering the region's



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		<i>International Journal of Sustainable Energy Planning and Management</i> , 14. <a href="https://doi.org/10.5278/ijsepm.2017.14.3">https://doi.org/10.5278/ijsepm.2017.14.3</a>	specific economic and political conditions where funds are tremendously difficult to raise. Implementing these recommendations will allow the electric power industry in West Africa to contribute to achieving sustainable development path.
100	West Africa	Momodu, A. S., Addo, A., Akinbami, J.-F. K., & Mulugetta, Y. (2017). Low-carbon development strategy for the West African electricity system: preliminary assessment using System dynamics approach. <i>Energy, Sustainability and Society</i> , 7(1). <a href="https://doi.org/10.1186/s13705-017-0113-4">https://doi.org/10.1186/s13705-017-0113-4</a>	Policy makers seek to understand the trade-offs needed between economic growth and climate change. This provides the context to explore low-carbon development (LCD) pathways for the West African electricity system. Electricity Planning-Low-Carbon Development (EP-LCD) model—with three modules, was developed for assessing WAPP in low carbon economy. High leverage points identified in the model simulation situate three policy options for overcoming poverty and mitigation targets as regards resource mix, investment cost recovery, and technical factors to reduce system's environmental footprint
101	Ethiopia	Moat, J., Williams, J., Baena, S., Wilkinson, T., Gole, T. W., Challa, Z. K., Demissew, S. and Davis, A. P. (2017) Resilience potential of the Ethiopian coffee sector under climate change, <i>Nature Plants</i> , 3, 17081	The article focuses on understanding the influence of climate change on coffee production against a backdrop of rapidly increasing temperatures and decreasing rainfall. The authors used a modelling approach in combination with remote sensing, supported by rigorous ground-truthing, to project changes in suitability for coffee farming under various climate change scenarios, specifically by assessing the exposure of coffee farming to future climatic shifts. The article showed that 39 - 59% of the growing area could experience climatic changes that are large enough to render them unsuitable for coffee farming, in the absence of significant interventions or major influencing factors. Conversely, relocation of coffee areas, in combination with forest conservation or re-establishment, could see at least a fourfold (>400%) increase in suitable coffee farming area. Key coffee-growing areas that are

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			susceptible to climate change, as well as those that are climatically resilient were identified
102	Zambia	Mulenga, B. P., Wineman, A. and Sitko, N. J. (2017) Climate Trends and Farmers' Perceptions of Climate Change in Zambia, <i>Environmental Management</i> , 59(2), pp 291–306	The article analyzes climate trends and compares local narratives of climate change with evidence found in meteorological records in Zambia. As pointed out by the authors, farmers offered remarkably consistent reports of a rainy season that is growing shorter and less predictable. For some climate parameters, notably, rising average temperature, there was a clear overlap between farmers' observations and patterns found in the meteorological records. The article however, indicated that the data did not support the perception that the rainy season used to begin earlier, and the authors did not detect a reported increase in the frequency of dry spells. Policy recommendations to help farmers adapt to climate change/variability, as well as suggestions to shape future climate change policies, programs, and research in developing countries were provided
103	Ethiopia	Muluneh, A., Stroosnijder, L., Keesstra, S. And Biazin, B. (2017) Adapting to climate change for food security in the Rift Valley dry lands of Ethiopia: supplemental irrigation, plant density and sowing date, <i>The Journal of Agricultural Science</i> , 155 (5), pp. 703-724	The article assesses the ability of farm-level adaptation options to offset the negative impacts of climate change and to improve food security. The authors employed the MarkSim Global Climate Model weather generator to generate projected daily rainfall and temperature data originally taken from the ECHAM5 general circulation model and ensemble mean of six models under high (A2) and low (B1) emission scenarios. The FAO AquaCrop model was validated and subsequently used to predict maize yields and explore three adaptation options: supplemental irrigation (SI), increasing plant density and changing sowing date. The article showed that SI is a promising option to bridge dry spells and improve food security in the Rift Valley dry lands of Ethiopia. It also indicated that shifting the sowing period of maize from the current Belg season (mostly April or May) to the first month of the longer rainy season (Kiremt)

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			(June) could offset the predicted yield reduction. The article showed that without adaptation, the occurrence of climate change will have negative effects on food security. However, the use of SI and shifting sowing dates are viable options for adapting to the changes, stabilizing or increasing yield and therefore improving food security for the future.
104	Nigeria	Musa, M. W. and Umar, S. (2017) Advancing the Resilience of Rural People to Climate Change through Indigenous Best Practices: Experience from Northern Nigeria. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) Climate Change Adaptation in Africa. <i>Climate Change Management</i> .	The paper shares experiences derived from the analysis of indigenous best practices employed by irrigation farmers in coping with the adverse effects of climate change in two agro-ecological zones of Katsina State in northern Nigeria. It highlights the valuable lessons, provoke critical thinking and give insights into the contributions rural people have to offer in addressing the context-specific issues of climate change. The article shows that in northern Nigeria, rural people and their communities have over long periods of time built indigenous strategies, coping mechanisms and best practices which have enabled them adapt to climate change threats. However, the authors indicated that the scientific, economic and social potentials associated with their mitigation and adaptive strategies have not been adequately unraveled or recognized in Nigeria's climate change policy formulation and implementation. The article will help all stakeholders within the national and international domains to urgently respond to the possibility of creating conditions that permits equitable and environmentally sustainable development
105	Kenya	Mungai, C., Opondo, M., Outa, G., Nelson, V., Nyasimi, M. and Kimeli, P. (2017) Uptake of Climate-Smart Agriculture Through a Gendered Intersectionality Lens: Experiences from Western Kenya. In: Leal Filho	The article demonstrates how a gendered intersectionality lens can be used to explore how and the extent to which farming communities are coping with climate change in western Kenya. It reveals how farmers, regardless of whether they are male or female, are willing to adopt climate smart technologies and practices although factors such as education, age and marital status determine

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		W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) Climate Change Adaptation in Africa. <i>Climate Change Management</i> . Springer, Cham, pp 587-601	the levels of uptake of climate-smart agriculture (CSA) technologies and practices. In addition, ethnicity which highlights existing social and cultural norms and practices related to farming among people within a community affected the rate of uptake. The authors pointed out that using a gendered intersectionality lens strengthens the argument for targeted interventions which focus on local needs and priorities while recognizing local contexts as informed by social, cultural and economic factors.
106	South Africa	Munyai, R. B. (2017). An assessment of community flood vulnerability and adaptation: A case study of Greater Tzaneen Local Municipality, South Africa (Doctoral dissertation), UnivenIR Repository, Department of Geography and Geo-Information Sciences, school of environmental sciences, <i>Retrieved from: <a href="http://hdl.handle.net/11602/941">http://hdl.handle.net/11602/941</a></i>	This study assesses flood vulnerability and adaptation in Limpopo province of South Africa. This study sought to establish the determinants of flood vulnerability assess the levels of flood vulnerability and coping strategies by communities. A quantitative survey approach was used to identify what determines flood vulnerability, indicators and coping strategies. Findings revealed that flood vulnerability in the study area was determined by dwelling quality, poor or lack of drainage, education levels, employment status, rainfall amount and topography. Some of the most prominent coping strategies in study areas were making „Le-guba“ around houses, sand-bags, making a furrow around houses and on roads and temporary relocation. It is expected that results from this study will contribute to flood disaster risk reduction. Some key recommendations made by the researcher includes public awareness; integrating modern mitigations with local knowledge; development of programs to ensure resilience through incorporation of (Integrated Development Planning) IDP and flood management and flood early warning system.
107	Mali and Burkina	Muthee, K., Mbow, C., Macharia, G. and Filho, W. L. (2017), “Ecosystem-Based Adaptation (EbA) as an adaptation strategy in	This study analyzed the dimensions of Ecosystem Services (ES) in the adaptation projects. We examined the Ecosystem Based Adaptation (EbA) concept based on thirty-one sample projects from Burkina Faso and Mali. Results showed that 49% of the adaptation

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		Burkina Faso and Mali”, in Leal Filho, W., Simane, B., Kalangu, S., Menas, W., Munishi, P. and Musiyiwa, K. (Eds), <i>Climate Change Management</i> , Springer Publishers, London, pp. 205-215	projects were within the agricultural sector, with generally low budgetary consideration and medium-term implementation duration. The projects mainly aimed to provide regulation and provisioning ES. Explicit EbA strategies were present in 16% of the studied projects, implying a limited consideration of ES in adaptation projects. The projects were largely sectoral with minimal integrated adaptation approaches. The study concludes that more considerations should be taken on community-based needs using natural assets for responding to climate change impacts. It recommends more inclusion of EbA concepts in the national adaptation policies, integration of local, indigenous and scientific knowledge to adaptation, and increased research on the EbA concept to support adaptation and mitigation strategies.
108	Kenya	Mutunga, E. J.; Charles, K. N.; Patricia, M. (2017), Smallholder Farmers’ Perceptions and Adaptations to Climate Change and Variability in Kitui County, Kenya, <i>Journal of Earth Science, Climate Change</i> , 8:389.	The article assessed the perceptions of small-scale farmers on climate change in selected villages in Kitui County, Kenya, and identify adaptation measures adopted by the farmers in response to climate change. The authors pointed out various adaptation options adopted by farmers in response to the decreasing rainfall and the unpredictable onset of rains. The article established that farmers in drier areas perceived climate change more and had adapted more to climate change and variability as compared to those in wetter areas. To increase the resilience of farmers in areas affected by climate change and variability, the authors suggested resources in terms of credit facilities, access to climate change information and extension services should be made available.
109	Kenya	Muriithi, G. M., Mutuma, E., Kinyua, J. M., Kaptalai, A. S., & Kipronoh, K. A. (2017). Assessment of vulnerability levels and coping strategies of pastoral communities to	The study was conducted to assess the vulnerability levels and coping strategies of the West Pokot communities with a view to recommending appropriate adaptation measures. Both case study and cross-sectional research designs were used. Interview schedules, guides and livelihood indicators were the tools used in

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		climate variability and change: A case study of the West Pokot, Kenya. <i>Livestock Research for Rural Development</i> . 29(9), 183.	the assessment of vulnerability and adaptation to climate change and variability. The sample size of respondents was 106. Statistical evidence of climate change was computed from historical climatic data of West Pokot County. It included daily rainfall, number of rain days and maximum and minimum temperatures for 31 years. Majority (62%) of the household respondents were highly vulnerable to adverse effects of climate change and variability. Households headed by women showed highest (63%) vulnerability levels and the poorest coping strategies to the adverse effects of climate change and variability against 53% for men.
110	sub-Saharan Africa	Notenbaert, A., Pfeifer, C., Silvestri, S. and Herrero, M. (2017) Targeting, out-scaling and prioritising climate-smart interventions in agricultural systems: Lessons from applying a generic framework to the livestock sector in sub-Saharan Africa, <i>Agricultural Systems</i> , 151, pp 153-162	The article described how a developed generic framework for targeting, out-scaling and prioritising climate smart agriculture (CSA) interventions in agricultural systems could be applied to CSA prioritization in livestock production systems in sub-Saharan Africa. The framework provided a generic, step-by-step guide for supporting decision-making processes. The authors illustrated with examples across a variety of livestock production systems and scales that the generic framework was applicable in different forms and settings. The article can be useful for CSA planners and implementers at all levels and can inform the planning process for climate-smart agriculture, which invariably involves multi-stakeholder, multi-scale and multi-objective decision-making.
111	Global	Niles, M. T., Ahuja, R., Esquivel, M. J., Mango, N., Duncan, M., Heller, M., Tirado, C. (2017) Climate change and food systems: Assessing impacts and opportunities. Meridian Institute, Washington, DC.	The document reviews peer-reviewed literature that examines the mutual impacts of food system activities and climate change and illustrate how applying a food systems perspective to climate change mitigation actions can be used to drive transformation and help policymakers anticipate effects from specific mitigation and adaptation opportunities. It offers a broad perspective on food system activities and seeks to help stakeholders explore new partnerships, share knowledge, and identify diverse communities,

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			sectors, and other stakeholders that have roles to play in support of changes needed within their food systems to contribute to sustainable, equitable, and resilient food systems. It highlights critical considerations for identifying and evaluating actions for climate change mitigation and food systems transformation. It focuses not only on agricultural production, but pre-production and post-production activities which also contribute significantly to climate change. It emphasized on the development of mitigation alternatives for pre-production and post-production activities in low-, middle- and high-income countries. The document offers eight key Climate Change Food Systems Principles to support stakeholders' engagement in developing food system transformation strategies and identifying adaptation and mitigation opportunities through a food systems lens. The document can contribute to the development of governance approaches by identifying relevant literature, gaps, and opportunities across varying scales for policy approaches.
112	Mozambique	Niquisse, S., Cabral, P., Rodrigues, Â., & Augusto, G. (2017). Ecosystem services and biodiversity trends in Mozambique as a consequence of land cover change. <i>International Journal of Biodiversity Science, Ecosystem Services and Management</i> , 13(1), 297–311. <a href="https://doi.org/10.1080/21513732.2017.1349836">https://doi.org/10.1080/21513732.2017.1349836</a>	The incorporation of ecosystem services (ES) information in planning decisions is an important factor in the sustainable use of natural resources. However, studies assessing the levels and changes of these services at national level are rare. In this paper, it was estimated of the past and future changes in multiple ES and biodiversity, as a consequence of land cover change (LCC) in Mozambique. Water yield, water quality, erosion regulation, climate regulation, and biodiversity were modeled using a spatially explicit approach. Changes in ES and biodiversity were mapped at province level between 2005 and 2009. Through the use of a land change model, land cover was projected for 2025, and the resulting impacts on ES and biodiversity were estimated.

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113	Kenya	Ngigi, M. W., Mueller, U. and Birner, R. (2017) Gender Differences in Climate Change Adaptation Strategies and Participation in Group-based Approaches: An Intra-Household Analysis from Rural Kenya, <i>Ecological Economics</i> , 138, pp 99-108	The article examines how husbands and wives within the same household perceive climate risks and use group-based approaches as coping strategies. The authors conducted Intra-household survey involving 156 couples in rural Kenya. The article indicated that options for adapting to climate change closely interplay with husbands' and wives' roles and responsibilities, social norms, risk perceptions and access to resources. A higher percentage of wives were found to adopt crop-related strategies, whereas husbands employ livestock- and agroforestry-related strategies. The article indicated gender-specific climate information needs, trust in information and preferred channels of information dissemination. It was established that group-based approaches benefit husbands and wives differently. It was suggested that policy interventions that rely on group-based approaches should reflect the gender reality on the ground in order to amplify men's and women's specific abilities to manage risks and improve well-being outcomes in the face of accelerating climate change.
114		Nunan, F. (Ed.). (2017). <i>Making climate compatible development happen</i> . Taylor & Francis.	The concept of climate compatible development (CCD) through exploring what it might look like, how it could be achieved in practice and identifying challenges and dilemmas raised by CCD. The book brings together research that explores the assumptions underlying CCD and applies the concept in a range of geographic and sectoral settings. The volume makes a significant contribution to the theorisation and evidence-base for how development efforts can be made more climate resilient and with lower greenhouse gas emissions than a 'business as usual' approach. It provides critical reflections on the vision and conceptualisation of CCD, exploring how to encourage it, and what trade-offs and challenges may be encountered. The contributions discuss the feasibility of achieving CCD, mechanisms that may support progress towards it, challenges



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			that may be experienced and the roles of, and impacts on, different stakeholder groups. Following a critical reflection on the concept of CCD, the potential nature of, and barriers to, CCD, it is examined in relation to agriculture, renewable energy, forestry, pastoralism, coastal areas and fisheries, with case studies taken from countries including Ghana, India, Kenya, Mongolia, Mozambique and Peru. The book provides a valuable cross-sectoral and international critical reflection on the theory and practice of CCD, and will be a resource for postgraduates, established scholars and undergraduates from any social science discipline, policymakers and practitioners studying or working on areas related to the interface between environment (climate change).
115	Nigeria	Nwaogu, C., Okeke, J. O., Okeke, H. U., Olawoyin, M. A., & Pechanec, V. (2017). Land use-land cover change, and its effects on nature conservation: A geoinformatics based approach in Oguta, South-Eastern Nigeria. In <i>International Multidisciplinary Scientific GeoConference Surveying Geology and Mining Ecology Management, SGEM 17</i> , pp 959–966). <a href="https://doi.org/10.5593/sgem2017/21/S07.121">https://doi.org/10.5593/sgem2017/21/S07.121</a>	Climate change and population growth are the key drivers of land use-land cover (LULC) change in sub-saharan Africa. Ecosystem services from the species biodiversity have been the sources of food and energy in Nigeria through agriculture and provision of food, firewood, and shelter. The study aimed at using Remote sensing and GIS in assessing LULC change, and its impacts on the major plant species towards restoring the natural ecosystem in the area. The result revealed that 1987 recorded the highest percentage cover for all plant species including chromolaena odorata and panicum maximum, and other species while, 2015 showed the lowest under all the investigated land-use types except wetland. The finding also revealed that wetland had 87.3% increase between 1987 and 2002, and 53% increase between 1987 and 2015. Recommendations were given on the conservation measures as to salvage human and flora communities since our analysis revealed that they will all become extinct in the next 3-4 decades if no action is taken.
116	South Africa	Ntombela, K. P. (2017). Assessing livestock farmers' ecological	This study is about local knowledge and understanding of climate change and variability (and associated environmental change) with

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		knowledge and adaptation to climate and environmental change in arid regions of South Africa, University of The Western Cape, Faculty of Natural Science, Department of Biodiversity and Conservation Biology, <a href="http://hdl.handle.net/11394/5864">http://hdl.handle.net/11394/5864</a>	its impacts and adaptation of communal livestock farmers in the semi-arid regions of the Northern Cape Province in South Africa. In this study, the author mentions that whilst other studies highlight the lack of awareness and understanding of climate change among livestock communal farmers, his study proves otherwise. Findings from this study show that intergeneration knowledge transfer and media sources contributed as sources of climate and farming management information. It was also revealed that even though adaptation measures are being carried out by livestock farmers, there are general barriers which include financial, biophysical environment, social and institutional barriers that inhibit effective adaptation. Adaptation strategies were discussed and concluded that the strategies adopted by the pastoralists are traditional, they are still viewed by the pastoralists as a valid response to climate and environmental changes.
117	Kenya	Nyangena, J.; Stott, C. and Wario, A. (2017). Finance for Resilience Building and Ecosystem-Based Adaptation in Kenya: A comparative study of local and national managed funds, International Institute for Environment and Development (IIED)	The article emphasized that ecosystem-based adaptation (EbA) initiatives need to be implemented at scale in order to reap the social and environmental benefits needed in a changing climate. It showed how EbA could be mainstreamed into national and county level government planning in Kenya, with finances made available accordingly. It thus provides key lessons on how EbA can be implemented and funded at scale, whilst retaining community knowledge and adaptation needs at its core. In addition, in order for the local communities to benefit from resilience-building interventions, the article showed that it is not only the amount of funding that matters but also the approach used to deliver them. The article is relevant for decision makers and planners who would like to know how to implement and fund EbA at scale.
118	Sub-Saharan Africa	Oeba, V. O., & Larwanou, M. (2017). Forestry and Resilience to	The paper identifies, and analyses forest-based adaptation strategies employed in sub-Saharan Africa that have the potential of enhancing

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		Climate Change: A Synthesis on Application of Forest-Based Adaptation Strategies to Reduce Vulnerability Among Communities in Sub-Saharan Africa. In <i>Climate Change Adaptation in Africa</i> pp. 153-168. Springer, Cham.	resilience of vulnerable communities to the impacts of climate change, with a view of recommending them for up-scale and adoption. It delineates the role of forestry in improving resilience to climate change to various forest ecosystems and people. The paper revealed that forest and tree-based systems in the context of sustainable forest management plays a significant role on disaster risk reduction and abatement to impacts of climate change. It indicated specifically that tree planting and forest conservation aid protection of soil and land against detrimental impacts of flooding; and rehabilitation of degraded lands and forests through tree planting and good forest management practices enhances water quality and other vital environmental services. It pointed out that the benefits associated with forests and tree-based systems improve capacity of communities in upstream and downstream to ameliorate impacts of climate change. The authors indicated that the adaptation strategies such as: sustainable forest management (SFM); agroforestry systems; forestry and food production; commercial forestry; and other ecosystem-based interventions enhance resilience among the vulnerable communities in the sub-Saharan Africa. The paper can inform ecosystem-based adaptation stakeholders, especially policy makers, to develop appropriate institutions, policies and legal frameworks that support coping mechanisms that integrate both adaptation and mitigation measured to strengthen resilience of vulnerable social groups and biophysical systems to the impacts of climate change.
119	South Africa	Ofoegbu, C., Paxie Chirwa, Francis, J., Babalola, F. (2017) "Assessing vulnerability of rural communities to climate change: A review of implications for forest-based	The authors of this paper illustrate the impacts of climate change on rural communities in Africa, showing that climate variability and change are affecting rural people and their livelihoods negatively. The main purpose of this study was to broaden the understanding of the impacts of climate change on rural communities in Africa and

No	Region	Citation	Annotation
		livelihoods in South Africa", <i>International Journal of Climate Change Strategies and Management</i> , 9 (3), pp. 374-386, <a href="https://doi.org/10.1108/IJCCSM-04-2016-0044">https://doi.org/10.1108/IJCCSM-04-2016-0044</a>	<p>their adaptive capacity, coping practices and ability to engage in sustainable forest use and management of climate change adaptation.</p> <p>The study revealed that even though climate change and variability are affecting rural people and their livelihoods negatively, forest-based livelihoods are particularly and more vulnerable. The study confirmed that the people have developed coping mechanisms to help them cope with effects of climate change. However, the authors discovered that the effectiveness and efficiency of the strategies are hindered by factors which are related mostly to the socio-economic characteristics of the people and the functionalities of services in communities. This study showed that climate change adaptation initiatives in rural communities of Africa should focus on improving people's socioeconomic conditions and the overall sustainable development of the community.</p>
120	Kenya	Ojwang, L., Rosendo, S., Celliers, L., Obura, D., Muiti, A., Kamula, J., & Mwangi, M. (2017). Assessment of coastal governance for climate change adaptation in Kenya. <i>Earth's Future</i> , 5(11), 1119-1132.	<p>The study aims to demonstrate the usefulness of the capitals approach framework to monitoring progress of local governments in responding to climate change using a scoring system to illustrate governance performance. The study was conducted in three coastal counties which are Kilifi, Mombasa and Kwale. This study employed the use of a modified capitals approach framework (CAF) which consisted of five capitals namely; social, financial, political, human and environment. According to the authors, these capitals correspond to key governance structures, factors, and processes presumed to be fundamental in securing support for sustained action toward the adoption of adaptation measures at a local level and in the context of coastal zone management. They stated these factors can indicate areas of concern or constraints to achieving adaptation.</p>
121	Kenya	Ojwang', G. O., Wargute, P. W., Said, M. Y., Worden, J. S.,	<p>This report provides a vivid depiction of the state of Kenya's conservation connectivity both within and outside protected areas,</p>

No	Region	Citation	Annotation
		Davidson, Z., Muruthi, P., Okita-Ouma, B. (2017). Wildlife Migratory Corridors and Dispersal Areas: Kenya Rangelands and Coastal Terrestrial Ecosystems. <i>Tourist Management Perspectives</i> pp. 217. Retrieved from <a href="http://www.kws.go.ke/content/launch-report-wildlife-corridors-and-dispersal-areas">http://www.kws.go.ke/content/launch-report-wildlife-corridors-and-dispersal-areas</a>	complete with maps and information on historical and recent wildlife migratory routes and corridors on the Kenya rangelands and coastal terrestrial ecosystems. A total of 58 migratory routes and corridors were identified in the southern Kenya rangeland ecosystems: Maasai-Mara ecosystem (17); Eburu Forest and Lakes Naivasha-Elmentaita-Nakuru conservation and ecological area (8), Athi-Kaputiei and Nairobi National Park (7), South Rift (8), Amboseli and west Kilimanjaro (8), and the Tsavo Conservation Area (10). 2. Fifty-two migratory routes or corridors were identified in the northern Kenya rangelands and coastal terrestrial ecosystems, with the majority found in the greater Ewaso ecosystem. More salient routes and corridors used by other wildlife species also exist in the Kenya rangelands, but were not considered and need further investigation.
122	Nigeria	Olayide, O. E. and Tetteh, I. K. (2017) Between Climate Reliance and Climate Resilience: Empirical Analysis of Climate Variability and Impact on Nigerian Agricultural Production. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) <i>Climate Change Adaptation in Africa. Climate Change Management</i> . Springer, Cham, pp 15-24	The article investigates the impact of both rainfall variability and irrigation on agricultural production. It reveals how irrigation can serve as a tool for adapting to climate change, and for promoting climate-resilient agriculture in Nigeria. The authors suggested the need for minimization of the impact of climate-induced agricultural production risks through climate-resilient agriculture which would involve expansion of arable land area under irrigation. The article can be of benefit to farmers, especially those practicing rain-fed agricultural production system, who's over reliance on rainfall is making them vulnerable to climate change and variability of rainfall. The article can inform appropriate agricultural policy for adapting to climate change to ensure climate resilience agriculture practices that lead to sustainable agricultural production and food security, including availability, access, and stability.
123	Ethiopia	Ogato, G. S., Abebe, K., Bantider, A. and Geneletti, D. (2017) Towards	The authors points to developing and communicating knowledge about what will be sustainable and environmentally friendly

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		Mainstreaming Climate Change Adaptation into Urban Land Use Planning and Management: The Case of Ambo Town, Ethiopia. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) <i>Climate Change Adaptation in Africa. Climate Change Management</i> . Springer, Cham	solutions and stimulating planning processes that can generate more debate about what values and interests needed to be promoted as being vital in sustainable urban development planning. The article assesses the needs for mainstreaming climate change adaptation into urban land use planning and management and proposes strategic actions for mainstreaming in Ambo town, Ethiopia. It identifies Urban flooding, water shortage, wind and dust storms as climate change related disaster risks in Ambo town. The article can help town administrators to take strategic actions of mainstreaming climate change adaptation into urban land use planning and management to promote sustainable urban development within the town and its surroundings.
124	Nigeria	Ogbonna, C., Albrecht, E. and Schönfelder, R. (2017) Adaptation Opportunities to Climate Variability and Potential Effects on Sustainable Development. The Case of Nigeria's Niger Delta Region. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) <i>Climate Change Adaptation in Africa. Climate Change Management</i> . Springer, Cham	The paper examined the links between observed climate and weather-related impacts on development in selected States of Nigeria's Niger Delta region and to provide perspectives for adaptation opportunities necessary to build a resilient future, as well as pathways to sustainable development. Current and future climate situations were examined by analyzing a 30-year temperature and rainfall data It was found that temperature trend in different States of the region was increasing while rainfall was variable and declining. The effects of climatic change such as seasonal and erratic flooding, coastal erosion, and variation in temperature and rainfall threatened people's wellbeing and contributed further to environmental degradation. However, the paper envisaged that practical adaptation measures are necessary to reduce negative impacts and exploit beneficial opportunities. In this regard, adaptation measures that need to be addressed to reinforce sustainable development initiatives were suggested. The paper will be useful to decision-makers, non-governmental organizations, relevant institutions, and government agencies especially in Nigeria.

No	Region	Citation	Annotation
125	West Africa	Olaniyan, O. F. and Orunmuyi, M. (2017) Promoting Farmers' Resilience to Climate Change: An Option of the N'Dama Cattle in West Africa. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) Climate Change Adaptation in Africa. <i>Climate Change Management</i> . Springer, Cham	The article describes some of the climate related challenges of livestock farming in West Africa and other developing countries. It indicates that the phenomenal impact of climate change is of a great concern for animal production, and the human populations that depend on it for income, meat, milk, and draught power. It explains how smallholder livestock farmers in West Africa are vulnerable and need to cope with environmental stressors associated with climate change. It highlights emerging trend of animal disease outbreaks, warm weather, reduced precipitation, and feed shortages especially in the prolonged dry seasons as some of the challenges which climate variability poses to livestock producers. It also highlights the adaptive traits of the N'Dama cattle, such as disease tolerance, in the context of climate change which would enhance the resilience of smallholder livestock farmers. The article can inform future policy design and implementation. It will help farmers, government and development agencies to sustainably utilize locally adapted breeds such as the N'Dama cattle to enhance climate change adaptation and food security in the West African region.
126	North Africa region	Otto, I. M., Reckien, D., Reyer, C. P., Marcus, R., Le Masson, V., Jones, L., ... & Serdeczny, O. (2017). Social vulnerability to climate change: a review of concepts and evidence. <i>Regional environmental change</i> , 17(6), 1651-1662.	This article provides a review of recent scientific literature on social vulnerability to climate change, aiming to determine which social and demographic groups, across a wide range of geographical locations, are the most vulnerable to climate change impacts within four well-being dimensions: health, safety, food security, and displacement. It analyzes how vulnerability changes over time and ask whether there is evidence of critical thresholds beyond which social vulnerability drastically changes.
127	Africa	Ponce-Reyes, R., Plumptre J.A., Segan, D., Ayebare, S., Fuller, A. R., Possingham H. P. and Watson, J.E.M (2017). Forecasting ecosystem	Climate change assessment mostly focusses on species and do not directly estimate how the entire ecosystem may change. This article presents a region wide climate change vulnerability assessment of seven major ecosystems in Africa's Albertine Rift (borders of

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		responses to climate change across Africa's Albertine Rift. <i>Biol. conserv.</i> 209 pp 464–472	Uganda, Rwanda, Burundi, Tanzania, and the Democratic Republic of Congo) using Maxent ver. 3.33 default parameters (an ecosystem-based modelling approach) on data available at the time and then projected the potential distribution of each ecosystem for 2050 and 2070. Results: They predicted that suitable ecosystem in the region will contract rapidly in extent and shift upwards in altitude. By 2050 only the savannah ecosystem is expected to expand with suitable conditions increasing by 32%. High-altitude ecosystems and the endemic species they support are at immediate risk, owing to rapid predicted shrinkage in their suitable extent. 44% of the region could be climatically unsuitable for the ecosystem by 2070. They recommended that Conservation planning across the Rift will be needed to account for these ecosystem shifts and rapidly changing boundary zones to ensure the long-term persistence of the many endemic species.
128	North Africa region	Price, R.A. (2017). Climate change and stability in North Africa. K4D Helpdesk Report. Brighton, UK: Institute of Development Studies. Retrieved from; <a href="http://opendocs.ids.ac.uk/opendocs/handle/123456789/13489">http://opendocs.ids.ac.uk/opendocs/handle/123456789/13489</a>	North Africa is highly vulnerable to the consequences of climate change because of its strong exposure to increases in temperature, changes in freshwater availability, and population growth. The production of agricultural goods is sensitive to changing climate conditions across northern Africa, as economies strongly depend on agriculture or livestock. Due to the already existing water scarcity and this strong dependence on rain-fed agriculture, there is additional vulnerability, further exacerbated by an adaptive capacity that is limited by poverty and political instability. The impacts of climate change in North Africa are complex and not fully understood, they also interact and amplify other drivers and socio-economic factors, making attribution difficult to detangle. However, in general, climate change is expected to have important impacts on drought, water supplies and food security, which may impact on the stability, prosperity and security of the region. However, research in



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			this emerging field has not yet succeeded in establishing a consensus on primary causes, mechanisms, links, and interventions between climate change and insecurity.
129	Africa	Ramyar, R., & Zarghami, E. (2017). Green infrastructure contribution for climate change adaptation in urban landscape context. <i>Applied Ecology and Environmental Research</i> , 15(3), 1193–1209. <a href="https://doi.org/10.15666/aeer/1503_11931209">https://doi.org/10.15666/aeer/1503_11931209</a>	Green infrastructure is strategic and spatial approach to landscape and environment planning, applying key principles of landscape ecology to urban environments, and specifically planning in multi-scale approach In this paper, it was investigated in this study on how and in what function and services, Green infrastructure strategy can help us in adopting to climate change in urban landscape context. At the first step, we classified the methods, principle and impacts on these two strategies (climate change adaptation and green infrastructure) to compare them. Results from this study showed a conceptual model is developed clarifying their complementarity and relationship.
130	Africa	Ramirez, B. (2017). Support for research towards understanding the population health vulnerabilities to vector-borne diseases: increasing resilience under climate change conditions in Africa. <i>Infectious diseases of poverty</i> , 6(1), 164.	This paper outlines and assesses the projects being run in partnership by WHO, TDR and International Centre for Research and Development (IDRC) on research capacity building on tropical diseases. The main focus of the partnership research initiative is on Vector Borne Diseases-related hazards, vulnerabilities, exposure and the impact of climate change in the Sahel and sub-Saharan Africa. Different projects being run in different countries which include Malawi, South Africa, Kenya, Cote d'Ivoire and other are studied and evaluated. The critical aspects of the projects that were assessed included; “early warning systems for improved human health and resilience to climate sensitive vector-borne diseases”, “an ecohealth approach to predicting and improving resilience of Maasai communities to vector-borne infections. The study provides a brief on some policy and good practice recommendations from existing and ongoing research projects in VBD.

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131	Africa	Raw, J. L., Perissinotto, R., Miranda, N. A., & Peer, N. (2017). Feeding dynamics of <i>Terebralia palustris</i> (Gastropoda: Potamididae) from a subtropical mangrove ecosystem. <i>Molluscan Research</i> , 37(4), 258-267.	The Study of Molluscan Diversity Mangrove gastropods was largely recognised for their roles as benthic deposit feeders that consume macrophyte-derived detritus. This study used an experimental approach that incorporated fluorometric techniques on MPB that was not clearly related to diel and tidal cycles at the subtropical location of Kosi Bay, South Africa. However, the results showed a faster ingestion rate and higher consumption/digestion efficiency during the experiments
132	Kenya	Recha, J. W., Radeny, M., Kinyangi, J. and Kimeli, P. (2017) Uptake of Resilient Crop Interventions to Manage Risks Through Climate-Smart Villages Approach in Nyando, Western Kenya. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) Climate Change Adaptation in Africa. <i>Climate Change Management</i> . Springer, Cham	The article explores the changes in farming practices made by households within Climate-Smart Villages (CSVs) which were developed through the partnership between research and development organizations and the Nyando rural community to test local actions that ensure food security, promote adaptation and build resilience to climatic stresses. The article shows that increased use of terracing to conserve soil and water, intercropping, use of improved crop varieties, and households adopting three or more new crop types, greatly expand on-farm choices for resilient varieties. The results can be used to showcase crop production practices suitable for adapting to the changing climate in rural communities.
133	Africa	Rey, B., Fuller, A., Mitchell, D., Meyer, L. C. R., & Hetem, R. S. (2017). Drought-induced starvation of aardvarks in the Kalahari: An indirect effect of climate change. <i>Biology Letters</i> , 13(7). <a href="https://doi.org/10.1098/rsbl.2017.0301">https://doi.org/10.1098/rsbl.2017.0301</a>	Aardvarks ( <i>Orycteropus afer</i> ) are elusive burrowing mammals, predominantly nocturnal and distributed widely throughout Africa except for arid deserts. This study was to measure their current physiological plasticity. Through the study, body temperature records revealed homeothermy (35.4-37.28C) initially, but heterothermy increased progressively through the summer, with declining troughs in the nycthemeral rhythm of body temperature reaching as low as 25.8C before death, likely due to starvation. Results do not bode well for the future of aardvarks facing climate change.

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134	Africa	Rizvi, A. R. and van Rie, K. (2017) Nature Based Solutions for Climate Change Adaptation – Knowledge Gaps: An Analysis of Critical Knowledge Gaps, Needs, Barriers and Research Priorities for Adaptation, IUCN EbA Knowledge Series – Working Paper. <a href="https://www.iucn.org/sites/dev/files/eba_knowledge_gaps.pdf">https://www.iucn.org/sites/dev/files/eba_knowledge_gaps.pdf</a>	<p>In this document, an in-depth systematic review has been conducted on the research and studies that have generated information and knowledge on climate related impacts and risks, vulnerability and adaptation to climate variability and change. This was done to assess the current state of knowledge available and what specific information is still required in order to identify areas that require attention and research to further our understanding. This paper provides an analysis of current and prevailing knowledge gaps as well as the barriers concerning climate change adaptation in general, and ecosystem-based adaptation in particular.</p> <p>The authors claim that the identified knowledge gaps and needs are both general and sector specific. In order to address these barriers the following recommendations are proposed by the authors; “strengthening action learning and knowledge management inter- and cross sectoral and with multiple stakeholders”; “ensure active participation, the integration of local, traditional knowledge and gender consideration”; “advance the scientific case for ecosystem-based adaptation”; “mainstream climate change and ecosystem-based adaptation initiatives into policies and plans”; “build capacity at multiple levels; vi) develop and test tools/methods for implementing and assessing different ecosystem-based adaptation approaches” and “ensure ongoing monitoring and evaluation of climate change and ecosystem-based adaptation approaches necessary for the sustainable management of natural resources and the resilience of both human society and the natural environment to climate.”</p>
135	Africa	Rockström, J., Williams, J., Daily, G., Noble, A., Matthews, N., Gordon, L., Wetterstrand, H., DeClerck, F., Shah, M., Steduto, P.,	The article discusses a paradigm shift aims at repositioning the worlds’ agriculture from its current role as the world’s single largest driver of global environmental change, to becoming a key contributor of a global transition to a sustainable world within a safe

No	Region	Citation	Annotation
		de Fraiture, C., Hatibu, N., Unver, O., Bird, J., Sibanda, L. and Smith, J. (2017) Sustainable intensification of agriculture for human prosperity and global sustainability. <i>Ambio</i> , 46(1), 4-17.	operating space on earth. The article proposes that a paradigm for sustainable intensification can be defined and translated into an operational framework for agricultural development. It argued that the paradigm must be defined, at all scales, in the context of rapidly rising global environmental changes in the Anthropocene, while focusing on eradicating poverty and hunger and contributing to human wellbeing. For a paradigm shift towards sustainable intensification of agriculture, the authors proposed an approach that integrates the dual and interdependent goals of using sustainable practices to meet rising human needs while contributing to resilience and sustainability of landscapes, the biosphere, and the Earth system. Recognizing the central role agriculture plays in determining and regulating Earth's resilience, the article could be useful in adopting sustainable intensification of agriculture as a strategy to meet twin objectives for people and the planet as adopted by the UN Sustainable Development Goals (SDGs).
136	Africa	Rojas-Downing, M. M., Nejadhashemi, A. P., Harrigan, T. and Woznicki, S. A. (2017) Climate change and livestock: Impacts, adaptation, and mitigation, Elsevier, <i>Climate Risk Management, Volume 16</i> , pp 145-163	The paper reviews the impacts of climate change on livestock production, the contribution of livestock production to climate change, and specific climate change adaptation and mitigation strategies in the livestock sector. The authors looked at climate change as a threat to livestock production considering the impacts on quality of feed crop and forage, water availability, animal and milk production, livestock diseases, animal reproduction, and biodiversity. The article considers the livestock sector as a key player in the mitigation of greenhouse gas (GHG) emissions and improving global food security. It stresses on adaptation and mitigation measures tailored to the location and livestock production system in use, and policies that support and facilitate the implementation of climate change adaptation and mitigation measures. The article can be useful to policy makers and all

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			stakeholders within the livestock sector in ensuring food security in the presence of climate change.
137		Rosa, M. F., Bonham, C. A., Dempewolf, J., & Arakwiye, B. (2017). An integrated approach to monitoring ecosystem services and agriculture: implications for sustainable agricultural intensification in Rwanda. <i>Environmental Monitoring and Assessment</i> , 189(1). <a href="https://doi.org/10.1007/s10661-016-5607-6">https://doi.org/10.1007/s10661-016-5607-6</a> *	Maintaining the long-term sustainability of human and natural systems across agricultural landscapes requires an integrated, systematic monitoring system that can track crop productivity and the impacts of agricultural intensification on natural resources. This study presented the design and practical implementation of a monitoring framework that combines satellite observations with ground-based biophysical measurements and household surveys to provide metrics on ecosystem services and agricultural production at multiple spatial scales, reaching from individual households and plots owned by smallholder farmers to 100-km (2) landscapes. A set of protocols was developed for monitoring and analyzing ecological and agricultural household parameters within two 10 × 10-km landscapes in Rwanda, including soil fertility, crop yield, water availability, and fuelwood sustainability. Initial results suggest providing households that rely on rainfall for crop irrigation with timely climate information and improved technical inputs pre-harvest could help increase crop productivity in the short term
138	Mali	Sanogo, K., Binam, J., Bayala, J., Villamor, G. B., Kalinganire, A., & Dodiomon, S. (2017). Farmers' perceptions of climate change impacts on ecosystem services delivery of parklands in southern Mali. <i>Agroforestry systems</i> , 91(2), 345-361.	In this study the perception of climate change by farmers in southern Somalia was sought, together with the consequences of the changes on ecosystem services delivery and their (farmers) adaptive capacity. The study shows that the most important provisioning service which is the shea butter for self-consumption and income generation of farmers in general and women in particular is ultimately affected by climate change. Drought was perceived to be the main recurrent phenomenon of climate change which affected the farmers crop production in the parklands. Thus, there is limited water availability in the parkland. The paper reports of similar findings by other studies. In a quest to overcome these effects of

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			climate change, the farmers have adopted adaptation measures which include diversification of crops, new crop varieties and seasonal migration. The authors noted that, without these adaptation strategies, food insecurity and poverty will increase. Furthermore, the authors suggested that off-farm income earning activities should be created for rural farmers to protect the active household population from seasonal migration and reduce their vulnerability to climate change
139	Senegal	Sanogo, D., Ndour, B. Y., Sall, M., Toure, K., Diop, M., Camara, B. A., Thiam, D. (2017) Participatory diagnosis and development of climate change adaptive capacity in the groundnut basin of Senegal: Building a climate-smart village model. <i>Agriculture and Food Security</i> , 6(1). <a href="https://doi.org/10.1186/s40066-017-0091-y">https://doi.org/10.1186/s40066-017-0091-y</a>	This paper describes the strategic approaches to the development of a climate-smart village (CSV) model in the groundnut basin of Senegal. A CSV model is a participatory integrated approach using climate information, improved context-based technologies/practices aiming at reaching improved productivity (food and nutrition security), climate resilient people and ecosystem and climate mitigation. In this study, participatory vulnerability analysis, planning adaptation capacity and participatory communication for development were implemented, putting people affected by the impacts of climate change (CC) at the center of the approach.
140		Sarkki, S., Ficko, A., Wielgolaski, F. E., Abraham, E. M., Bratanova-Doncheva, S., Grunewald, K., ... Sutinen, M. L. (2017). Assessing the resilient provision of ecosystem services by social-ecological systems: Introduction and theory. <i>Climate Research</i> , 73(1–2), 7–15. <a href="https://doi.org/10.3354/cr01437">https://doi.org/10.3354/cr01437</a>	The concepts of resilience and ecosystem services broaden the opportunities for assessing sustainability of social-ecological systems (SESs). The lack of operational frameworks for assessing the resilient provision of ecosystem services by SESs impedes greater integration of resilience thinking in natural resource governance. This study was to understand the capacity of the SES to (re)organize itself and sustain the flow of benefits from nature to people under various global and local pressures and trade-offs between ecosystem services users. Also to assess the resilience of an SES within a single framework, we propose a new approach which is a combination of: (1) the Driver-Pressure- State-Impact-

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			Response (DPSIR) framework; (2) social-ecological indicators; and (3) scenario building.
141	West Africa	Schroth, G., Läderach, P., Martinez-Valle, A.I. and Bunn, C. (2017) From site-level to regional adaptation planning for tropical commodities: cocoa in West Africa, <i>Mitigation and Adaptation Strategies for Global Change</i> , August 2017, 22, (6), pp 903–927. <a href="https://doi.org/10.1007/s11027-016-9707-y">https://doi.org/10.1007/s11027-016-9707-y</a>	The article discussed a regional adaptation approach for cocoa in West Africa. The authors argued that for tropical agricultural commodity like cocoa ( <i>Theobroma cacao</i> ), larger-scale adaptation planning that attempts to balance production trends across countries and regions could help reduce negative impacts of climate change on regional economies and global commodity supplies, despite the institutional challenges that this integration may pose. The article highlighted not only those areas where deterioration of climatic conditions will require the adaptation of farming systems (and crops) to new climatic conditions, but also those areas where the relative absence of climatic risks should encourage investments in the intensification and, possibly, expansion of cocoa production systems. The authors divided the cocoa belt of West Africa into zones of vulnerability to climate change and identified a set of actions appropriate for each zone, thereby moving from a local, crisis management approach towards a regional, sustainable development approach to climate change adaptation. The approach can inform decision making in other agricultural commodities, especially where they are of major regional importance for the economies of developing countries and the livelihoods of their inhabitants.
142	South Africa	Senyolo, M. P., Long, T. B., Blok, V., & Omta, O. (2017). How the characteristics of innovations impact their adoption: An exploration of climate-smart agricultural innovations in South Africa. <i>Journal</i>	According to the authors of this paper, It is well known that climate-smart agricultural technological innovations at the farm level have the potential to address climate-related challenges. However, there is an inadequate adoption of these. This study identifies available climate-smart agricultural technological innovations (CSATIs) in South Africa and explores their characteristics and context of use using an exploratory and qualitative research approach. The aim of

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		<i>of Cleaner Production</i> , 172, 3825-3840.	using this approach was to look at the adoption topic using the wider perspective of those who work in the field of climate smart agriculture (CSA) and water management for agriculture. Main tools for collecting relevant data for the study included in depth literature review and interviews with expert stakeholders. From the study, results indicated that Conservation Agriculture, Rainwater Harvesting and Seed Varieties that are Drought Tolerant and Early Maturing may be the most suited technologies for climate-smart agriculture in South Africa, particularly for smallholder farmers. However, high initial investment costs, additional labour requirements and management intensity associated with conservation agriculture and rainwater harvesting may pose problems within the South African context. This study also identified gaps in knowledge that require further exploration to deepen our understanding of the (CSA) adoption puzzle in South Africa. This study provided the context of CSATIs in South Africa, their characteristics as well as factors likely to influence their adoption. Moreover, key results indicated at the end of the study that conservation agriculture (CA), rain water harvesting and seed varieties that are drought tolerant and early maturing seem to be the most suited technologies and practices for the promotion of CSA agriculture in South Africa.
143	Africa and others	Shaffril, H. A. M., Samah, A. A., & D'Silva, J. L. (2017). Climate change: Social adaptation strategies for fishermen. <i>Marine Policy</i> , 81, 256-261.	This paper suggests that in order to improve social adaptation, the following six main strategies should be emphasized: 1) minimization of the risks associated with fishing routines of fishermen; 2) strengthening of social relationships; 3) management of knowledge on changes in the climate; 4) learning and acquisition of alternative skills; 5) involvement in the planning of adaptation to changes in the climate; and 6) provision of credit facilities. This list of adaptation strategies will provide a clearer understanding of how fishermen can adapt to climate change and provide policy makers with the means to



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			build community resilience to future challenges of climate changes. A key role may be played by fisheries extension services in the practical implementation of policies for climate change adaptation by small-scale fishing communities
144	Africa	Shepherd M., Godwell N., (2017) "Climate change and the African livestock sector: Emerging adaptation measures from UNFCCC national communications", <i>International Journal of Climate Change Strategies and Management</i> , 9 (2), pp 241-260, <a href="https://doi.org/10.1108/IJCCSM-07-2016-0093">https://doi.org/10.1108/IJCCSM-07-2016-0093</a>	This study focuses on climate change adaptation in the livestock sector and pays attention to a wide spectrum of adaptation measures that are emerging across the African continent as reported periodically by the United Nations Framework Convention on Climate Change (UNFCCC) National Communications. In this study the focus is on adaptation measures in the livestock sector ranging from dairy cattle, beef cattle, sheep, goats, pigs, horses and poultry, which contribute almost 92 per cent of the income in Africa. The authors mention that climate change impact on livestock seem to be under-researched. The method used in this study included a review of adaptation measures in National Communications to the UNFCCC from 21 African countries. The countries were purposefully sampled based on criteria. 95 categories of adaptation interventions emerged and were organized into eight thematic areas. Content analysis and thematic analysis were both employed for this study. Moreover, to derive meaning from the retrieved information the authors used the grounded theory approach. From the study the key adaptation measures that emerged are livestock breeding; disease, vectors and parasites management; livestock diversification and intensification; integrated pasture management; and capacity building, extension, training, awareness and information sharing. All countries reported benefits from implementing these adaptation measures. The study further concluded that for the adaptation measures to be successful there is the need for changes to behaviour since policies, strategies and programmes alone cannot effectively improve adaptive capacity.
145	East Africa	Shikuku, K. M., Winowiecki, L., Twyman, J., Eitzinger, A., Perez, J. G., Mwongera, C. and Läderach, P. (2017) Smallholder farmers'	The article examined farmers' attitudes and assessed determinants of adaptation to climate risks using data from a random sample of 500 households in Borana, Ethiopia; Nyando, Kenya; Hoima, Uganda; and Lushoto, Tanzania. Adaptation was measured using a

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		attitudes and determinants of adaptation to climate risks in East Africa, <i>Climate Risk Management</i> , 16, pp 234-245	livelihood-based index that assigned weights to different individual strategies based on their marginal contributions to a household's livelihood. The paper showed that farmers' attitudes across the four sites strongly favored introduction of new crops, changes in crop varieties, and changes in planting times. However, farmers disfavored soil, land, and water management practices. The authors indicated that although households adapted to improve food security status of their households, hunger was a barrier to adaptation. The article pointed out that providing climate information to inform timely planting, promoting crop diversification, and encouraging adoption of adapted varieties of crops might be successful to enhancing resilience of farming systems in the short-term. Meanwhile, increased investment in reducing hunger, encouraging groups formation, and easing liquidity constraints will be required to promote adaptation through implementation of soil, water, and land management strategies in the long-term
146	Africa	Siam, M. S. and Eltahir, E. A. B. (2017) Climate change enhances interannual variability of the Nile river flow, <i>Nature Climate Change</i> , 7, pp 350–354	The article presents empirical evidence from observations and consistent projections from climate model simulations suggesting that the standard deviation describing interannual variability of total Nile flow could increase by 50% ( $\pm 35\%$ ) (multi-model ensemble mean $\pm 1$ standard deviation) in the twenty-first century compared to the twentieth century. The authors attributed the relatively large change in interannual variability of the Nile flow to projected increases in future occurrences of El Niño and La Niña events and to observed teleconnection between the El Niño–Southern Oscillation and Nile River flow. The article emphasized on the need to re-evaluate the adequacy of the current water storage capacity and plans for additional storage capacity in the basin, given the projected enhancement of interannual variability in the future flow of the Nile

No	Region	Citation	Annotation
			river, to successfully adapt to the negative impacts enhanced through climate change.
147	Ethiopia	Simane B. and Bird N. (2017) Enhancing Adaptation and Mitigation Activities Through Effective Climate Change Financing Policy in Ethiopia. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) Climate Change Adaptation in Africa. <i>Climate Change Management</i> . Springer, Cham	The paper focuses on Ethiopia's Climate Resilient Green Economy (CRGE) climate policy that aims to ensure economic development whilst pursuing a low emissions pathway and building resilience to climate change. The paper points out that while the green economy strategy targets the financial opportunities and sustainability co-benefits of low emissions development, the climate resilient strategy focuses on managing risk and building resilience to shocks brought about by climate change. The authors assessed the effectiveness of these national policy processes in directing the delivery of climate finance through the use of principles, criteria and indicators (PCI) analytical framework. The paper indicated that the mitigation (or green economy) element has been influential in informing the overall growth trajectory that aims to secure for Ethiopia middle income status by 2025 in a carbon neutral way. It added that the adaptation (or climate resilience) part of the strategy has been prepared for the agriculture, forestry, water and energy sectors to secure the livelihoods of the most vulnerable to climate change. The paper identified two areas where further effectiveness gains may be sought for enhancing adaptation and effective implementation of Ethiopia's CRGE climate policy.
148	Africa	Stöber, S., Chepkoech, W., Neubert, S., Kurgat, B., Bett, H. and Lotze-Campen H. (2017) Adaptation Pathways for African Indigenous Vegetables' Value Chains. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) Climate Change Adaptation in	The paper assesses adaptation pathways for smallholder African Indigenous Vegetable (AIV) value chains. The analysis is based on field research in three agro-climatic zones (ACZ) of Kenya. The article indicates that AIVs can be part of the solution to hidden hunger in Kenya since they are relatively easy to grow within a short vegetation period and rich in micronutrients (e.g. vitamins A and C, and iron). They also contribute to an increased income for smallholders when production, transport and marketing function

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		Africa. <i>Climate Change Management</i> . Springer, Cham	adequately. The authors pointed out that growing AIVs is itself considered an adaptation strategy, as their sensitivity to climate variability is generally low. In addition, incremental adaptation strategies such as changing crop portfolios and adaptations that require transformative efforts will help farmers adapt their farm-level management to climate change. The article will help policy makers recognize that empowerment of growers to participate in high value and ecologically sustainable AIV value chains requires specific policies and extension in order to close the adaptation gaps of AIV smallholders.
149	Sub-sahara Africa	Serdeczny, O.; Adams, S.; Baarsch, F.; Coumou, D.; Robinson, A.; Hare, W.; Schaeffer, M.; Perrette, M.; Reinhardt, J.(2017) Climate change impacts in sub-Saharan Africa: From physical changes to their social repercussions. <i>Reg. Environ. Chang</i> , 17, 1585–1600.	The repercussions of climate change will be felt in various ways throughout both natural and human systems in Sub-Saharan Africa. Climate change projections for this region point to a warming trend, particularly in the inland subtropics; frequent occurrence of extreme heat events; increasing aridity; and changes in rainfall—with a particularly pronounced decline in southern Africa and an increase in East Africa. The region could also experience as much as one meter of sea-level rise by the end of this century under a 4 C warming scenario. Sub-Saharan Africa’s already high rates of undernutrition and infectious disease can be expected to increase compared to a scenario without climate change. Particularly vulnerable to these climatic changes are the rainfed agricultural systems on which the livelihoods of a large proportion of the region’s population currently depend. As agricultural livelihoods become more precarious, the rate of rural–urban migration may be expected to grow, adding to the already significant urbanization trend in the region. The movement of people into informal settlements may expose them to a variety of risks different but no less serious than those faced in their place of origin, including outbreaks of infectious disease, flash flooding and food price

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			increases. Impacts across sectors are likely to amplify the overall effect but remain little understood.
150	Ghana	Sova, C. A., Thornton, T. F., Zougmore, R., Helfgott, A. and Chaudhury, A. S. (2017). Power and influence mapping in Ghana's agricultural adaptation policy regime, <i>Climate and Development</i> , 9(5), 399-414, DOI: 10.1080/17565529.2016.1154450	The paper applies a power-mapping technique, Multilevel Stakeholder Influence Mapping (MSIM), to stakeholders in Ghana's agricultural adaptation policy regime. The authors, with the view that debates around the design and content of climate change adaptation policies are shaped, in part, by the power and influence of actors within an adaptation regime, employed a method that provides a quantitative influence score and visual map for actor groups active-in or affected-by the policy process, from the differentiated perspectives of national, regional, and local-level respondents. The paper seeks to determine the underlying power structure of the adaptation regime. It indicates that Ghana's adaptation regime is bipolar and elite-centred in its power distribution with technical government and international agencies as dominant group of power holders. The authors noted that several potential cross-level bridging institutions are not considered influential at all operational levels. They emphasized that Ghana's policy regime would benefit from increased participation from political agents, as well as from traditional authorities and farmers to help reverse the a-political nature of the adaptation regime, improve power pluralism across actor groups and levels, and facilitate cross-level cooperation between formal and informal institutions crucial to adaptation success.
151	Mali	Traore, B., Descheemaeker, K., van Wijk, M. T., Corbeels, M., Supit, I. and Giller, K. E. (2017). Modelling cereal crops to assess future climate risk for family food self-sufficiency	The article assessed the farm-level impact of climate change on family food self-sufficiency and evaluated potential adaptation options of crop management. Using three years of experimental data on maize and millet from an area in southern Mali representing the Sudano-Sahelian zone of West Africa, the authors calibrated and tested the Agricultural Production Systems sIMulator (APSIM)

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		in southern Mali, <i>Field Crops Research</i> , 201, pp 133-145	model on changes in future rainfall, maximum and minimum temperature and their simulated effects on maize and millet yield. The APSIM model predictions indicated that the use of mineral fertilizer at recommended rates cannot fully offset the impact of climate change but can buffer the losses in yield. The authors illustrated that crop management strategies must be tailored to the capacity and resource endowment of local farmers. The article can support decision making by extension and development agents and policy makers.
152	Uganda	Twinomuhangi, R., & Vela, C. (2017). <i>Terminal Evaluation of the UN Environment Project: Ecosystem Based Adaptation for Mountain Ecosystems (Nepal, Peru and Uganda)</i> , UN Environment Evaluation Office, URI: <a href="http://hdl.handle.net/20.500.11822/2413">http://hdl.handle.net/20.500.11822/2413</a>	This paper gives a project evaluation report of an ecosystem-based adaptation approach for mountainous ecosystems. This project was established on the fact that mountain regions are being degraded and communities living in these regions are vulnerable to climate change. The main goal of this study was to strengthen the capacity of countries that are particularly vulnerable to climate change impacts, to build ecosystem resilience for promoting ecosystem-based adaptation options and to reduce the vulnerability of communities with particular emphasis on mountain ecosystems". Furthermore, the major objective of the evaluation was to assess project performance (in terms of relevance, effectiveness and efficiency), determine its outcomes and impacts as well as their sustainability, and to identify valuable lessons learnt. The evaluations were done based on desk review of project documents, key informant interviews, group discussions and field visits to pilot sites in Nepal, Peru and Uganda as well as evaluation of the technical aspects of the projects that have been implemented. The paper discusses lessons learned which include considering local contexts, building capacity through learning by doing and demonstration.

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153	East Africa	Tetteh, I. K., Appiah-Badu, N. K. A., Semazzi, F. H. M. and Olayide, O. E. (2017) Deriving Useful Information from Bimonthly Global-Scale Climate Analysis for Climate Change Adaptation Over East Africa, In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) Climate Change Adaptation in Africa. <i>Climate Change Management</i> . Springer, Cham	The article focuses on bimonthly global-scale climate analysis in relationship to rainfall to enhance adaptive capacity. It points out that implementation of appropriate climate change adaptation strategies is contingent on a good understanding of climate variability. The authors employed empirical analyses using nearly 60 years of standardized gridded rainfall, horizontal wind and sea surface temperature (SST) data, to gain predictive understanding of the region's climate. This study has delineated SST and divergent circulation features related to rainfall modes which responded differently to the Pacific ENSO, Atlantic and Indian Oceans. The article indicated that the SST predictor features identified may be used to enhance operational seasonal climate prediction scheme. In this way, end users would be better prepared to select appropriate climate change adaption options.
154	Sub-Saharan Africa	Tesfaye, K., Menale, K., Jill, E. C., Misiko, M., Clare, S., Tsedeke, A., Prasanna, B. M., Mulugetta, M., Habtamu, H., Rahut, D. B., Olaf, E. and Bruno, G. (2017) Potential for Scaling up Climate Smart Agricultural Practices: Examples from Sub-Saharan Africa. In: Leal Filho W., Belay S., Kalangu J., Menas W., Munishi P., Musiyiwa K. (eds) Climate Change Adaptation in Africa. <i>Climate Change Management</i> . Springer, Cham	The paper focuses on the need for scaling-up adoption of appropriate interventions that can help increase crop yields and resilience to climate change among smallholder farmers in producing enough food to feed the ever-growing population. It reviews and analyses the potential climate-smart agricultural practices (CSAs) in Sub-Saharan Africa (SSA) and indicates some CSAs that are increasingly adopted by farmers and show potential for scaling up such as drought tolerant (DT) maize varieties, sustainable intensification through crop associations, water harvesting and small-scale irrigation, climate information, and natural resource conservation. The authors recommended that farmers' efforts should be supported through exchange of knowledge, incentives and policies.
155	Liberia	The environmental protection Agency of Liberia (2017). National Biodiversity Strategy and action	This document presents Liberia 's strategic goals and objectives for the sustainable management and utilization of treasures and threatened biological resources under the Global Strategic Plan

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		plan-II (2017-2025). The republic of Liberia	2011- 2020 and is in consonance with the Environmental Pillar of the Agenda for Transformation – Liberia’s national development strategy up to 2030. The strategy identifies three key components to ensure effective implementation, one of which is Financial and Resource Mobilization Plan (FRMP). The strategy includes capacity building, efficient technology and proper communication.
156	South Africa	Tibesigwa, B., Visser, M. and Turpie, J. (2017) Climate change and South Africa’s commercial farms: An assessment of impacts on specialised horticulture, crop, livestock and mixed farming systems, <i>Environment, Development and Sustainability, Springer, 19</i> , (2), pp 607–636 <a href="https://doi.org/10.1007/s10668-015-9755-6">https://doi.org/10.1007/s10668-015-9755-6</a>	The article employed the Ricardian cross-sectional framework to examine the impact of climate change on a nationwide sample of crop, horticulture, livestock and mixed commercial farming systems. The authors indicated that a simultaneous decrease in precipitation and an increase in temperature will reduce productivity; and that an increase in temperature alone negatively affects farm output more than a decrease in precipitation. The article indicated that the strongest impact will be amongst specialised commercial crop farming system while mixed farming systems appeared to be the least vulnerable and areas that already face disadvantageous climatic conditions will become even less productive. The authors suggested that practicing mixed farming methods will strengthen the resilience of commercial farms to climate change and that access to extensions (insurance and irrigation) is likely to reduce the risks.
157	Senegal and Mauritania	Tiedemann, M., Fock, H. O., Brehmer, P., Döring, J., & Möllmann, C. (2017). Does upwelling intensity determine larval fish habitats in upwelling ecosystems? The case of Senegal and Mauritania. <i>Fisheries Oceanography, 26</i> (6), pp 655–667. <a href="https://doi.org/10.1111/fog.12224">https://doi.org/10.1111/fog.12224</a>	Round sardinella ( <i>Sardinella aurita</i> ) comprise two-thirds of total landings of small pelagic fishes in the Canary Current Eastern Boundary Ecosystem (CCEBE). Their spawning habitat is the continental shelf where upwelling is responsible for high productivity. While upwelling intensity is predicted to change through ocean warming, the effects of upwelling intensity on larval fish habitat expansion is not well understood. The Larval habitat characteristics of both species were investigated in this research during different upwelling intensity regimes. Three surveys were



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			carried out to sample fish larvae during cold (permanent upwelling) and warm (low upwelling) seasons along the southern coastal upwelling area of the CCEBE (13°–22.5°N). <i>Sardina pilchardus</i> larvae were observed in areas of strong upwelling during both seasons. Larval habitat expansion was restricted from 22.5°N to 17.5°N during cold seasons and to 22.5°N during the warm season. <i>Sardinella aurita</i> larvae were observed from 13°N to 15°N during cold seasons and 16–21°N in the warm season under low upwelling conditions. Generalized additive models predicted upwelling intensity driven larval fish abundance patterns. Observations and modeling revealed species-specific spawning times and locations, that resulted in a niche partitioning allowing species' co-existence.
158	southern Africa	Thierfelder, C., Chivenge, P., Mupangwa, W., Rosenstock, T. S., Lamanna, C. and Eyre, J. X. (2017) How climate-smart is conservation agriculture (CA)? – its potential to deliver on adaptation, mitigation and productivity on smallholder farms in southern Africa, <i>Food Security</i> , 9, (3), pp 537–560	The article analysed smallholder farms from Southern Africa to assess whether conservation agriculture (CA) can deliver on the three principles of climate-smart agriculture which are: a) adapt to the effects of climate and be of increased resilience; b) mitigate climate effects by sequestering carbon (C) and reducing greenhouse gas emissions (GHG); and c) sustainably increase productivity and income. The article showed that CA systems in Southern Africa have a positive effect on adaptation and productivity, but its mitigation potential lags far behind expectations. Although CA systems maintained higher infiltration rates, conserved soil moisture which helped to overcome seasonal dry-spells, and recorded increased productivity and profitability, the authors indicated that immediate economic benefits such as reduced labour requirements in some systems would make CA more attractive in the short term to farmers who cannot afford to wait for several seasons until yield benefits accrue. In addition, the effects of CA on soil organic C (SOC) and reductions in greenhouse gases, depended on the agro-ecological environment and the available biomass for surface

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			residue retention. The authors suggested that improved intercropping/relay cropping systems, agroforestry and other tree-based systems may improve delivery of mitigation benefits and need further exploration.
159	South Africa and others	Triyanti, A., & Chu, E. (2017). A Survey of Governance Approaches to Ecosystem-based Disaster Risk Reduction: Current Gaps and Future Directions, <i>International Journal of Disaster Risk Reduction</i> , 32, pp 11-21	This paper reviews the current status of governance studies in the context of EbA and Eco-DRR. The analysis is grounded in the interdisciplinary theories of governance, socio-ecological systems, infrastructure studies, and multilevel politics, with sources derived from scientific databases including Scopus and Science Direct advanced query. Based on the review, we evaluate existing governance theories, assessment methods, and implementation through illustrating emblematic examples from around the world. The paper concludes with a synthesis of governance gaps and opportunities, and notes that while emerging ecological engineering approaches provide distinct opportunities, there is a lack of comprehensive assessment beyond diagnosing potential financial, institutional, and political shortfalls. We therefore highlight the need for future research on the socio-ecological, spatial/scalar, and political dimensions of EbA and Eco-DRR.
160	Nigeria	Udemezue, J. (2017). Climate Change and adaptation by Yam Farmers in Anambra West Local Government Area in Anambra State, Nigeria. <i>British Journal of Research</i> , 4(2), 1-14	As to reduce the effect of climate change on crop, yam farmers adopted some strategies such as: use of mound and ridges, early planting of crops, increase of farm size, early harvesting of crop, shifting from water to dried region and change in farming system. The implication of this is that some of them are aware of climate change in local terminology and its effects on the crops. Traditional belief beliefs, lack of access to information high illiteracy among farmers, no knowledge of weather forecast and lack of knowledge on climate change were reported as the constraints to their adaptive strategies. This research, therefore, recommends that stakeholders of weather forecast in collaboration with extension agents should

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			make it available to farmers in order to be abreast with weather conditions. Some other coping strategies stated by intergovernmental panel on climate change (IPCC) should be articulated into their beliefs and norms in order to have a wider knowledge on climate change mitigation Stakeholder and extension agents should organize workshop on climate change for farmers in the study area to enable them to have a proper knowledge on climate change and mitigation.
161	Ghana	United nation environment Program. (2017). Climate change resilient landscape for sustainability livelihoods in the northern Ghana. The republic of Ghana.	This paper addresses the effect of climate change such as shifting rainfall pattern, temperature regimes and its effect on crops and Ghanaian economy in the Northern sector. The paper proposes ecosystem-based approaches to address the impact of climate change such as such as soil nutrient loss, flood damage and drought induced crop failure. Ecosystem based approaches proposed includes; conservation agriculture techniques; agroforestry; fire management; and riverbank stabilization.
162	Africa	Veenema, T. G., Thornton, C. P., Lavin, R. P., Bender, A. K., Seal, S., & Corley, A. (2017). Climate Change–Related Water Disasters’ Impact on Population Health. <i>Journal of Nursing Scholarship</i> , 49(6), pp 625-634.	Rising global temperatures have resulted in an increased frequency and severity of cyclones, hurricanes, and flooding in many parts of the world. The purpose of this study was to conduct a systematic review of the literature concerning the impact of CCRWDs on public health in order to identify factors in these events that are amenable to preparedness and mitigation. Results from the study is to be used by nurses to advocate for greater preparedness initiatives and inform national and international disaster policy.
163	south-eastern Africa	Willemen, L., Crossman, N. D., Quatrini, S., Egoh, B., Kalaba, F. K., Mbilinyi, B., de Groot, R. (2017) Identifying ecosystem service hotspots for targeting land degradation neutrality investments in	The article presents methods to prioritise locations for degradation mitigation investments based on stakeholder preferences for ecosystem services. It indicated that land degradation response actions need motivated stakeholders and investments to improve land management. The authors combined participatory and spatial modelling approaches for Zambia, South Africa, and Tanzania to: i)

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		south-eastern Africa. <i>Journal of Arid Environments</i> 159, pp 75-86	prioritise ecosystem services in each country; ii) to map the supply of these ecosystem services in each country, and; iii) prioritise areas important for investment for the continuous delivery of these ecosystem services based on their vulnerability to land degradation. The authors were with the view that ecosystem services that are identified as important by diverse stakeholder groups have a broader level of awareness and could therefore drive motivations, commitments, and actions towards improved land management, contributing to land degradation neutrality.
164	Ethiopia	Worku, H. (2017). Integrating climate change adaptation strategies in urban planning and landscape design of Addis Ababa City, Ethiopia: Using urban planning and landscape design to mitigate flooding, drought, and urban heat island effects. <i>Environmental Quality Management</i> , 27(1), 5-21.	Climate change (CC) is now recognized as posing a serious threat to the sustainable development of Addis Ababa city, Ethiopia. As a consequence, city authorities are showing increasing interest in combating CC by streamlining adaptation measures into city development planning through a comprehensive and integrated approach. Nevertheless, in the past, the integration of CC adaptation into urban planning (UP) and landscape design (LD) was not given adequate consideration by planners and designers due to lack of knowledge regarding CC and the efforts that can be taken to mitigate its effects. The objective of this work is: To summarize the current state of knowledge of, and conceptualization of, the core elements of CC impacts and responses in Addis Ababa in terms of their implications for UP and LD in the city; To develop a common understanding among urban planners and related professionals of how improvements in UP and LD can contribute to CC adaptation; and to mainstream CC in future UP and LD endeavors. The results of this study show that integrating CC adaptation and other response options into UP and LD at the city, subcity/catchment, neighborhood, site/project, and building levels will enhance the sustainability of the city with respect to its resilience to flood risk

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			hazards, water supply during drought periods, and urban heat island effects.
165	Niger	Wouterse, F. (2017). Empowerment, climate change adaptation, and agricultural production: evidence from Niger. <i>Climatic Change</i> , 145, 367–382.	The study uses new household level data from Niger and regression analysis to study the role of drought perception and human capital—including empowerment—in climate change adaptation through the digging of zai pits and effects of these pits on agricultural productivity. We find that selection of households into adoption of zai pits is influenced by the perception that the frequency of droughts has increased. More educated, experienced, and empowered households are also more likely to have put in place zai pits. Accounting for endogeneity of adoption, zai pits are found to significantly increase cereal yields. Our counterfactual analysis reveals that even though all households would benefit from adoption of zai pits, the effect would be significantly larger for households that did not adopt if they had adopted. For the latter group, empowerment in particular is associated with significantly higher yields.
166	Ghana	Wrigley-Asante, C., Owusu, K., Egyir, I. S. and Owiyo, T. M. (2017) Gender dimensions of climate change adaptation practices: the experiences of smallholder crop farmers in the transition zone of Ghana, <i>African Geographical Review</i> , DOI: 10.1080/19376812.2017.1340168	The paper discusses the gender dimensions of climate change adaptation strategies among small holder crop farmers in the transition zone of Ghana. The authors indicated that adaptation strategies are gendered with men mostly resorting to on-farm agronomic practices such as the use of artificial fertilizers and moving into new cash crops. Although female farmers also use similar on-farm agronomic practices particularly artificial fertilizers to boost crop production, they mostly resorted to off-farm strategies such as petty trading in agricultural and consumable goods. The article showed that the high resilience level of women improved their decision-making role at the household level, an indicator of empowerment. The article can inform institutions that support climate change adaptation initiatives at the local level to take gender

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			differences into consideration and support particularly women to strengthen their resilience and consolidate their empowerment.
167	Benin	Yegbemey, R. N., Yegbemey, E. O., & Yabi, J. A. (2017). Sustainability analysis of observed climate change adaptation strategies in maize farming in Benin, West Africa. <i>Outlook on Agriculture</i> , 46(1), 20–27. <a href="https://doi.org/10.1177/0030727016689638">https://doi.org/10.1177/0030727016689638</a>	The aim of this article was to analyse possible relationships between observed climate change adaptations as developed by farmers and the sustainability level of their production systems. The results highlighted that farmers' socio-economic characteristics such as contact with extension services, organization membership, access to credit, farm size and observed climate change adaptations such as on-farm diversification, land use changes and other adaptations were found to be the major driving forces underlying the sustainability level of maize farming systems. Among the observed climate change adaptations, on-farm diversification and land use change strategies were found to be sustainable options, whereas other adaptations such as change of activity (e.g. on-farm to off-farm activity), migration to another agro-ecological zone, prayers and access to credit appeared to be unsustainable options.
168	Benin	Yves, C. Z. (2017) Smallholder Farmers' Adaptive Capacity and Choice of Adaptation Strategies Against Weather Risks In Northern Benin, Department of Agricultural Economics and Agribusiness, PhD thesis, University of Ghana. (Retrieved from <a href="http://www.ugspace.ug.edu.gh/handle/123456789/23557">http://www.ugspace.ug.edu.gh/handle/123456789/23557</a> )	The book suggested that supporting farmers to build their capacity to adapt to climate risks can be a means to reducing smallholders' vulnerability to weather risks. It analyzed how smallholder farmers' adaptive capacity affects their choice of adaptation strategies to weather risks. Specifically, it sought to: i) analyze farmers' perceived vulnerability to weather risks, their adaptation responses and assess their perceived and adaptive capacities; ii) identify the factors that influence the choice of adaptation strategies; and iii) assess the link between farmers' adaptive capacity and the effectiveness of their adaptation strategies. The book indicated that floods, drought, decreasing levels of, and increasing variability of rainfall, late onset of the rainy season are the major weather risks which farmers perceived themselves vulnerable to. Adaptation strategies used were crop management, calendar management,

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			improved seeds, irrigation and soil and water management. The book pointed out that on average, smallholder farmers had moderate adaptive capacity to respond to weather risk except for rice farmers who had high adaptive capacity. Factors like age, experience, education, access to credit, land tenure, access to climate information and access to extension services affected the choice of adaptation strategies. Farmers with high adaptive capacity achieved the highest impact on yields from the application of improved seed and soil, water and irrigation strategies. The book can be useful for policy makers to design policies that will help farmers address weather risks and have an effective impact on farmers' livelihoods.
169	Ghana	Yiran, G.A.B. & Stringer, L.C. (2017). <i>Environmental Management</i> 60 665. <a href="https://doi.org/10.1007/s00267-017-0901-9">https://doi.org/10.1007/s00267-017-0901-9</a>	People in Ghana's savannah ecosystem have historically experienced a range of climatic hazards that have affected their livelihoods. In view of current climate variability and change, and projected increases in extreme events, adaptation to climate risks is vital. This paper examined current policy actions and their implementation alongside an assessment of barriers to local adaptation. Policy documents were analysed that covered key livelihood sectors, which were identified as climate sensitive. Integration of local perspectives into policy needs to be strengthened in order to enhance adaptation. Results from this study considered adaptation to climate change in development policies and to pursue efforts to reduce or remove the key barriers to implementation at the local level.
170	Zimbabwe	Zamasiya, B., Nyikahadzoi, K., & Mukamuri, B. B. (2017). Factors influencing smallholder farmers' behavioural intention towards adaptation to climate change in transitional climatic zones: A case	This paper examines factors influencing behavioural change among smallholder farmers towards adaptation to climate change in transitional climatic zones of Africa, specifically, Hwedza District in Zimbabwe. Data for this study were collected from 400 randomly-selected smallholder farmers, using a structured questionnaire, focus group discussions and key informant

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		study of Hwedza District in Zimbabwe. <i>Journal of environmental management</i> , 198, 233-239.	interviews. The study used an ordered logit model to examine the factors that influence smallholder farmers' behavioural intention towards adaptation to climate change. Results from the study show that the gender of the household head, access to extension services on crop and livestock production, access to climate information, membership to social groups and experiencing a drought have a positive influence on farmers' attitude towards adaptation to climate change and variability. The study concluded that although the majority of smallholder farmers perceive that the climate is changing, they continue to harbour negative attitudes towards prescribed climate change adaptation techniques. This study recommends more education on climate change, as well as adaptation strategies for both agricultural extension workers and farmers. This can be complemented by disseminating timely climate information through extension officers and farmers' groups.
171	Namibia	Zhu, B. Q. (2017). The geomorphological and landscape evolution of Namibia in Southwestern Africa, and the related environmental changes they present. In <i>Advances in Environmental Research</i> 56, pp. 205–233). Retrieved from <a href="https://www.scopus.com/inward/record.uri?eid=2-s2.0-85048781277&amp;partnerID=40&amp;md5=1e0709b02da126f53d28a1b48a093000">https://www.scopus.com/inward/record.uri?eid=2-s2.0-85048781277&amp;partnerID=40&amp;md5=1e0709b02da126f53d28a1b48a093000</a>	This paper focuses on the study of geomorphology and landscape evolution in Namibia, southwestern Africa. The relationship between geomorphology and climate in Namibia reveals the degree and extent to which its landscapes are determined by changing environmental conditions. Landscape degradation seems to have started in pre-colonial times most likely as a consequence of cattle farming. Geomorphological evidence of Quaternary change can be used to assist in the better management of contemporary and future environmental conditions.



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172	South Africa	Ziervogel, G., Pasquini, L., & Haiden, S. (2017). Nodes and networks in the governance of ecosystem-based adaptation: the case of the Bergrivier municipality, South Africa. <i>Climatic Change</i> , 144(2), 271-285.	This study was conducted in Bergrivier municipal in South Africa. Organizations (nodes) that have the potential to implement ecosystem-based adaptation are studied. The authors claim that a nodal governance focus on institutional structures, mentalities, technologies, and resources can be highly effective for understanding the factors supporting or constraining ecosystem-based adaptation. The study analysis reveals that in Bergrivier municipal area, both agricultural best practices and restoration activities are side-lined compared to other activities such as land use planning despite the importance of the agricultural sector in the Bergrivier area. The authors thus concluded in their study that a theory of nodal governance provides a highly detailed account of the process through which ecosystem-based adaptation in the Bergrivier area is governed. Moreover, an important aspect of the nodal approach is that it sees governance as a relationship contained within a shifting network of alliances rather than as a product of the realization of governing interests. Also, the use of nodal governance and SNA allows for the characterization and visualization of nodes and their networks and explains their impact on governance outcomes including knowledge access, mobilization of resources, and critical relations to others. This paper makes an important theoretical contribution by demonstrating the potential value of nodal governance theory and social network theory to both theory and practice regarding the governance of adaptation.
173	Uganda	Zizinga, A., Kangalawe, R. Y., Ainslie, A., Tenywa, M. M., Majaliwa, J., Saronga, N. J., & Amoako, E. E. (2017). Analysis of Farmer's Choices for Climate Change Adaptation Practices in	This study assessed the household determinants to climate change adaptation. This assessment was drawn from a case study of agricultural adaptation in the Mount Rwenzori area of South Western Uganda. In this study the major adaptation practices adopted by farmers were identified. The study also referred to the continuous on-farm practices, which farmers adjust on a seasonal

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		South-Western Uganda, 1980–2009. <i>Climate</i> , 5(4), 89.	basis to cope with climatic changes with an aim of improving yield and their land productivity as sustainable adaptation. According to the authors, despite the multiple functions of adaptation to smallholder farmers, there are limited studies that have focused on an assessment of the key drivers influencing the adoption of adaptation practices for climate change in the Albertine rift of Uganda. Data was collected through field observations, key informant interviews and questionnaire interviews for Small holder farmers. Furthermore, a multinomial logistic regression model was used to assess the drivers of farmers' choice for adaptation practices, factors influencing the choice of adaptation, and barriers. From the study major adaptation practices were identified and included the use of different crop varieties, tree planting, soil and water conservation, early and late planting, and furrow irrigation. The choice model results showed that the age of the household head, experience in farming, household size, climate change shocks, land size, use of agricultural inputs, landscape position (location), were factors which influenced farmers' choice of climate change adaptation practices.

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174	Mali	Zoundji, G. C., Vodouhe, S. D., Okry, F., Bentley, J. W., & Tossou, R. C. (2017). Beyond Striga Management: Learning Videos Enhanced Farmers' Knowledge on Climate-Smart Agriculture in Mali. <i>Sustainable Agriculture Research</i> , 7(1), 80.	This paper assesses the climate smart agricultural practices triggered by learning videos on integrated striga management, soil fertility and cost-benefit evaluation practices. Using household head interviews and focus group discussions, this study revealed that farmers have similar perceptions of climate change and related impacts in video-villages and in non-video-villages. However, farmers' observation of climate-change and related impacts are influenced by gender; men perceived more climatechange and related impacts than women. In non-video villages, few respondents adopted crop rotation, intercropping, crop diversification, improved short-cycle seed varieties and zaï techniques as climate change adaptation strategies. Videos contribute more to the adoption of crop rotation, intercropping and fertiliser application for men than for women. Videos on accounting (managing money) enable more women than men to enhance their cost-benefit evaluation practices for income improvement. During the interviews, women farmers in video-villages were eager to demonstrate their knowledgeabout cost-benefit evaluation. We also found that the yield of sorghum, millet and maizeis higher in video-villages than in non-video-villages. Thus, using videos as an extensiontool is suitable for knowledge development and leads to the high adoption of climate-smart agricultural practices for food securit

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175	Africa	Zscheischler, J., Mahecha, M. D., Avitabile, V., Calle, L., Carvalhais, N., Ciais, P., ... & Ichii, K. (2017). Reviews and syntheses: An empirical spatiotemporal description of the global surface-atmosphere carbon fluxes: opportunities and data limitations. <i>Biogeosciences</i> , 14(15), 3685-3703.	Understanding the global carbon (C) cycle is of crucial importance to map current and future climate dynamics relative to global environmental change. This research used a data-driven approach to synthesize a wide range of observation-based spatially explicit surface-atmosphere CO2 fluxes from 2001 and 2010, to identify the state of today's observational opportunities and data limitation. Results on the consistent derivation of data uncertainties could serve as prior knowledge in multi-criteria optimization such as the Carbon Cycle Data Assimilation System (CCDAS) without overstating data credibility. Also results from the spatially explicit flux estimates may be used as a starting point to assess the validity of countries' claims of reducing net C emissions in climate change negotiations.

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1	Sub-Saharan Africa	Abdulai, A. (2018). Simon Brand Memorial Address: The challenges and adaptation to climate change by farmers in Sub-Saharan Africa. <i>Agrekon</i> , 57(1), 28-39.	In this paper, a review of literature on the challenges and adaption to climate change by farmers in the sub-Saharan African (SSA) countries. It first provided an overview of the literature on the challenges and adaptation to climate change within the last two decades, followed by a brief discussion of the methods used in modelling the impact of adaptation to climate change on farm performance. Finally, it presents some empirical results on the impact of adoption of climate-smart techniques on crop yields by farmers in Ghana, and provide some thoughts on policy implications and future research in the area. Climate change continues to pose a threat to food and nutrition security for many households in the region. Several studies have therefore examined the challenges of climate change to agricultural productivity and poverty, and the impacts of adaptation to climate change on outcomes such as farm yields, net farm incomes, as well as food and nutrition security of households in SSA. The increasing threat of climate change to food and livelihood security, especially in sub-Saharan African countries, calls for measures to identify location specific adaptation strategies. The influence of climate and weather was discussed, in particular, rising temperatures on food and nutrition security. The greater negative impact of climate change on agricultural productivity in in SSA countries is related to its proximity to the equator, where crops grown are already exposed to the risk of exceeding their physiological temperature thresholds. The continuous warming also adversely affects seed development, hastens senescence, eventually leading to low yields. According to the article, future interventions to increase

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			agricultural productivity and reduce farmers' risk exposure should consider alleviating farmers' climate adaptation difficulties through the provision of irrigation facilities and improved access to off-farm work opportunities. Moreover, promoting research on heat and drought-resistant varieties, as well as making quality climate information accessible to farmers would be a useful strategy in helping them adapt to the challenges of climate change.
2	Ethiopia	Abera, K., Crespo, O., Seid, J., & Mequanent, F. (2018). Simulating the impact of climate change on maize production in Ethiopia, East Africa. <i>Environmental Systems Research</i> , 7(1), 4.	This study assesses the impact of climate change on maize production in three representative sites of maize growing areas in Ethiopia. Climate change is expected to significantly impact agricultural production across Africa. While a number of studies assessed this impact in semi-arid southern Africa, or tropical West Africa, only a limited number took interest in the mountainous and climatically varying Ethiopia of eastern Africa. The assessment relies on the DSSAT crop model simulation of maize under current climate and future projections (19 Global Climate Models and 2 Representative Concentration Pathways). The period 1980–2010 was used to represent the baseline climate, while future climate projections cover three periods; near term (2010–2039), mid-century (2040–2069) and end-of-century (2070–2099). Climate, soil and crop management data were collected for the study sites representing the maize growing areas in the country. Climate change/variability and its impact, as projected by the 19 GCMs in combination with 2 Representative Concentration Pathways and crop model, demonstrate variable response of maize crop yield in maize growing areas of Ethiopia. From a treatment perspective, planting dates and fertilizer rates always have an effect over simulated yield responses, yet the most promising combinations largely vary from one to another location. Through three major production areas in Ethiopia, this study improves our

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			understanding of local production variations under global climate change.
3	Nigeria	Abraham, T. W., & Fonta, W. M. (2018). Climate change and financing adaptation by farmers in northern Nigeria. <i>Financial Innovation</i> , 4(1), 11.	This paper examines farmers' perceptions of their exposure to climate change in rural northern Nigeria. It also examines whether there is a significant relationship between the exposure of farmers to climate change and their need for financial access as an adaptation strategy. Questionnaires were administered to 320 respondents in rural communities in northern Nigeria. Descriptive analysis shows that rural farmers are affected by climate change through increased temperature, prolonged dry seasons, floods, and drought, which lead to low harvest and, in turn, low income. An estimate from a non-parametric test also shows a significant relationship between farmers' perceived exposure to climate change and their need for credit. Although the Spearman correlation results show a 63% association between exposure to climate change and the need for finance, 96% of those seeking credit to mitigate these impacts would be unable to do so due to financial exclusiveness. The paper recommends that the Central Bank of Nigeria should ensure that microfinance institutions refocus their products/services to those who need them the most in order to enhance access to financial resources and enable farmers to build resilience that will maximize post-harvest gains. Lastly, considering that climate change is a global phenomenon with local effects, perhaps the international community could support lending to smallholder farmers through central banks by insuring the loans that banks give to farmers towards financing climate change adaptation strategies.
4	Africa	Adamson, G. C., Hannaford, M. J., & Rohland, E. J. (2018). Re-thinking the present: the role of a historical focus in climate change adaptation	The paper argues for three important areas where historians should engage with climate change adaptation. The first area is particularizing adaptation; this is the development of long-term empirical studies that uncover societal relations to climate in a

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		research. <i>Global Environmental Change</i> , 48, 195-205.	particular place, including climate's cultural dimensions which can provide a baseline and contextualisation for climate change adaptation options. The second, institutional path dependency and memory, argues for a focus on the evolution of formal institutions with a responsibility for adaptation, to understand how historical events and decisions inform and constrain practices today. The third argument is for an appreciation of the history of ideas and concepts that underpin climate change adaptation. The call is made to the second-order observation – observation of the observers – within climate change research, to ensure that adaptation does not perpetuate historically-grown power structures.
5	Egypt and Nigeria	Adeleke, M. L., Al-Kenawy, D., Nasr-Allah, A. M., Murphy, S., El-Naggar, G. O., & Dickson, M. (2018). Fish Farmers' Perceptions, Impacts and Adaptation on/of/to Climate Change in Africa (The Case of Egypt and Nigeria). In <i>Theory and Practice of Climate Adaptation</i> (pp. 269-295). Springer, Cham.	This research assesses the fish farmers' perceptions, impacts and adaptation on/of/to climate change in Africa, using Egypt and Nigeria as archetypal examples. It also annotates the precautionary measures taken by the fish farmers to ameliorate the negative impacts of climate change in the continent. KoboCollect method was used to design relevant questions and analyzed the fish farmers' responses. The results revealed that climate change has both positive and negative impacts on African aquaculture and it is believed that aquaculture is a way of adapting to the adverse effect of climate change on fisheries. 93% of the fish farmers in Africa have the ideal of climate change, 64% believe that the change will linger and persevere in the next 10–20 years. In Nigeria, 61% of the respondents relied on stream and river while in Egypt, 99% of the fish farmers cultured their fish on earthen ponds and depend on the use of agricultural drainage water. Fish production could not meet up with the demand of the consumers in Nigeria as a result of pending constraints unlike Egypt which has achieved the scale of aquaculture expansion compare to other African countries. It is therefore, expedient that efforts should be geared towards regional and continental integration in order to



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			encourage aquaculture practices in other part of Africa and climate change investment should be encouraged.
6	Nigeria	Agbede, T. M., Adekiya, A. O., Ale, M. O., Eifediyi, E. K., & Olatunji, C. A. (2018) Effects Of Green Manures And NPK Fertilizer On Soil Properties, Tomato Yield And Quality In The Forest-Savanna Ecology Of Nigeria. <i>Experimental Agriculture</i> , 1-14.	Green manures (GM) as an alternative to inorganic fertilizer offer considerable potential as a source of plant nutrients and organic matter (OM). Hence, field experiments were carried out during 2015 and 2016 cropping seasons to compare impacts of GM and NPK (15:15:15) fertilizer on soil properties, growth, fruit yield, mineral, lycopene and vitamin C contents of tomato ( <i>Lycopersicon esculentum</i> Mill). GMs were composed by green tender stems and leaves of pawpaw ( <i>Carica papaya</i> L.), neem ( <i>Azadirachta indica</i> A. Juss.), moringa ( <i>Moringa oleifera</i> Lam.) or gliricidia ( <i>Gliricidia sepium</i> (Jacq.) Kunth ex Walp.) and applied at 5 Mg ha <sup>-1</sup> , whereas NPK was applied at 300 kg ha <sup>-1</sup> and there was a no fertilizer plot (control). Application of GMs reduced soil bulk density and increased soil OM, N, P, K, Ca, Mg, growth, number of fruits and fruit yield of tomato compared with the control. NPK fertilizer had no effect on soil bulk density and soil OM, but it increased soil fertility and tomato yield as compared with the control. When comparing treatments, the highest tomato yield and best cost: benefit ratio were obtained with gliricidia as GM. The GMs and NPK fertilizer increased mineral, lycopene and vitamin C contents in tomato fruits and the highest K, Ca, Fe, Zn, Cu, lycopene and vitamin C contents in tomato fruits were found with moringa as GM. The results revealed that GM has potential to improve soil properties, tomato yield and quality, being an alternative for cropping management.
7	Ghana	Aggarwal, P. K., Jarvis, A., Campbell, B. M., Zougmore, R., Khatri-Chhetri, A., Vermeulen, S. & Radeny, M. (2018). The climate-smart village approach: framework of	This paper presents the climate-smart village (CSV) approach as a means of performing agricultural research for development that robustly tests technological and institutional options for dealing with climatic variability and climate change in agriculture using participatory methods. It aims to scale up and scale out the

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		<p>an integrative strategy for scaling up adaptation options in agriculture.</p> <p>.</p>	<p>appropriate options and draw out lessons for policy makers from local to global levels. Increasing weather risks threaten agricultural production systems and food security across the world. Maintaining agricultural growth while minimizing climate shocks is crucial to building a resilient food production system and meeting developmental goals in vulnerable countries. Experts have proposed several technological, institutional, and policy interventions to help farmers adapt to current and future weather variability and to mitigate greenhouse gas (GHG) emissions. The approach discussed in this article incorporates evaluation of climate-smart technologies, practices, services, and processes relevant to local climatic risk management and identifies opportunities for maximizing adaptation gains from synergies across different interventions and recognizing potential maladaptation and trade-offs. It ensures that these are aligned with local knowledge and link into development plans. Results from initial studies indicate that the CSV approach has a high potential for scaling out promising climate-smart agricultural technologies, practices, and services. Climate analogue studies indicate that the lessons learned at the CSV sites would be relevant to adaptation planning in a large part of global agricultural land even under scenarios of climate change. Key barriers and opportunities for further work are also discussed.</p>
8	Uganda	<p>Ajak, B. J., Kyazze, F. B., &amp; Mukwaya, P. I. (2018). Choice of Adaptation Strategies to Climate Variability among Smallholder Farmers in the Maize Based Cropping System in Namutumba District, Uganda. <i>American Journal of Climate Change</i>, 7(03), 431.</p>	<p>This study employed a multi-stage sampling procedure to select the study area and household respondent identity adaptation strategies and factors influencing their choices. In order to respond to the impact of climate variability stresses, smallholder farmers have adapted growing drought-resistant crops (12.2%), extension of the agricultural frontier into wetlands during the dry spells (37%), whereas use of crop rotation (9.8%) is the most dominant strategies used to manage pest and diseases, similarly soil and</p>

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			water conservation (15.3%) and climate-smart planning basin (11%) are the most dominant adaptation strategies use to manage flood. Empirical results from multinomial logit modeling showed that predictor variables gender, level of education, years of farming, house size, access to credit, and own radio have a significant influence on the choice of adaptation strategies with differences significant level during the dry spell. The study recommends that future policies should focus on strengthening the existing extension training package, strengthening the existing farmer's groups and cooperatives, encouraging informal social networks in order to boost smallholder farmers' adaptation to climate variability.
9	Nigeria	Akanoa, O., Modirwa, S., Yusuf, A., & Oladele, O. (2018). Making smallholder farming systems in Nigeria sustainable and climate smart. <i>13th European IFSA Symposium</i>	Agriculture is the predominant occupation among rural dwellers who are mostly smallholder farmers in Nigeria. Changes in the frequency and severity of droughts and floods, extreme temperatures, protracted rainy season as occasioned by recent climatic changes are leading to reduced food productivity of smallholders and thereby threatening food security. The sustainable productivity of smallholders, therefore, depends on their ability to adapt to climatic changes and variability hinged on holistic approaches to agricultural production. This paper sought to analyses and review farming systems in Nigeria, smallholders' understanding of climate change, climate change impact on agricultural productivity, and mitigation and adaptation strategies. Identifying and implementing climate-smart practices such as integrated soil fertility management, improved agricultural inputs, water, and nutrient management in interdisciplinary synergism with concepts such as decision support systems and scaled up rural advisory services, potentially improves the sustainability of smallholder systems. This creates better livelihoods for farmers, accelerated rural development and food security. In addition,

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			ensuring food security in Nigeria requires prioritization of smallholder farming systems with appropriate measures of how climate change impacts will be mitigated, long before they are experienced.
10	Africa	Alexander, P., Rabin, S., Anthoni, P., Henry, R., Pugh, T. A., Rounsevell, M. D., & Arneth, A. (2018). Adaptation of global land use and management intensity to changes in climate and atmospheric carbon dioxide. <i>Global change biology</i> , 24(7), 2791-2809.	In this study, land use and demand projections were evaluated against historical data to assess suitability for exploring future scenarios, a task often not conducted for land use models. These coupled models were used to investigate the potential for adaptation to climate change within the agricultural system and possible climate change impacts on land use. The results suggest that the global agriculture and food system has the capacity to potentially diminish the negative impacts and take greater advantage of the more positive outcomes of climate change through adaptation, for example, by changing crop types, management practices or shifting cultivated area.
11	Ghana	Amadou, M. L., Villamor, G. B., & Kyei-Baffour, N. (2018). Simulating agricultural land-use adaptation decisions to climate change: An empirical agent-based modelling in northern Ghana. <i>Agricultural Systems</i> .	The aim of this article is to examine local agricultural adaptation to climate change and variability in a semi-arid area of the Upper East Region of Ghana. This is performed by integrating the two-step decision making sub-models, Perception-of-Climate-Change and Adaptation-Choice-Strategies, to the Land Use Dynamic Simulator (LUDAS). The simulation results suggest that the land-use choices in the study area reflect a tendency towards increasing subsistence farming in an area where there has been a gradual trend away from traditional land uses such as cereal production to the cultivation of groundnut, rice, maize and soybean. Groundnut monoculture production has emerged locally as coping measure for dealing with increased climatic variability. In terms of livelihood strategy, there is an increasing contribution of rice and groundnut to household gross incomes. The predicted pattern of changes in gross household income under a scenario in which climate change is perceived by local farmers explicitly revealed

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			the contribution of adaptation options to household livelihood strategy.
12	Nigeria, Uganda	Amare, M., Mavrotas, G., & Edeh, H. (2018). Farmers' Crop Choice Decisions: Trends and Determinants in Nigeria and Uganda.	This study investigates how farmers allocate their available farm land under various drivers of crop choice. It also investigates the determinants and trends of crop area and income diversification. The study use panel data from nationally representative household-level surveys for Nigeria and Uganda that contain rich socioeconomic and demographic information, merging the survey data with detailed weather shocks and land cover change. They use both the shares of land and income of the major crop categories to measure farmers' crop choice decisions. The main results using seemingly unrelated and fixed-effects regression models for crop choice decision and crop diversification are summarized as follows. It was found that weather shocks affect farmers' crop choice decisions, but effects differ across major crop categories. For example, rainfall shocks increase the land share of pulses in both countries. However, rainfall shocks have a negative effect on the land share of tuber crops in Nigeria and cash crops in Uganda. The analysis also highlights the importance of household characteristics, plot characteristics, and road accessibility in explaining farmers' crop choice decisions, measured using land and income shares of major crops. We also examine the determinants of crop diversification using both crop area and income diversification. The results show that significant variables are heterogeneous in sign and magnitude across the two countries.
13	Ethiopia	Amare, Z. Y. (2018). Indigenous knowledge of rural communities for combating climate change impacts in west central Ethiopia. <i>Journal of Agricultural Extension</i> , 22(1), 181-195.	The study examined how local knowledge of climate change plays a role in adjusting to changing climate and how these beliefs may influence future decision making about how to go about adjusting to climate change at a local level. The study was conducted in west central Ethiopia at the edge of the Blue Nile. The current indigenous knowledge practiced by the local community in

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			adopting the changing environmental conditions was discussed. Rural communities have local knowledge in areas such as weather and seasonal forecasting (44%), drought forecasting (20.9%), crop pest & disease (47%), and weed (99.7%) control methods to adapt to some of the climate change impacts. Not all households have the same levels and types of indigenous knowledge. Therefore, awareness creation and experience sharing among community members are important in increasing the application of indigenous knowledge for climate change adaptation
14	Sudan	Amarnath, G., Simons, G. W. H., Alahacoon, N., Smakhtin, V., Sharma, B., Gismalla, Y & Andriessen, M. C. M. (2018). Using smart ICT to provide weather and water information to smallholders in Africa: The case of the Gash River Basin, Sudan. <i>Climate Risk Management</i> , 22, 52-66.	In the Gash Delta of Eastern Sudan, spate irrigation (flood-recession farming) contributes substantially to rural livelihoods by providing better yields than rainfed dryland farming. However, spate irrigation farmers are challenged by the unpredictability of flooding. In recent decades, the number of farmers practicing spate irrigation has decreased, due to varying rainfall intensity and frequency, insufficient infrastructure and farmers' limited capacity to manage such variations. One solution that may help farmers face such challenges is for them to access real-time water-related information by using smart Information and Communication Technology (ICT). This paper shows how integrating remote sensing, Geographical Information Systems (GIS), flood-forecasting models and communication platforms can, in near real time, alert smallholder farmers and relevant government departments about incoming floods, using the Gash basin of Sudan as an example. The research, initially conducted on a 60 × 60 km site, was later extended to the entire Gash basin. The paper outlines how to develop tools that can monitor plot-specific information from satellite measurements, and supply detailed and specific information on crops, rather than providing very general statements on crop growth.

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15	Benin	Amouzou, K. A., Naab, J. B., Lamers, J. P., & Becker, M. (2018). CERES-Maize and CERES-Sorghum for modeling growth, nitrogen and phosphorus uptake, and soil moisture dynamics in the dry savanna of West Africa. <i>Field Crops Research</i> , 217, 134-149.	The findings of this paper support the identification of sustainable production and intensification options for the maize- and sorghum-based production systems of West Africa that would be more resilient under future climate variability and thus support better-informed decision-making. The CERES-Maize and CERES-Sorghum models predicted with satisfaction yield components and the underlying soil water and plant N and P demands under current weather conditions. While assuming the long-term weather scenario, both models predicted increased soil C and N, water- and N- use efficiencies, and grain yields under the integrated soil-crop management practice compared to un-amended soil and high rates of mineral fertilizer use. Since the models realistically predicted seasonal soil water and nitrate-nitrogen dynamics in both maize- and sorghum-based productions systems in northern Benin, it can be concluded that both models perform well in water- and nutrient-stress-free as well as nutrient-deficient crop production environments. This evidence the robustness of the CERES-Cropping System models to perform under dry savanna agro-ecological conditions as prevail in various parts of West Africa. Consequently, both models are appropriate tools for exploring potential impacts of predicted climate change on soil water and nutrient use efficiencies.
16	The Gambia	Amuzu, J., Jallow, B., Kabo-Bah, A., & Yaffa, S. (2018). The Climate Change Vulnerability and Risk Management Matrix for the Coastal Zone of The Gambia. <i>Hydrology</i> , 5(14), 21-22.	Coastal zones are vulnerable to its impacts. An effective approach with long-term prospects in addressing climate change impacts is it's mainstreaming into development agenda of sectoral policies. A comprehensive risk and vulnerability assessment is a pre-requisite to ensure that the right adaptive response is taken for effective integration into developmental plans. The relevance of this study was to create a link between the sub-national and local levels in order to facilitate the integration and mainstreaming of climate change into sectoral and local policies for more climate-

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			resilient communities. This aided in the promotion of strategic investment of constrained developmental resources to actualize successfully dynamic coping strategies, elude ‘maladaptation’ and less compelling responsive measures. A purposive expert sampling technique was used in selecting respondents for the study. The findings of the study reveal that by the end of the 21st century, the climatic variables likely to have the highest impact on the coastal zone of The Gambia are ‘increased flood severity’ and ‘increased temperature’. The coastal zone of The Gambia showed a high vulnerability to these climate change variables. The suggested adaptive response in addressing the impacts of increased flood intensity in the study area includes; improving regulations for restricting agriculture and livestock grazing activities to improve land cover; strengthening of early-warning systems, among others. The suggested adaptive response in addressing the increase in temperature includes: increase crop diversification and rotation to reduce total crop failure; switching to drought-tolerant crop and animal species, among others.
17	Nigeria	Anabaraonye, B., Okafor, J. C., & Hope, J. (2018). Educating Farmers in Rural Areas on Climate Change Adaptation for Sustainability in Nigeria. <i>Handbook of Climate Change Resilience</i> , 1-19.	This chapter closely examines the impacts of climate change in Nigeria and most especially in the agricultural sector. It also explores the need to educate farmers in rural areas on climate change adaptation and the tools which can be creatively used for climate change education for farmers in rural areas in Nigeria to enable them to adapt effectively for sustainability. Climate change is one of the global issues which we must of necessity tackle with alacrity in order to prevent global warming too unbearable for the survival of mankind. While the industrialized countries of the world, the major contributors to climate change, have the capacity to respond to the impact of climate change, most developing countries like Nigeria do not have sufficient adaptive capacity to climate change and global warming. They, therefore, need



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			assistance from developed countries for climate change adaptation. Climate change education is therefore vital in every community in order to prepare people for climate change impacts and to learn how to adapt effectively.
18	Ghana	Antwi-Agyeia, P., Dougillb, A.J., Stringerb, L.C., Nii Ardet, S.C. (2018) Adaptive outcomes and maladaptive approach to vulnerable hotspots in Northern Ghana. <i>Climate risk management</i> , 19, 83-93	This paper explores the effects of climate change coping and adaptation responses in three villages across the Central Gonja district of northern Ghana. The study addresses the following research questions: What are the key climatic and non-climatic stressors confronting households in northern Ghanaian communities? How are households adapting to climatic and non-climatic stressors? And what are the outcomes of these coping and adaptation responses on development? The study identified various adaptation measures including extensification and intensification of agriculture, temporary migration, planting of drought resistant varieties, irrigation, and livelihood diversification.
19	Ghana	Apuri, I., Peprah, K., & Achana, G. T. W. (2018). Climate change adaptation through agroforestry: The case of Kassena Nankana West District, Ghana. <i>Environmental development</i> .	The paper aims at assessing agroforestry as an adaptation strategy to a changing local climate. Agroforestry is necessitated by the need to improve tree population along the Sisili River and other areas in the Kassena Nankana West District. Primary data were generated through survey methods in which questionnaires were administered to 75 agroforestry farmers. It was triangulated with eight focus group discussions and five key informant interviews. Additionally, secondary data on rainfall and temperature (1984–2015) were analysed. The study revealed that farmers have noticed changes in the local climate as declining rainfall and increasing sunshine associated with rising temperature. Secondly, agroforestry was found to be useful in reducing water and wind erosion of soil, it improves soil nutrients, moisture retention and household food availability. Agroforestry is challenged with water shortages, unsupervised livestock grazing and bushfires. The study

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			concludes that agroforestry is a dynamic agricultural adaptation option to a changing local climate. Therefore, the Ministry of Food and Agriculture and NGOs should support farmers with dams and fencing materials and encourage more farmers to adopt agroforestry.
20	Ethopia	Asrat, P., & Simane, B. (2018). Farmers' perception of climate change and adaptation strategies in the Dabus watershed, North-West Ethiopia. <i>Ecological Processes</i> , 7(1), 7. <a href="http://doi.org/10.1186/s13717-018-0118-8">http://doi.org/10.1186/s13717-018-0118-8</a>	The study employed descriptive methods to assess farmers' perception of climate change, local indicators of climate change and types of adaptation measures exercised to cope up with the risk of the change in climate. The study also employed the Heckman sample selection model to analyze the two-step process of adaptation to climate change which initially requires farmers' perception that climate is changing prior to responding to the changes through adaptation measures. Based on the model result educational attainment, the age of the head of the household, the number of crop failures in the past, changes in temperature and precipitation significantly influenced farmers' perception of climate change in wet lowland parts of the study area. In dry lowland condition, farming experience, climate information, duration of food shortage, and the number of crops failures experienced determined farmers' perception of climate change. Farmers' adaptation decision in both the wet and dry lowland conditions is influenced by household size, the gender of household head, cultivated land size, education, farm experience, non-farm income, income from livestock, climate information, extension advice, farm-home distance and number of parcels.
21	Africa	Awojobi, O., & Anamani, M. (2018). Adaptation Plans: Building Climate Resilience in Agriculture. <i>International Journal of Agriculture and Environmental Research</i> , 4(1). 211-219.	Climate change is real, and its impacts are overwhelming, particularly in developing countries. This paper examines how adaptation plans can be built in order to enhance the climate resilience in the agricultural sector. Data were collected from the United Nations Development Programme (UNDP) and the Food and Agriculture Organization of the United Nations (FAO) experts

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			through the United Nations Institute for Training and Research (UNITAR) Massive Open Online Course (MOOC) on national adaptation planning in the agriculture sector. The data were analysed by manual coding. The findings from the analysis indicate that increasing temperature variability and changes in the level of precipitation will adversely affect the poor, such as fishers, farmers, cattle breeders, and communities depending on forest products as well as women and indigenous people. And this will, in turn, lead to an increase in poverty, a rise in food insecurity, alteration of the nutrition, unemployment, and conflicts and violence within poor communities leading to forced displacement and migration. The findings from this study outline measures that can be taken to build adaptation plans to reduce the magnitude of the impacts of climate change.
22	Ethiopia	Ayal, D. Y., Radeny, M., Desta, S., & Gebru, G. (2018). Climate variability, perceptions of pastoralists and their adaptation strategies: Implications for livestock system and diseases in Borana zone. <i>International Journal of Climate Change Strategies and Management</i> , 10(4), 596-615.	This paper provided detailed insights about the rainfall and temperature trend and variability for the past three decades. The finding pointed that pastoralists' livelihood is under climate variability stress, and it has implications to food insecurity. The paper aims to examine climate variability and its impact on livestock system and livestock disease among pastoralists in Borana, Southern Ethiopia. Climate variability and extremes adversely affect the livestock sector directly and indirectly by aggravating the prevalence of livestock diseases, distorting production system and the sector profitability. Data were collected through a combination of quantitative and qualitative methods using household questionnaire, field observations, focus group discussions and key informant interviews. Areal grid decadal rainfall and temperatures data from 1985 to 2014 were collected from national meteorological agency. The quantitative and qualitative data were analysed and interpreted using appropriate analytical tools and procedures. The result revealed that the study

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			area is hard hit by moisture stress, due to the late onset of rainy seasons, decrease in the number of rainy days and volume of rainfall. The rainfall distribution behaviour coupled with the parallel increase in minimum and maximum temperature exacerbated the impact on livestock system and livestock health. Majority of the pastoralists are found to have rightly perceived the very occurrence and manifestations of climate variability and its consequences. Pastoralists are hardly coping with the challenges of climate variability, mainly due to cultural prejudice, poor service delivery and the socio-economic and demographic challenges. The finding of the study provides baseline information for practitioners, researchers and policymakers.
23	Nigeria	Ayanlade, A., Radeny, M., & Akin-Onigbinde, A. I. (2018). Climate variability/change and attitude to adaptation technologies: a pilot study among selected rural farmers' communities in Nigeria. <i>GeoJournal</i> , 83(2), 319-331.	This Paper aims at assessing climate variability/change, the perception of rural farmers on climate change and preferred adaptation strategies among the farmers in some selected farming communities in Nigeria. The study thus used both meteorology data and social survey, to examine variability/change in climate and factors determining the adaptation techniques adopts by rural farmers. The results show a relatively uniform temperatures and some seasonal variations in recent years (diurnal range of temperature is about 10 C) but the rainfall shows much more seasonal variations. The rainfall has relatively undeviating trend from 1981 to 1996 but the trend appears to be upwards from the year 1997 to 2010. About 72.8% participants responded in the affirmative that climate is changing but there appears to be a significant relationship between the length of farming experiences and farmers' perceptions of climate change adaptation techniques. Water-related (about 53%) and nutrient related (about 52%) technologies appear to have a high preference among the farmers. The major driver that determines farmers' preference for climate change adaptation techniques is their incomes and experiences

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24	Niger	Badou, D. F., Diekkrüger, B., Kapangaziwiri, E., Mbaye, M. L., Yira, Y., Lawin, E. A. & Afouda, A. (2018). Modelling blue and green water availability under climate change in the Beninese Basin of the Niger River Basin, West Africa. <i>Hydrological Processes</i> , 32(16), 2526-2542.	The aim of this study was to quantify climate change impact on future blue water (BW) and green water (GW) resources as well as the associated uncertainties for 4 subbasins of the Beninese part of the Niger River Basin. Driven by the downscaled climate data, future BW and GW were evaluated with hydrological models validated with streamflow and soil moisture, respectively. The results indicate that GW will increase in all the 4 investigated subbasins, whereas BW will only increase in one subbasin. The overall uncertainty associated with the evaluation of the future BW and GW was quantified through the computation of the interquartile range of the total number of model realizations (combinations of regional climate models and selected hydrological models) for each subbasin. The results show larger uncertainty for the quantification of BW than GW. To cope with the projected decrease in BW that could adversely impact the livelihoods and food security of the local population, recommendations for the development of adequate adaptation strategies are briefly discussed.
25	Ethopia	Balehey, S., Tesfay, G., & Balehegn, M. (2018). Traditional gender inequalities limit pastoral women's opportunities for adaptation to climate change: Evidence from the Afar pastoralists of Ethiopia. <i>Pastoralism</i> , 8(1), 23.	A triangulation of different techniques including focused group discussions, individual interviews, case studies and structured observations was used to see if there is a difference in factors that determine the level of vulnerability and adaptive capacity between Afar men and women. Gender inequality inherent in the Afar customary tradition (Adda) acts as a risk multiplying factor, resulting in women being more vulnerable than men to climate change-induced food insecurity and related risks. Moreover, men have better scores in different variables determining vulnerability and adaptive capacity, including wealth ownership, wealth inheritance, household-level decision power, opportunities for community-level participation, household burdens and health or body mass index (BMI). Despite their limited scores in many of

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			these factors, Afar pastoral women make higher contributions to household-level adaptation to recurrent drought and weather variability. A gendered approach that recognizes the difference in potentials, limitations and vulnerabilities of pastoral women and men is required for successful implementation of adaptation measures.
26	Niger	Baragé, M., Moussa, B., & Comby, J. (2018). "Climate change perception and adaptation strategy associated with farming techniques in Tamou district wester Niger" farmers. <i>African Journal of Agricultural Research</i> , 13(30), 1496-1507.	The variability of climate parameters in most of agricultural areas in Niger represents a major risk for farmers. This work is aimed at analyzing farmer's perception and adaptation to climate change parameters in Tamou district. The study was conducted on seventy three (73) millet farmers from seven villages in Tamou, namely Allambaré, Bani Guiti, Guieme, Tollondi , Moli Haoussa and Welgorou. The sample was random, and tables were built from the results of a brief survey of millet farmers. The results obtained showed that farmers appreciate changes in climae parameters through rainfall (92.6%) while 7.4% do not perceive this parameter as factor, wind (88.9%), and temperature (85.2%). The adaptations techniques include organic and mineral fertilizers (87%) adjustment of farming to rainfall calendar (96%), using improved seeds varieties (75%), crop diversification (49%), water and soil preservation techniques (34%) and rural migration (3.8%). These adaptations are identified in the rural community of Tamou by several factors: degree of experience importance in terms of agricultural practices, the supervision of extension agents, the number of workers per household, the property rights and a good annual income. These adaptations and determining factors must be taken into account by all stakeholders in decision making in Niger's agricultural policy to guarantee food securityfarmers.
27	Burkina Faso	Baumert, S., Khamzina, A., & Vlek, P. L. (2018). Greenhouse gas and energy balance of Jatropha biofuel	This article showed that all biofuel production scenarios of Jatropha curcas systems introduced on croplands in Burkina Faso showed positive GHG and energy balances in comparison to diesel

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		production systems of Burkina Faso. <i>Energy for Sustainable Development</i> , 42, 14-23.	fuel production, particularly under the assumption that J. curcas by-products are used as additional energy sources. The production and use of J. curcas fuel can therefore contribute to climate change mitigation and increasing energy independency in Burkina Faso. The main trade-offs that could compromise this potential are (1) very low land-use efficiency that characterized J. curcas intercropping and monocultural plantations, and failing plantings on marginal lands; and (2) high share of human energy in the overall energy balance of intercropping systems. If these points are not well addressed, J. curcas production risks to compete for land either with food crops or natural savanna and will not be economically viable for smallholder producers. The decentralized production and use of SVO in diesel engines for power and electricity generation, substituting for expensive fossil diesel, seems to be promising for enhancing energy access and rural development. In order to reach energy supply targets without compromising other ecosystem services, the J. curcas cultivation systems need to be made more efficient based on silvicultural knowledge of yield responses of domesticated J. curcas breeds.
28	West Africa	Bautze, L., Nicolay, G. L., Meier, M., Gattinger, A., & Muller, A. (2018). Climate Change Adaptation Through Science-Farmer-Policy Dialogue in Mali. <i>Handbook of Climate Change Resilience</i> , 1-15.	This chapter shows the project results of the science-farmer-policy dialogue established in this project, moderated by interdisciplinary researchers and the innovation platform established in Southern Mali. Particular emphasis is given on how effective climate change adaptation measures (both technical and institutional) can be selected in a participatory process with smallholders' groups as well as taking into account the institutional context within the involved region. Additionally, the project explores how insights from farmers' groups and extensionists can be utilized and disseminated via innovation platform-based processes and how the latter may serve to identify and develop new solutions. Through innovation platforms, other stakeholders like extensionists,

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			researchers, value chain operators, farmer organizations, and policy makers can support the resilience of smallholders' farms. Therefore, this chapter presents lessons learned from the process of establishing innovation platforms in Mali. It is essential to learn and exchange these experiences with other farmers, farmer groups, researchers, and policy makers in drought-prone regions to further develop this concept as a practical solution for climate change adaptation in the area.
29	Mauritius and others	Becker, A., Ng, A. K., McEvoy, D., & Mullett, J. (2018). Implications of climate change for shipping: Ports and supply chains. <i>Wiley Interdisciplinary Reviews: Climate Change</i> , 9(2), e508.	Ports are an important economic actor at local, national, and international scales that have been identified as being vulnerable to future changes to the climate. This paper details the findings from an international review of state-of-the-art knowledge concerning climate risks, and adaptation responses, for ports and their supply chains. Evidence from both academic and gray literature indicates that there has already been major damage and disruption to ports across the world from climate-related hazards and that such impacts are projected to increase in the years and decades to come. Findings indicate that while a substantial and growing body of scientific evidence on coastal risks and potential adaptation options is acting as a stimulus for port authorities to explicitly consider the risks for their assets and operations, only a notable few have actually made the next step toward implementing adaptation strategies. This paper concludes by putting forward constructive recommendations for the sector and suggestions for research to address remaining knowledge gaps. It emphasizes a call for collaboration between the research and practice communities, as well as the need to engage a broad range of stakeholders in the adaptation planning process.
30	Africa	Bedeke, S., Vanhove, W., Gezahegn, M., Natarajan, K., & Van Damme, P. (2018). Adoption of climate change	This study investigates how maize-dependent smallholders in Ethiopia adapt to climate change. Both household and plot-level data were collected, and subsequently analysed by a multivariate



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		adaptation strategies by maize-dependent smallholders in Ethiopia. NJAS-Wageningen <i>Journal of Life Sciences</i> .	probit regression model. Results show that most climate change adaptation strategies implemented by maize-dependent smallholders, are complementary. Combining conservation tillage, mixed maize-legume cropping and terracing along with the use of drought-resistant maize varieties allows farmers to increase productivity while building resilience to climate change more than a subset of these strategies. Findings indicate that the likelihood of adopting soil and water conservation practices, drought-resistant maize varieties and chemical fertilizers significantly increase among young and male-headed households as well as farmers having confidence in extension agents and membership in local organisations. Hence, policies should aim at further building agricultural extension agents' capacity by providing effective and continuous education and training on climate change impacts and responses. Promoting family ties and household memberships in local organisations through facilitating mutual cooperation and communication among farming communities would help to foster adoption of climate change adaptation strategies.
31	South Africa	Belle, J. A., Collins, N., & Jordaan, A. (2018). Managing wetlands for disaster risk reduction: A case study of the eastern Free State, South Africa. <i>Jàmbá: Journal of Disaster Risk Studies</i> , 10(1), 1-10.	This article investigated the knowledge and practice of a nature-based solution to reduce disaster risks of drought, veld fires and floods using wetlands in the eastern Free State, South Africa. Ninety-five wetlands under communal and private ownership as well as a few in protected areas were sampled, with their users completing questionnaires. The study showed that communal wetlands were more degraded, while wetlands in protected areas and in private commercial farms were in a good ecological state. An extensive literature review reveals that healthy wetlands are effective buffers in reducing disaster risks such as drought, veld fires and floods which are recurrent in the study area. Therefore, through better land-use and management practices, backed by education and awareness, wetlands could be good instruments to

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			mitigate recurrent natural hazards in the agriculturally dominated eastern Free State in South Africa. According to the article wetlands could be a cost-effective, community-driven, bottom-top approach in mitigating the recurrent risks of drought, veld fires and floods in the eastern Free State if wetlands are properly managed. This ecosystem-based approach to reduce disaster risk and adapt to climate change has received and continues to receive much international attention in recent years.
32	Sahel Regions	Béné, Christophe, Cornelius, Alex, Howland, Fanny (2018). Bridging humanitarian responses and long-term development through transformative changes-some initial reflections from the World Bank's adaptive social protection program in the Sahel. Sustainability (Switzerland), 10(6): 1697	In the context of increasing climate-related extreme events and other crises, the concept of adaptive social protection (ASP) has been recognized as a potentially effective policy response to reduce the impacts of these shocks and stressors on vulnerable households. The concept is currently being tested at scale by the World Bank in six countries in the Sahel region. Based on conceptual considerations, this paper aims to address three questions: How and to what extent can adaptive social protection be considered transformative? Where does this concept sit along the humanitarian–development continuum? And, how does it relate to resilience? To answer these questions the paper draws on the authors' exposure to the on-going World Bank ASP program, as well as documents derived from the emerging body of literature on climate- and shock-responsive social protection. Drawing on these different materials the paper first demonstrates that ASP can effectively be considered as a transformative intervention at two different levels: at the system level and at the beneficiaries' level. The paper also shows how, through its activities designed to strengthen households' adaptive capacity, an ASP program can contribute to building resilience beyond the short-term coping strategies which humanitarian interventions generally focus on. As such ASP covers a larger spectrum along the humanitarian–

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			development continuum than most other interventions proposed in the context of shock-responsive interventions
33	Kenya	Benjamin, E. O., Ola, O., & Buchenrieder, G. (2018). Does an agroforestry scheme with payment for ecosystem services (PES) economically empower women in sub-Saharan Africa? <i>Ecosystem Services</i> , 31, 1–11. <a href="http://doi.org/10.1016/j.ecoser.2018.03.004">http://doi.org/10.1016/j.ecoser.2018.03.004</a>	The objective of the study is to determine whether equitable agroforestry schemes with PES have a positive effect on the agribusiness profitability of female smallholder farmers and to provide insights on the characteristics of poor women (not) participating in agroforestry PES schemes acknowledging that female farmers are not a homogenous economic group due to varying levels of ownership and access to resources. Results show that agroforestry PES scheme that considers gender equity during its design and implementation process can empower female smallholder farmers.
34	Sub-Saharan Africa	Berck, C. S., Berck, P., & Di Falco, S. (Eds.). (2018). <i>Agricultural Adaptation to Climate Change in Africa: Food Security in a Changing Environment</i> . Routledge.	This book is to document the effects of climate change on agriculture in Africa and to discuss strategies for adaptation to hotter weather and less predictable rainfall. These strategies include promoting opportunities for farmers to adopt technologies that produce optimal results in terms of crop yield and income under local agro-ecological and socioeconomic conditions. A changing climate is likely to have a drastic impact on crop yields in Africa. The focus is on sub-Saharan Africa, an area that is already affected by changing patterns of heat and rainfall. Because of the high prevalence of subsistence farming, food insecurity, and extreme poverty in this region, there is a great need for practical adaptation strategies. The book includes empirical research in Ethiopia, Kenya, South Africa, Tanzania, and other Sub-Saharan countries, and the conclusion summarizes policy-relevant findings from the chapters. It is aimed at advanced students, researchers, extension and development practitioners, and officials of government agencies, NGOs, and funding agencies. It also will provide supplementary reading for courses in environment and development and in agricultural economics.

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35		Boansi, D., Tambo, J. A., & Müller, M. (2018). Intra-seasonal risk of agriculturally-relevant weather extremes in West African Sudan Savanna. <i>Theoretical and Applied Climatology</i> , 1-19.	This article reported on farmers' perception of climate change and the adaptation practices adopted in the face of these changes. Using household survey data and historical daily climate data for 29 communities across Upper East Ghana and Southwest Burkina Faso, we document climatic conditions deemed major threat to farming in the West African Sudan Savanna and assess risks posed by such conditions over the period 1997–2014. Based on farmers' perception, it is found that drought, low rainfall, intense precipitation, flooding, erratic rainfall pattern, extremely high temperatures, delayed rains, and early cessation of rains are the major threats farmers face. Using first-order Markov chain model and relevant indices for monitoring weather extremes, it is discovered that climatic risk is a general inherent attribute of the rainy season in the study area. Due to recent changes in onset of rains and length of the rainy season, some farmers have either resorted to early planting of drought-hardy crops, late planting of drought-sensitive crops, or spreading of planting across the first 3 months of the season to moderate harm. Each of these planting decisions however has some risk implications. The months of May, June, and October are found to be more susceptible to relatively longer duration of dry and hot spells, while July, August, and September are found to be more susceptible to intense precipitation and flooding. To moderate harm from anticipated weather extremes, farmers need to adjust their cropping calendar, adopt appropriate crop varieties, and implement soil and water management practices. For policy makers and other stakeholders, we recommend the supply of timely and accurate weather forecasts to guide farmers in their seasonal cropping decisions and investment in/installation of low-cost irrigation facilities to enhance the practice of supplemental irrigation.

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36	West Africa	Boateng, I. (2018). An assessment of vulnerability and adaptation of coastal mangroves of West Africa in the face of climate change. In <i>Threats to Mangrove Forests</i> (pp. 141-154). Springer, Cham.	This chapter seeks to evaluate the current status of West Africa's mangroves. It assesses Climate Change vulnerability and adaptation options for mangroves in West Africa. This assessment has identified that both the past and the present vulnerability were more controlled by anthropogenic activities than the effects of climate change, though it is expected that climate change may be the major driving force in the long-term. However, many adaptation options exist to enhance specific ecosystem services in ways that reduce negative trade-offs, but these involve changes in policies, institutional framework and better practices for exploitation, and good management strategies. The chapter concludes that West Africa should implement adaptation policy options including reducing anthropogenic impacts, maintaining coastal buffer zones, restoration of mangroves, catchment management, establishing regional monitoring and regulations and education and local participation to enhance sustainability
37	Ethiopia	Bommarco, R., Vico, G., & Hallin, S. (2018). Exploiting ecosystem services in agriculture for increased food security. <i>Global Food Security</i> , 17, 57–63. <a href="http://doi.org/10.1016/j.gfs.2018.04.001">http://doi.org/10.1016/j.gfs.2018.04.001</a>	This study assesses agro-ecology specific vulnerability of smallholder farmers to climate change and variability in the Dabus Watershed (North-west Ethiopia). Recognizing the physiographic and climatic diversity that exists across agro-ecologies in the study area, Livelihood Vulnerability Index (LVI) framed within the United Nations Intergovernmental Panel on Climate Change (IPCC) vulnerability framework (LVI-IPCC) is adapted to assess agro-ecology specific vulnerability in two local agro-ecologies, namely wet lowland and dry lowland. For each agro-ecology, exposure, sensitivity and adaptive capacity indices as well as LVI-IPCC vulnerability score was calculated. The result shows that the dry lowland agro-ecology has a relatively higher exposure and sensitivity to climate stresses with a comparatively limited adaptive capability. On the other hand, the wet lowland agro-ecology exhibits intermediate vulnerability with a relatively lower

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			perceived exposure and higher adaptive capacity. Higher exposure relative to adaptive capacity resulted in a positive LVI-IPCC score in the dry lowland agro-ecology and positioned it in more vulnerable level than the wet lowland. A higher adaptive capacity relative to exposure unveils a negative LVI-IPCC score for the wet lowland agro-ecology and positioned it in a moderate vulnerability category. In line with the findings, there is a need to set agro-ecology specific priorities for intervention that is most needed to cop up with the effects of climate variability and change in each agro-ecology. Climate risk exposure levels can be reduced through timely provision of climate specific information and early warning systems aimed at enhancing preparedness of farm households to extreme events. It is also crucial to expand availability of infrastructural facilities such as market, health services, and veterinary services so as to enhance adaptive capacity. Supporting alternative livelihood options and enhancing water harvesting practices for supplementary irrigation also call policy attention.
38	Algeria	Boughedir, S. (2015). Case study: disaster risk management and climate change adaptation in Greater Algiers: overview on a study assessing urban vulnerabilities to disaster risk and proposing measures for adaptation. <i>Current Opinion in Environmental Sustainability</i> , 13, 103-108.	The study assesses the vulnerabilities of Algiers when dealing with climate change and natural disasters up to 2030, and proposes a set of recommendations to improve risk management capacities of the Wilaya of Algiers. The study results show actions that have been identified as a priority, given their expected benefits (compared to their costs), are essentially within the institutional and the urban planning spheres. These actions cover all types of disaster risks, are low cost and ‘no regrets’ (useful even in the absence of climate change), and reversible. The priority actions can be classified into five broad categories: (i) integrating risk management into urban planning; (ii) increasing awareness of risk issues among policy makers, professionals and inhabitants; (iii) strengthening institutional arrangements for risk management; (iv)

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			developing risk knowledge tools and (vi) developing flood prevention infrastructures.
39	North-Africa region	Boukhelkhal, A., & Bengana, I. (2018). Cointegration and causality among electricity consumption, economic, climatic and environmental factors: Evidence from North-Africa region. <i>Energy</i> , 163, 1193-1206.	This paper investigates the relationship among carbon dioxide emissions, economic growth and electricity consumption in the presence of two other variables which are trade openness and annual average temperature. The study uses data of four selected North- African countries over the period 1971–2014. The study applied the Autoregressive Distributed Lag Cointegration approach (ARDL) known as the Bounds approach. The long run analysis reveals that economic growth and electricity consumption are the main cause of environment degradation, while the increased temperature over the year leads to increase electricity consumption in Egypt and Morocco. On the other hand, the analysis of short run causalities confirms the growth hypothesis in these two countries. These findings imply that environmental and economic corrective measures have to be adopted to achieve green growth and sustainable development.
41	Tanzania, Ethiopia and South Africa	Butt, N., Shanahan, D. F., Shumway, N., Bekessy, S. A., Fuller, R. A., Watson, J. E. & Hole, D. G. (2018). Opportunities for biodiversity conservation as cities adapt to climate change. <i>Geo: Geography and Environment</i> , 5(1), e00052	In this paper the prevalence of key themes of human adaptation response that could have biodiversity conservation outcomes in cities were identified. Furthermore, the area of impact for actions that identify specific targets for greening or green infrastructure that could involve natural ecosystems were identified, providing an indicator of potential co-benefits to biodiversity. The study further explored the total area of land that could benefit from catchment management approaches, the area of waterways that could benefit from nature-based improvement of these spaces, and finally the number of threatened species that could benefit across these cities. The results indicate that from 80 city climate adaptation plans analyzed, it was found that urban greening plays a key role in most adaptation strategies, and represents an

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			enormous opportunity for biodiversity conservation, given the diversity of animal and plant species in urban environments.
42	Uganda	Bwambale, B., Muhumuza, M., & Nyeko, M. (2018). Traditional ecological knowledge and flood risk management: A preliminary case study of the Rwenzori. <i>Jàmbá: Journal of Disaster Risk Studies</i> , 10(1), 1-10.	This article contributes to addressing the challenge of exploring the existence of traditional ecological knowledge (TEK) to flooding in the Rwenzori Mountains, Uganda. The shift from flood protection to flood risk management, together with recent arguments on incorporating culture in managing risk, underscores the application of TEK in managing disasters from flood hazards. Yet, documentation and incorporation of TEK into practice remains a challenge. Using semi-structured interviews, data were collected from residents of the Nyamwamba watershed where intense flash floods caused deadly impacts in May 2013. Collected data were analysed using content, thematic and interpretive analysis techniques. Results indicate that TEK is exhibited through various traditional ecological approaches (TEAs). Although endangered, TEAs (conducted through collective action for a communally accepted end) are framed in three main activities: (1) assessment and prediction of rainfall and flood by the traditional hydro-meteorologist (diviner) and the traditional rain forecaster (rainmaker); (2) the mountain cleansing ritual (which act as flood risk awareness platform); and (3) immunising riverine communities through planting certain indigenous plants, which improve hydrological systems through their high conservation value for native ecological diversity. As most TEAs are conducted through collective action, they represent a platform to understand local capacities and enhance adoption of measures, and/or a source of knowledge for new measures to address flood risk. Therefore, full-scale investigations of these TEAs, determining how relevant TEAs are fine-tuned, and (scientific) measures enculturated based on fine-tuned TEAs could result in effective flood risk



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			management in various flood hotspots where TEAs influence action.
43	Africa	Cai, H., Lam, N. S., Qiang, Y., Zou, L., Correll, R. M., & Mihunov, V. (2018). A synthesis of disaster resilience measurement methods and indices. <i>International journal of disaster risk reduction</i> . .	The study reviewed literature on development of tools or metrics for measuring and monitoring progress of resilience is a critical component that requires extensive research to achieve better understanding. However, different fields have different emphases and the knowledge gained from the various studies are scattered and fragmented. To provide an integration of the literature and reflect on the current state of resilience measurement, we conducted a synthesis analysis through a systematic review of 174 scholarly articles on disaster resilience measurement from 2005 to 2017. Using a review table designed for this study and content analysis, we extracted key information from each article on resilience definition, type of measurement method, resilience indicators used, and proposed adaptation strategies. Results indicate that 39.7% of the articles used qualitative methods for resilience measurement and 39.1% of the articles used quantitative methods. However, only 10.3% of all the 174 articles conducted empirical validation of their proposed resilience indices. The three most frequently suggested adaptation strategies were empowering local governments and leaders, raising community awareness, and enhancing community infrastructure and communication. These findings suggest that future research need to incorporate validation and inferential ability into resilience measurement. Extending from static resilience measurement to dynamic system modeling and bridging the disconnection between resilience scientific research and practical actions are also pressing needs
44	Africa	Callo-Concha, D. (2018). Farmer Perceptions and Climate Change Adaptation in the West Africa Sudan Savannah: Reality Check in Dassari,	In the study sites Dassari, Benin, and Dano, Burkina Faso, farmers' climate change perceptions and practiced coping measures were qualitatively and quantitatively recorded. Analyses included statistical testing to detach anecdotal responses from factual

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		Benin, and Dano, Burkina Faso. <i>Climate</i> , 6(2), 44.	decisions. Results reveal that responses regarding climate change perception and adaptation are frequently subjective, conjectural and inconsistent. Farmers' acknowledge that adaptations to climate change impacts are diverse, but site specific. Measures do not causally respond to the type of hazard, nor to its impacts, but instead tend to address wide-ranging demands, such as household food security, income generation and capitalization. Hence, causally linking hazards, impacts and responses can be misleading, and measures can thus be ineffective. After our findings, key qualities of effective coping measures are short-term economic returns, compatibility with local ecological, social and institutional settings and agreeing with the customary farming traditions. With respect to operability, the national agricultural extension services are still the most relevant instances. Considering these aspects can support local farming adaptation and also increase the general resilience of the household
45	Kenya and Ethiopia	Capitani, C., Garedew, W., Mitiku, A., Berecha, G., Hailu, B. T., Heiskanen, J. & Johansson, T. (2018). Views from two mountains: exploring climate change impacts on traditional farming communities of Eastern Africa highlands through participatory scenarios. <i>Sustainability Science</i> , 1-13.	A participatory scenario development framework in two parts of the Eastern Afromontane Biodiversity Hotspot was applied: Taita Hills in Kenya and Jimma rural area in Ethiopia. In each area, local stakeholders were facilitated in envisioning adaptation scenarios under projected climate changes by mid-21st century and assessed the potential impacts of these pathways on land use and land cover. In the Taita Hills, under a business-as-usual scenario, human population and activities concentrate at high elevation, triggering cascade effects on remnant forest cover, biodiversity and ecosystem services. Alternative adaptation scenarios envisage reforestation associated with either improved agricultural practices or ecosystem restoration. In the Jimma area, rising temperatures are expected to disrupt traditional coffee production under a business-as-usual scenario, resulting in the loss of coffee-forest canopies and reduction of forest-dependent biodiversity.

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			Alternative adaptation scenarios envisage either expansion of commercial coffee plantations or expansion of agroforestry, including traditional coffee farming. In the both Taita and Jimma, adaptation pathways present trade-offs between provisioning, supporting and regulating services, and between livelihoods and biodiversity conservation. The findings encourage the use of multidisciplinary, bottom-up approaches for developing locally tailored, climate-smart and sustainable adaptation pathways.
46	Mali	Carr, E. R., & Onzere, S. N. (2017). Really effective (for 15% of the men): Lessons in understanding and addressing user needs in climate services from Mali. <i>Climate Risk Management</i> .	The paper interprets a body of critical, empirically-informed work on climate services as a powerful call for more serious attention to the social science of climate services for development. If people are design and implement climate services that truly help users address their weather- and climate-related vulnerabilities, we must understand who our users are in all of their diversity, what challenges these different users face, whether or not weather and climate information can address any of these challenges, and what information best addresses these challenges for different members of the same user population. Simply put, it is possible to design climate services that, in the context of a specific stressor for a specific group of people, work brilliantly, but when applied to a wider group of users for new purposes, fail dramatically. The results are then turn to efforts to assess the use and efficacy of this program for farmers in southern Mali. The assessment found very low, highly gendered rates of advisory use. On the surface, these results appear deeply disheartening for those who view climate services as an important tool for adaptation, vulnerability reduction, and resilience building. meeting
47	Africa	Castells-Quintana, D., del Pilar Lopez-Urbe, M., & McDermott, T. K. (2018). Adaptation to climate change: A review through a	This paper looks at adaptation to climate change from the point of view of (poor) households. Since the development literature has firmly established the role of weather risk as a source of income volatility for the poor, and climate change is expected to increase

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		development economics lens. <i>World Development</i> , 104, 183-196.	this risk, we review the range of risk-coping mechanisms available to poorer households, with a focus on possible barriers to adaptation. We ask both how government interventions affect the set of options available for adaptation and risk coping, and also what these adaptive responses imply for the prospects of sustainable development. Support for adaptation can involve efforts to make existing locations, livelihoods and forms of production more resilient to climate risk (in-situ adaptation), or reductions in vulnerability through the geographical and sectoral mobility of the poor (transformational adaptation). Our review shows how successful adaptation will need to strike a balance between the two forms of adaptation, avoiding locking-in unsustainable practices in locations that are already marginal from an economic perspective, and taking account of broader socio-economic trends already taking place in many developing countries (such as population growth and urbanisation). We also highlight important considerations for policy-makers, which to date have been relatively neglected in the literature, in particular related to the dynamic interaction between adaptation and sustainable development.
48	Nigeria	Chah, J. M., Attamah, C. O., & Odoh, E. M. (2018). Differences in climate change effects and adaptation strategies between male and female livestock entrepreneurs in Nsukka Agricultural Zone of Enugu State, Nigeria. <i>Journal of Agricultural Extension</i> , 22(1), 105-115.	The study examined differences in climate change effects and adaptation strategies between male and female livestock entrepreneurs in Nsukka Agricultural Zone of Enugu State, Nigeria. It was conducted using 80 randomly selected livestock entrepreneurs. Data were collected using interview schedule. Descriptive statistics were used to analyze data. Fifty percent of the respondents were female. Males sourced more climate-related livestock information than females; recording 29.6% difference in feed formulation information; which is the most differed. Females were more affected by climate change than males, with the difference more on disruption of animal heat period due to high

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			temperature (male $X^-$ =2.80; female $X^-$ =3.50; difference in mean{dm}=-0.70). Male entrepreneurs differed from females in the adaptation strategies used in combating climate change and also on their view on effectiveness of adaptation strategies. Females were more constrained than male in adapting to climate change; with the variance more on lack of information facilities (male $X^-$ =2.28; female $X^-$ =2.60; dm=-0.32). Males and females differed in their effects and adaptation strategies to climate change. Hence, government and extension should step in to boost productivity by addressing climate-related bottle neck faced by entrepreneurs in livestock production, especially those faced
49	Zimbabwe	Chanza, N., Chigona, A., Nyahuye, A., Mataera-Chanza, L., Mundoga, T., & Nondo, N. (2018). Diagnosing barriers to climate change adaptation at community level: reflections from Silobela, Zimbabwe. <i>GeoJournal</i> , 1-13.	This study utilises the experiences of locals witnessing environmental changes associated with climate change. It uses participatory climate impact analysis to understand whether available livelihoods coping practices can withstand climatic impacts. Participatory research was used to rank the spectrum of livelihood options according to their significance in the face of climate change-induced drought and other socio-economic pressures. A coping capacity index (CCI) was used to estimate the level of adaptation limit imposed by each livelihood strategy, with composite CCI values generated to compare the coping capacities of villages studied. Given that most of the livelihood's options are climate dependent, and combined with other non-climatic drivers of vulnerability that are besetting rural areas in Zimbabwe, we argue that adaptation limits abound. Most of these limits are explained by the limitation of the environment that the villagers largely depend on for their survival. With the analytic capabilities of participants engaged, the article isolates three departure points for adaptation research, policy and practice: understanding the type and magnitude of climatic hazards that the locals are exposed to; assessment of their coping capacities and determination of

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			adaptation barriers; and using their knowledge of the local environment to suggest interventions for evading adaptation barriers.
50	South Africa	Chari, M. M., Hamandawana, H., & Zhou, L. (2018). Using geostatistical techniques to map adaptive capacities of resource-poor communities to climate change: A case study of Nkonkobe local municipality, Eastern Cape province, South Africa. <i>International Journal of Climate Change Strategies and Management</i> .	This paper aims to present a case study-based approach to identify resource-poor communities with limited abilities to cope with the adverse effects of climate change. The study area is the Nkonkobe Local Municipality, in the Eastern Cape which is one of South Africa's provinces ranked as being extremely vulnerable to the adverse effects of climate change because of high incidences of poverty and limited access to public services such as water and education. The paper attempts to bridge this gap by providing a user-friendly, replicable, practically implementable and adaptable methodology that can be used to cost-effectively and timeously identify vulnerable communities with low coping capacities. A geostatistical approach was used to assess and evaluate adaptive capacities of resource-poor communities in the Nkonkobe Local Municipality. The geospatial component of this approach consisted of a multi-step Geographical Information Systems (GIS) based technique that was improvised to map adaptive capacities of different communities. The statistical component used demographic indicators comprising literacy levels, income levels, population age profiles and access to water to run automated summation and ranking of indicator scores in ArcGIS 10.2 to produce maps that show spatial locations of communities with varying levels of adaptive capacities on a scale ranging from low, medium to high. The analysis identified 14 villages with low adaptive capacities from a total of 180 villages in the Nkonkobe Local Municipality. This finding is important because it suggests that our methodology can be effectively used to objectively identify communities that are vulnerable to climate change.

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51	Kenya	Chepkoech, W., Mungai, N. W., Stöber, S., Bett, H. K., & Lotze-Campen, H. (2018). Farmers' perspectives: Impact of climate change on African indigenous vegetable production in Kenya. <i>International Journal of Climate Change Strategies and Management</i> , 10(4), 551-579.	This study aims to analyse how African indigenous vegetable (AIV) farmers perceive climate change in three different agro-climatic zones (ACZs) in Kenya, identify the main differences in historical seasonal and annual rainfall and temperature trends between the zones, discuss differences in farmers' perceptions and historical trends and analyse the impact of these perceived changes and trends on yields, weeds, pests and disease infestation of AIVs. Understanding farmers' perceptions of how the climate is changing is vital to anticipating its impacts. Farmers are known to take appropriate steps to adapt only when they perceive change to be taking place. Farmers perceived that higher temperatures, decreased rainfall, late onset and early retreat of rain, erratic rainfall patterns and frequent dry spells were increasing the incidences of droughts and floods. Meteorological data provided some evidence to support farmers' perceptions of changing rainfall. No trend was detected in mean annual rainfall, but a significant increase was recorded in the semi humid zone. A decreasing maximum temperature was noted in the semi-humid zone, but otherwise, an overall increase was detected. There were highly significant differences in mean annual rainfall between the zones. Farmers perceived reduced yields and changes in pest infestation and diseases in some AIVs to be prevalent in the dry season. This study's findings provide a basis for local and timely institutional changes, which could certainly help in reducing the adverse effects of climate change.
52	South Africa	Chersich, M. F., Scorgie, F., Rees, H., & Wright, C. Y. (2018). How climate change can fuel listeriosis outbreaks in South Africa. <i>South African Medical Journal</i> , 108(6), 453-454.	In summary, long-term water scarcity can influence cleaning practices and alter water sources in ways that favour the persistence of <i>Listeria</i> in food-processing plants, but also in retail outlets and domestic settings. Much closer monitoring of food industry standards, changes in dietary habits of the public and heightened responses to listeriosis outbreaks are required, in

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			<p>conjunction with efforts to increase the volume of potable municipal water and to ensure that all citizens have access to this water. Ultimately, infectious disease outbreaks, which may become more frequent with rising ambient temperatures and water scarcity, are the proverbial canary in a coal mine. They serve as but one reminder of the devastating effects of climate change presently unfolding in SA. As with all nations, the country needs to take rigorous steps to prepare for these changes. The high levels of carbon emissions in SA, especially its reliance on coal for power, may well worsen the impact of climate change. Without concerted action to prepare for the health effects of climate change, and in the absence of efforts to reduce further environmental degradation, South Africans may face many more large outbreaks of infectious diseases in years to come.</p>
53	South africa	<p>Chersich, M., Wright, C., Venter, F., Rees, H., Scorgie, F., &amp; Erasmus, B. (2018). Impacts of Climate Change on Health and Wellbeing in South Africa. <i>International journal of environmental research and public health</i>, 15(9), 1884.</p>	<p>Given its associated burden of disease, climate change in South Africa could be reframed as predominately a health issue, one necessitating an urgent health-sector response. The growing impact of climate change has major implications for South Africa, especially for the numerous vulnerable groups in the country. We systematically reviewed the literature by searching PubMed and Web of Science. Of the 820 papers screened, 34 were identified that assessed the impacts of climate change on health in the country. Most papers covered effects of heat on health or on infectious diseases (20/34; 59%). We found that extreme weather events are the most noticeable effects to date, especially droughts in the Western Cape, but rises in vector-borne diseases are gaining prominence. Climate aberration is also linked in myriad ways with outbreaks of food and waterborne diseases, and possibly with the recent <i>Listeria</i> epidemic. The potential impacts of climate change on mental health may compound the multiple social stressors that already beset the populace. Climate change heightens the pre-</p>



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			existing vulnerabilities of women, fishing communities, rural subsistence farmers and those living in informal settlements. Further gender disparities, eco-migration and social disruptions may undermine the prevention—but also treatment—of HIV. Our findings suggest that focused research and effective use of surveillance data are required to monitor climate change’s impacts; traditional strengths of the country’s health sector. The health sector, hitherto a fringe player, should assume a greater leadership role in promoting policies that protect the public’s health, address inequities and advance the country’s commitments to climate change accords.
54	Ethiopia	Chiemela, S. N., Noulèkoun, F., Chiemela, C. J., Zenebe, A., Abadi, N., & Birhane, E. (2018). Conversion of degraded agricultural landscapes to a smallholder agroforestry system and carbon sequestration in drylands. <i>International Journal of Climate Change Strategies and Management</i> , 10(3), 472-487.	This paper aims at providing the evidence about how carbon sequestration in terrestrial ecosystems could contribute to the decrease of atmospheric CO2 rates through the adoption of appropriate cropping systems such as agroforestry. Using stratified randomly selected plots, data were collected on tree diameter at breast height (DBH). Composite soil samples were collected from three soil depths for soil carbon analysis. Above ground biomass estimation was made using an allometric equation. The spectral signature of each plot was extracted to study the statistical relationship between carbon stock and selected vegetation indices. There was a significant difference in vegetation and soil carbon stocks among the different land use/land cover types ( $P < 0.05$ ). The potential carbon stock was highest in the vegetation found in sparsely cultivated and in soil in bushland. Carbon sequestration potential of the study area significantly increased as a result of conversion of intensively cultivated agricultural lands to agroforestry systems. The amount of sequestered carbon was found to be dependent on species diversity, tree density and tree size. The vegetation indices had a better correlation with soil and total carbon. The paper has addressed an important aspect in

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			curbing greenhouse gases in integrated land systems. The paper brings a new empirical insight of carbon sequestration potentials of agroforestry systems with a focus on drylands.
55	Africa	Chirisa, I., Matamanda, A., & Mutambwa, J. (2018). Africa's Dilemmas in Climate Change Communication: Universalistic Science Versus Indigenous Technical Knowledge. In <i>Handbook of Climate Change Communication: Vol. 1</i> (pp. 1-14). Springer, Cham.	The paper engages literature review on ITK and universal science and uses case studies from across the region to demonstrate this in the thesis of the paper. Interviews have also been conducted with key informants who include environmentalists and traditional leaders. The problem with gathering information on ITK knowledge is that most of the information is undocumented and in most cases is known by a few people usually the elderly. The results indicate that universalistic science has a tendency to ask for collective action based on regional and global trends to climate change while indigenous technical knowledge begins with an observation that 'something is wrong somewhere' but it is the responsibility of the individual to make sure they do the right thing in a bid to achieve environmental harmony. In the latter, there is reference to Spiritism and Nature because the "spirits are angry". To some extent these beliefs by ITK seem to be well placed with the only problem being that much of the information remains enclosed and unknown to many. Communicating ITK then becomes the way to go considering the potential impacts of such initiatives in the realm of climate change. Yet, in universalistic science such claims are hogwash and absurd. In most cases, in Africa the division is also explained by the generation gap between the youthful and elderly as well as between religious inclinations that different people adhere to. This paper will be useful to policy makers, academics and community members so that they all get to accept and appreciate the utility of ITK in climate change communication.
56	Ethiopia	Cholo, T. C., Fleskens, L., Sietz, D., & Peerlings, J. (2018). Land	Household food security among smallholder farmers is sensitive to a variable and changing climate, requiring farmers in the Gamo

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		fragmentation, climate change adaptation, and food security in the Gamo Highlands of Ethiopia. <i>Agricultural Economics</i> .	Highlands of Ethiopia to adopt new land management practices to improve food security. Agricultural land in the Gamo Highlands is highly fragmented. The extent to which land fragmentation (LF) moderates the food security effects of sustainable land management (SLM) practices is unknown. This study used probit and Poisson models to explain this relationship. The study found that food insecurity was severe during the food shortfall season. LF provides more potential opportunities for improving food security than challenges. Furthermore, SLM practices had both positive and negative effects on food security and their effects were conditioned by the magnitude of LF. Reducing severe LF through the assembly of small parcels into larger heterogeneous plot clusters could enhance food security by exploiting synergies between adaptation practices and LF.
57	Ghana, Zambia,	Cooper, M. (2018). Using Natural Areas and Empowering Women to Buffer Food Security and Nutrition from Climate Shocks. <a href="http://www.wocan.org/sites/default/files/Empowering%20women%20to%20buffer%20food%20security.pdf">http://www.wocan.org/sites/default/files/Empowering%20women%20to%20buffer%20food%20security.pdf</a>	In this study, data from Feed the Future datasets from Ghana, Zambia, and Bangladesh was used to examine the impact of precipitation extremes on food security as well as the role of natural land cover and women's empowerment in creating resilience. As climate change makes precipitation shocks more common, policymakers are becoming increasingly interested in protecting food systems and nutrition outcomes from the damaging effects of droughts and floods (Wheeler and von Braun, 2013). Increasing the resilience of nutrition and food security outcomes is especially critical throughout agrarian parts of the developing world, where human subsistence and well-being are directly affected by local rainfall. We first model the effects of extreme rainfall on indicators of nutrition and food security, and then examine whether women's empowerment and environmental land cover types can dampen the effects of rainfall shocks on these food security and nutrition outcomes. Our results find that there is a strong association between extreme precipitation and household

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			hunger. Further, they suggest that in certain contexts land cover types providing ecosystem services can reduce household hunger scores, that empowering women can mitigate the effects of precipitation shocks, and that there may be an interactive effect between ecosystem service availability and women's empowerment.
58	Kenya and Senegal	Crick, F., Eskander, S. M., Fankhauser, S., & Diop, M. (2018). How do African SMEs respond to climate risks? Evidence from Kenya and Senegal. <i>World Development</i> , 108, 157-168.	This paper investigates to what extent and how micro, small and medium-sized enterprises (SMEs) in developing countries are adapting to climate risks. We use a questionnaire survey to collect data from 325 SMEs in the semi-arid regions of Kenya and Senegal and analyze this information to estimate the quality of current adaptation measures, distinguishing between sustainable and unsustainable adaptation. We then study the link between these current adaptation practices and adaptation planning for future climate change. We find that financial barriers are a key reason why firms resort to unsustainable adaptation, while general business support, access to information technology and adaptation assistance encourages sustainable adaptation responses. Engaging in adaptation today also increases the likelihood that a firm is preparing for future climate change. The finding lends support to the strategy of many development agencies who use adaptation to current climate variability as a way of building resilience to future climate change. There is a clear role for public policy in facilitating good adaptation. The ability of firms to respond to climate risks depends in no small measure on factors such as business environment that can be shaped through policy
59	Africa	Crick, F., Gannon, K. E., Diop, M., & Sow, M. (2018). Enabling private sector adaptation to climate change in sub-Saharan Africa. <i>Wiley</i>	The private sector is increasingly recognized as having important potential to help society adapt and become more resilient to climate change. Yet there is limited research examining how to promote and facilitate private sector adaptation in developing

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		<i>Interdisciplinary Reviews: Climate Change</i> , 9(2), e505.	countries and in particular how governments can create an enabling environment to stimulate and incentivize domestic private sector adaptation. In this paper this gap is addressed through a review of the key factors required to provide an enabling environment for the private sector denoted by existing adaptation literatures. We do this with a focus on adaptation by small and medium enterprises (SMEs) in sub-Saharan Africa (SSA). To advance this review, the paper draws insights from a much larger, yet generally independent, literature on enabling environments for private sector development. This literature disaggregates the private sector and highlights key constraints to the development and growth of SMEs in SSA, including deficient infrastructure and evidence of an African gap in access to and use of finance. Both areas of scholarship are then combined in a framework identifying key “building blocks” constituting enabling conditions for private sector adaptation. The framework could be applied in many ways including to focus strategies to enhance private sector adaptation and to identify trade-offs and interactions between policies or initiatives surrounding private sector development. By combining these literatures, the study calls for a more holistic approach to develop enabling environments for SME adaptation and climate resilient development that addresses the broader structural deficits that condition vulnerability and barriers that limit adaptive capacity.
60	Ethiopia	Crossland, M., Winowiecki, L. A., Pagella, T., Hadgu, K., & Sinclair, F. (2018). Implications of variation in local perception of degradation and restoration processes for implementing land degradation	In the absence of studies that apply the concept to local scales and engage local stakeholders, our study was undertaken in the Gilgel-Abay watershed of northwest Ethiopia using sites that equate to a local landscape scale (10–1000 km <sup>2</sup> ) at which decisions about land use are made. Combining participatory mapping, farmer interviews and a field survey of soil erosion prevalence, our objectives were to: (i) understand local perceptions of land

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		neutrality. <i>Environmental development</i> , 28, 42-54.	degradation and restoration activities; (ii) assess their implications for LDN, and (iii) explore the utility of engaging local land users in the assessment of land degradation and restoration activities. The findings demonstrate that engaging land users can provide a comprehensive overview of land degradation and restoration activities at local scales; that land users may not share the same priorities, in terms of where, when and how to address degradation, as one another, or with other actors involved in restoration initiatives, which implies a need for negotiation; and that the impacts of restoration activities are likely to be socially differentiated. This makes it important to understand how livelihoods interact with different restoration interventions and to take measures to ensure that striving for LDN does not disadvantage the most vulnerable people. Based on these findings, we propose three guiding strategies for implementing LDN at local scales: negotiate priorities and incentivize action; match options to context; and, co-produce knowledge and indicators.
61	South Africa	Dalu, M. T., & Shackleton, C. M. (2018). The potential use of natural resources in urban informal settlements as substitutes for financial capital during flooding emergencies. <i>Physics and Chemistry of the Earth, Parts A/B/C</i> , 104, 18-27.	There is an insufficient understanding of the natural resource's contribution to the resilience of poor urban communities living in informal settlements and the financial implications thereof. Thus, household strategies used to recover from the October 2012 flood shock were investigated within the informal settlements of three small South African towns using questionnaires. Within the vulnerability paradigm and the sustainable livelihood framework, the study also quantified and evaluated the relative contribution of natural resources to recovery strategies and the impacts on household financial capital. We found that natural resources contributed up to 70% to recovery of households from the flood shock, most of this being to reconstruct housing structures after the flood. Factors such as household head education level, household income, kinship level, the extent of property damage and the cost

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			associated with property rehabilitation significantly influenced the uptake of natural resources in recovery from floods, and this was variable among settlements and towns. The main findings showed that natural resources reduced household vulnerability of urban informal settlements by providing an emergency-net function that substitutes financial capital. Their inclusion in disaster management plans and responses has the potential to contribute to the sustainable livelihoods of the urban poor in the Eastern Cape, South Africa.
62	Africa	Dayamba, D. S., Ky-Dembele, C., Bayala, J., Dorward, P., Clarkson, G., Sanogo, D. & Binam, J. N. (2018). Assessment of the use of Participatory Integrated Climate Services for Agriculture (PICSA) approach by farmers to manage climate risk in Mali and Senegal. <i>Climate Services</i> .	In a recent study, a new approach to extension and climate information services, namely Participatory Integrated Climate Services for Agriculture (PICSA) has been developed. PICSA makes use of historical climate records, participatory decision-making tools and forecasts to help farmers identify and better plan livelihood options that are suited to local climate features and farmers' own circumstances. This approach was implemented in 2016 in two sites in Senegal and Mali, with 57 and 47 farmers, respectively. At the end of the growing season, these farmers were surveyed to explore their perceptions on the use of the approach. In Senegal and Mali, respectively 97% and 76% of the respondents found the approach 'very useful'. The approach enabled farmers to make strategic plans long before the season, based on their improved knowledge of local climate features. Moreover, evidence demonstrates that PICSA stimulated farmers to consider and then implement a range of innovations which included: (i) changes in timing of activities such as sowing dates, (ii) implementing soil and water management practices, (iii) selection of crop varieties, (iv) fertiliser management and (v) adaptation of plans for the season (farm size, etc.) to the actual resources available to them. The study also demonstrated the potential of farmer-to-farmer extension in scaling up the approach, which is of

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			great interest especially in the current context of limited extension services in the West African region.
63	Africa	de Jalón, S. G., Iglesias, A., & Neumann, M. B. (2018). Responses of sub-Saharan smallholders to climate change: Strategies and drivers of adaptation. <i>Environmental Science &amp; Policy</i> , 90, 38-45. .	This paper explores how adaptation strategies are adopted by small-holders in sub-Saharan Africa as a function of their adaptive capacity. The latter is characterised by five types of capital: natural, physical, financial, human, and social. We use responses from farm households in sub-Saharan Africa dating from 1536 obtained by Climate Change, Agriculture and Food Security (CCAFS). This data provides information on the adoption of adaptation practices during the study period as well as information with which we develop indicators for the five types of capital. The results suggest that all the five types of capital positively influence adoption of adaptation practices. Human and social capital both displayed a positive and significant effect on the uptake of most adaptation practices. This finding suggests that the effect of less tangible kinds of capital such as knowledge, individual perceptions, farmers' networks and access to information may be stronger than normally assumed. Directing more development policies towards enhancing human and social capital may therefore be more cost-effective than further investments into physical and financial capital and could help in overcoming social barriers to adaptation to climate change.
64	North African Region.	de Sousa Fragoso, R. M., & de Almeida Noéme, C. J. (2018). Economic effects of climate change on the Mediterranean's irrigated agriculture. <i>Sustainability Accounting, Management and Policy Journal</i> , 9(2), 118-138. .	The paper aims to assess the economic effects of climate change on the Mediterranean's irrigated agriculture and how the adoption of alternative crop varieties adapted to the expected length of the growing season can be an effective adaptation measure. A case study of two irrigation areas in Southern Portugal is used to assess the response to climate change impacts on crop yields and irrigation requirements, and an agricultural supply model is calibrated using a positive mathematical programming (PMP) approach was developed.



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65	Zimbabwe	Descheemaeker, K., Zijlstra, M., Masikati, P., Crespo, O., & Tui, S. H. K. (2018). Effects of climate change and adaptation on the livestock component of mixed farming systems: A modelling study from semi-arid Zimbabwe. <i>Agricultural Systems</i> , 159, 282-295.	This study addressed this knowledge gap through the development and use of a dynamic modelling framework integrating climate, crop, pasture and livestock models. The framework generates essential information for effective targeting of solutions towards climate resilience. Comparing the effects of contrasting climate scenarios illustrated the typical uncertainty in climate impact assessments and highlighted the vulnerability of the livestock component of mixed systems. The current poor livestock productivity in the study area was related to dry-season feed gaps, as animals rely on grazing and low-quality crop residues. These feed gaps also explain the sensitivity to climate change. A comparison of two adaptation packages revealed that improving the quality of the feed through crop diversification with legumes raised animal productivity and reduced vulnerability. Climate-smart livestock production would require keeping less but better fed and hence more productive animals. However, such a transition needs to be enabled by changes in the institutional context, including rural banking and insurance services, functioning markets, and improved access to agricultural inputs
66	Global	Dinesh, D., Zougmore, R., Vervoort, J., Totin, E., Thornton, P., Solomon, D. & Körner, J. (2018). Facilitating change for climate-smart agriculture through science-policy engagement. <i>Sustainability</i> , 10(8), 2616.	Climate change impacts on agriculture have become evident and threaten the achievement of global food security. On the other hand, the agricultural sector itself is a cause of climate change, and if actions are not taken, the sector might impede the achievement of global climate goals. Science-policy engagement efforts are crucial to ensure that scientific findings from agricultural research for development inform actions of governments, private sector, non-governmental organizations (NGOs) and international development partners, accelerating progress toward global goals. However, knowledge gaps on what works limit progress. This paper analysed 34 case studies of science-policy engagement efforts, drawn from six years of agricultural research for

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			development efforts around climate-smart agriculture by the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). Based on lessons derived from these case studies, they critically assessed and refined the program theory of the CCAFS program, leading to a revised and improved program theory for science-policy engagement for agriculture research for development under climate change. This program theory offers a pragmatic pathway to enhance credibility, salience and legitimacy of research, which relies on engagement (participatory and demand-driven research processes), evidence (building scientific credibility while adopting an opportunistic and flexible approach) and outreach (effective communication and capacity building).
67		Dowla, A. (2018). Climate change and microfinance. <i>Business Strategy &amp; Development</i> , 1(2), 78-87.	This paper explains the process through which climate change will impact the MFIs and their clients, and more importantly, how they can adapt to these changes. Further, the paper will show that in addition to being a threat, climate change also opens opportunities for the MFIs and their clients. It is recommended that the MFIs climate-proof their existing products and services and develop new products and partnerships to deal with the consequences of climate change. The plight of many individuals is linked to the ability of microfinance institutions (MFIs) to adapt to the consequences of climate change. We recommend that the MFIs climate-proof their existing products and services and develop new products and partnerships to deal with the consequences of climate change.
68	East Africa	du Toit, M. J., Cilliers, S. S., Dallimer, M., Goddard, M., Guenat, S., & Cornelius, S. F. (2018). Urban green infrastructure and ecosystem services in sub-Saharan Africa. <i>Landscape and Urban Planning</i> .	This is a review paper which spanned across 20 African countries and included 74 urban areas. The most studied urban areas outside South Africa were Dar es Salaam, Tanzania and Addis Ababa, Ethiopia. The earliest relevant review investigated the role of urban agriculture in the resilience and sustainability of cities in Rwanda, Kenya and Ethiopia among others. A review of ES of urban green spaces in Africa was conducted. In systematic review

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			study, it was revealed that only 23% of Sub Saharan Africa countries produced research on Eco-System Services based adaptation that assessed it in some way generating empirical data.
69	Zimbabwe	Dube, E., & Munsaka, E. (2018). The contribution of indigenous knowledge to disaster risk reduction activities in Zimbabwe: A big call to practitioners. <i>Jàmbá: Journal of Disaster Risk Studies</i> , 10(1), 1-8.	This article examined the contribution of indigenous knowledge to disaster risk reduction activities in Zimbabwe. The use of indigenous knowledge of communities by practitioners when dealing with disasters', is often viewed as outdated and primitive. This study sought to examine this problem through analysing the potential contribution of indigenous knowledge as a useful disaster risk reduction intervention. One major conclusion is that the indigenous knowledge of local communities plays an important part in disaster risk reduction activities. The study also found that communities possess valuable capacities in the form of indigenous knowledge, which can empower them to deal with all kinds of hazards and disasters. The article further concluded that it is highly possible for disaster risk reduction practitioners to integrate modern scientific knowledge with indigenous knowledge so that disaster risk reduction interventions become more effective. Whilst, communities lack modern scientific knowledge and technology, likewise, disaster risk reduction practitioners lack indigenous knowledge. As such, the study also found that both members of the community and disaster risk reduction practitioners can immensely benefit from indigenous knowledge if they consider this knowledge when dealing with disaster events. Therefore, the indigenous knowledge of local communities is a vital empowerment tool that can be used in all stages of disaster risk reduction.
70	Malawi, Tanzania, Zambia	England, M. I., Dougill, A. J., Stringer, L. C., Vincent, K. E., Pardoe, J., Kalaba, F. K., & Afionis, S. (2018). Climate change adaptation	Using the cases of Malawi, Tanzania and Zambia, this paper investigates the extent of coherence in national policies across the water and agriculture sectors and to climate change adaptation goals outlined in national development plans. A two-pronged

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		and cross-sectoral policy coherence in southern Africa. <i>Regional Environmental Change</i> , 18(7), 2059-2071.	qualitative approach is applied using Qualitative Document Analysis of relevant policies and plans, combined with expert interviews from non-government actors in each country. Findings show that sector policies have differing degrees of coherence on climate change adaptation, currently being strongest in Zambia and weakest in Tanzania. We also identify that sectoral policies remain more coherent in addressing immediate-term disaster management issues of floods and droughts rather than longer-term strategies for climate adaptation. Coherence between sector and climate policies and strategies is strongest when the latter has been more recently developed. However, to date, this has largely been achieved by repackaging of existing sectoral policy statements into climate policies drafted by external consultants to meet international reporting needs and not by the establishment of new connections between national sectoral planning processes. For more effective mainstreaming of climate change adaptation, governments need to actively embrace longer-term cross-sectoral planning through cross-Ministerial structures, such as initiated through Zambia's Interim Climate Change Secretariat, to foster greater policy coherence and integrated adaptation planning
71	Global	Enríquez-de-Salamanca, Á., Díaz-Sierra, R., Martín-Aranda, R. M., & Santos, M. J. (2017). Environmental impacts of climate change adaptation. <i>Environmental Impact Assessment Review</i> , 64, 87-96.	Climate change adaptation reduces adverse effects of climate change but may also have undesirable environmental impacts. However, these impacts are yet poorly defined and analysed in the existing literature. To complement this knowledge-gap, this study reviewed the literature to unveil the relationship between climate change adaptation and environmental impact assessment, and the degree to which environmental impacts are included in climate change adaptation theory and practice. Literature review showed that technical, social and economic perspectives on climate change adaptation receive much more attention than the environmental perspective. The scarce interest on the environmental impacts of

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			adaptation may be attributed to (1) an excessive sectoral approach, with dominance of non-environmental perspectives, (2) greater interest in mitigation and direct climate change impacts rather than in adaptation impacts, (3) a tendency to consider adaptation as inherently good, and (4) subjective/preconceived notions on which measures are good or bad, without a comprehensive assessment. Results suggest that there is a need to address adaptation proactively by including it in Environmental Assessment, to update current policy frameworks, and to demand robust and reliable evaluation of alternatives. Only through the full EA of adaptation measures can we improve our understanding of the primary and secondary impacts of adaptation to global environmental change.
72	Liberia	Environmental Protection Agency (2018) <i>National policy and response strategy on climate</i> . The republic of Liberia.	This paper talks about the climate challenges on development of the republic of Liberia. Adaptation Policy Framework recognizes that there are four major principles that provide a basis from which integrated actions to adapt to climate change can be developed. These are: Adaptation to short-term climate variability and extreme events to serve as a starting point for reducing vulnerability to longer-term climate change; Adaptation at different levels in society, including the local level; Adaptation policy and measures assessed in a development context; and the adaptation strategy and the stakeholder process by which it is implemented given equal importance. The Policy and Response Strategy recognized forestry and wildlife, agriculture, coastal areas, water resources, fishery, energy, mining, industry, transport, tourism, Infrastructure, urbanization and settlement, and health as priority sectors for adaptation and strategies clearly stipulated in the paper.
73	Benin	Fadina, A. M. R., & Barjolle, D. (2018). Farmers' Adaptation	Climate change is a global phenomenon. Its impact on agricultural activities in developing countries has increased dramatically.

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		Strategies to Climate Change and Their Implications in the Zou Department of South Benin. <i>Environments</i> ,5(1), 15.	Understanding how farmers perceive climate change and how they adapt to it is very important to the implementation of adequate policies for agricultural and food security. This paper aims to contribute to an understanding of farmers' adaptation choices, determinants of the adaptation choices and the long-term implications of the adaptation choices. Data were collected from 120 respondents in the Zou Department of Benin. A binary logit model was used to analyze the factors influencing household decisions to adapt to climate change. Multinomial logistic regression analysis was estimated to analyze the factors influencing households' choice of adaptation strategies to climate change. The results show that farmers have a developed perception of climate change. These changes are translated by rainfall disturbances (rainfall delays, early cessation, bad rainfall distribution etc.), shortening of the small dry season, increasing of temperature and sometimes, violent winds. The survey reveals that Benin farmers adopt many strategies in response to climate change. These strategies include "Crop–livestock diversification and other good practices (mulching, organic fertilizer)," "Use of improved varieties, chemical fertilizers and pesticides," "Agroforestry and perennial plantation" and "Diversification of income-generating activities." The findings also reveal that most of the respondents use these strategies in combination. From the binary logit model, we know that "farming experience" and "educational level of household head" positively influence adaptation decisions. The result of the multinomial logit analysis shows that farming experience, educational level, farm size and gender have a significant impact on climate change adaptation strategies. Based on in-depth analysis of each strategy, we identify crop diversification and agroforestry as being the most promising

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			strategies with benefits for farmers, the environment and future generations
74	Ghana	Fagariba, C.J., Song, S., Baoro, S.K.G. (2018). Climate Change Adaptation Strategies and Constraints in Northern Ghana: Evidence of Farmers in Sissala West District. <i>Sustainability</i> . 10, 1484.	This paper assessed adaptation strategies suitable for livelihood and microclimate improvement. It investigated constraints impeding farmers' efforts to cope with the adverse impacts of climate change. It also evaluated the effects of climate change on livelihood and agricultural practices as well as identification of factors that influence farmers' ability to adapt to climate change in the Upper West Region of Ghana. The paper showed that agroforestry practices, drought-resistant crops, and mulching were the most preferred climate adaptation methods and concluded that adaptation to climate change can be improved if the Environmental Protection Agency and the Ministry of Food and Agriculture intensify climate adaptation campaigns, increase access to weather information, and train farmers on adaptable strategies including, but not limited to, alternative sources of livelihood.
75	Africa	Fanzo, J., Davis, C., McLaren, R., & Choufani, J. (2018). The effect of climate change across food systems: Implications for nutrition outcomes. <i>Global Food Security</i> , 18, 12–19. <a href="http://doi.org/10.1016/j.gfs.2018.06.001">http://doi.org/10.1016/j.gfs.2018.06.001</a>	The purpose of this paper is to examine the relationships between climate change, diets, and nutrition through a food system lens. The paper begins with the impacts of climate change on nutrition. It discusses the interrelated nature of climate change, food systems, and diets: climate variability disrupts food systems and diets, yet food systems and diets also have repercussions for climate change. Thereafter, the paper describes promising “climate-smart, nutrition-sensitive” mitigation and adaptation actions to improve food systems, diets, and nutrition. Governments, nongovernmental organizations, and the private sector must act to maximize nutrition in the face of climate change. These actions must target the urban and rural poor in low- and middle-income countries because they will be the most affected by climate change and the least able to respond on their own. It is also

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			essential to evaluate the unique needs and priorities of each situation and recognize the trade-offs inherent in these actions.
76	Africa	Fernandino, G., Elliff, C. I., & Silva, I. R. (2018). Ecosystem-based management of coastal zones in face of climate change impacts: Challenges and inequalities. <i>Journal of environmental management</i> , 215, 32-39.	
77	Nigeria	Fonta, W. M., Kedir, A. M., Bossa, A. Y., Greenough, K. M., Sylla, B. M., & Ayuk, E. T. (2018). A Ricardian valuation of the impact of climate change on Nigerian Cocoa production: Insight for adaptation policy. <i>International Journal of Climate Change Strategies and Management</i> .	This study is to examine the relative importance of climate normals (average long-term temperature and precipitation) in explaining net farm revenue per hectare (NRh) for supplementary irrigated and rainfed cocoa farms in Nigeria. NRh was estimated for 280 cocoa farmers sampled across seven Nigerian states. It was regressed on climate, household socio-economic characteristics and other control variables by using a Ricardian analytical framework. Marginal calculations were used to isolate the effects of climate change (CC) on cocoa farm revenues under supplementary irrigated and rainfed conditions. Future impacts of CC were simulated using Six CORDEX regional climate model (RCM) ensemble between 2036-2065 and 2071-2100. Results indicate high sensitivity of NRh to Nigerian climate normals depending on whether farms use supplementary irrigation. Average annual temperature increases, and precipitation decreases are associated with NRh losses for rainfed farms and gains for supplementary irrigated cocoa farms. Projections of future CC impacts suggest a wide range of NRh outcomes on supplementary irrigated and rainfed farm revenues, demonstrating the importance of irrigation as an effective adaptation strategy in Nigeria.



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78	Developing countries	Gangwar, D. S., Tyagi, S., & Soni, S. K. (2018). A conceptual framework of agroecological resource management system for climate-smart agriculture. <i>International Journal of Environmental Science and Technology</i> , 1-10.	Agroecological resource management system is defined as a network of components aiming to acquire, format and disseminate operational information related to precision farming. As precision farming is gaining popularity in the industrialized countries, now it is advancing toward the countries like India, China, Brazil and even some of the African countries. Features of several commercial and prototype sensor platforms designed and implemented for agricultural applications have been described, in many of the recent research publications, globally. This paper describes a conceptual framework for a low-cost agroecological resource management system suitable in Indian context. It presents an empirical investigation on the performance of this prototype system. This work highlights the advantages of multi-sink approach with the lightweight communication protocols for wireless sensor networks. This approach helps in handling the key issues like bottleneck problem and energy efficient data transmission to prolong the overall network lifetime with improved network performance.
79	Tanzania	Goldman, M. J., Turner, M. D., & Daly, M (2018). A critical political ecology of human dimensions of climate change: Epistemology, ontology, and ethics. <i>Wiley Interdisciplinary Reviews: Climate Change</i> , 9(4), e526.	This review adopts a political ecology approach, informed by Science and Technology Studies concepts and research on multiple ontologies to understand the broader epistemological and ontological politics of human dimensions of climate change. The interest was in assessing critical approaches to climate change knowledge as related to adaptation policies to understand the broader epistemological and ontological politics of human dimensions of climate change. The review addresses three specific areas where more critical engagement could help move debates about knowledge politics in human dimensions research forward in fruitful ways: first, discourse and a focus on the language used to talk about and reflect on human dimensions of climate change; second, co-production and the troubling proliferation of

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			depoliticized “instrumental” co-productions of knowledge for adaptation; and third, the emerging literature on multiple ontologies exposing multiple enactments of climate change processes. The study reviews each of these areas of literature, highlighting where more direct engagement with epistemological, ontological, and ethical questions is underway. In doing so, the study subjects the knowledge and practices that underlie dominant understandings of climate change to critical political ecology scrutiny.
80	Developing countries	Güven, A., & Şebcioğlu, Ş. (2018). Impact of climate change on financial analysis of a small hydropower project. <i>International Journal of Environmental Science and Technology</i> , 1-6.	Wise prediction of discharge is vital for effective utilization of water resources and hydropower generation. There is no doubt that the future climate change will substantially affect precipitation amount, discharge and hydro-meteorology which are considered as major sources for hydropower energy. In the study, we present an application of downscaling technique on prediction of discharge of a local gage station in developing countries. Different sub-models are developed and calibrated based on the training period, and the best model is selected based on the testing period. Future projecting of discharge is done based on the Third Generation Coupled Global Climate Model A2 scenario, and the financial analysis is carried out by using this forecasted Qvalues.
81	Africa	Hansen, J., Hellin, J., Rosenstock, T., Fisher, E., Cairns, J., Stirling, C & Campbell, B. (2018). Climate risk management and rural poverty reduction. <i>Agricultural Systems</i> .	This article assessed evidence published in the last ten years that a set of production technologies and institutional options for managing risk can stabilize production and incomes, protect assets in the face of shocks, enhance uptake of improved technologies and practices, improve farmer welfare, and contribute to poverty reduction in risk-prone smallholder agricultural systems. Production technologies and practices such as stress-adapted crop germplasm, conservation agriculture, and diversified production systems stabilize agricultural production and incomes and, hence, reduce the adverse impacts of climate-related risk under some

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			<p>circumstances. Climate variability is a major source of risk to smallholder farmers and pastoralists, particularly in dryland regions. A growing body of evidence links climate-related risk to the extent and the persistence of rural poverty in these environments. Stochastic shocks erode smallholder farmers' long-term livelihood potential through loss of productive assets. The resulting uncertainty impedes progress out of poverty by acting as a disincentive to investment in agriculture by farmers, rural financial services, value chain institutions and governments. While some research documents improvements in household welfare indicators, there is limited evidence that the risk-reduction benefits of the interventions reviewed have enabled significant numbers of very poor farmers to escape poverty. The article discussed the roles that climate-risk management interventions can play in efforts to reduce rural poverty, and the need for further research on identifying and targeting environments and farming populations where improved climate risk management could accelerate efforts to reduce rural poverty.</p>
82	Africa	Hodgkinson, J. H., & Smith, M. H. (2018). Climate change and sustainability as drivers for the next mining and metals boom: The need for climate-smart mining and recycling. <i>Resources Policy</i>	The study reviewed both the adaptive measures needed for the industries to be resilient to climate-related interruptions and impacts, and the climate mitigation efforts the industries need to perform. A roadmap is presented that provides a synthesis of adaptation and mitigation strategies towards a climate-smart mining and recycling (CSM&R) strategy
83		Husnain, M. I. U., Subramanian, A., & Haider, A. (2018). Robustness of geography as an instrument to assess impact of climate change on agriculture. <i>International Journal of Climate Change Strategies and Management</i> .	This paper aims to investigate the relationships between climate change and agriculture and test the potential reverse causality and endogeneity of climatic variables to agriculture. The empirical literature on climate change and agriculture does not adequately address the issue of potential endogeneity between climatic variables and agriculture, which makes their estimates unreliable. This study introduces a geographical instrument, longitude and

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			latitude, for temperature to assess the impact of climate change on agriculture by estimating regression using IV-two-stage least squares method over annual panel data for 60 countries for the period of 1999-2011. The identification and F-statistic tests are used to choose and exclude the instrument. The inclusion of some control variables is supposed to reduce the omitted variable bias. The study finds a negative relationship between temperature and agriculture. The study provides strong implications for policymakers to confront climate change, which is an impending danger to agriculture. In designing effective policies and strategies, policymakers should focus not only on crop production but also on other agricultural activities such as livestock production and fisheries, in addition to national and international socio-economic and geopolitical dynamics. This paper contributes to the growing literature in at least four aspects. First, empirical settings introduce an innovative geographical instrument, second, it includes a wider set of control variables in the analysis. Third, it extends previous studies by involving agriculture value addition. Finally, the effects of temperature and precipitation on a single aggregate measure, agriculture value addition, are separately investigated.
84	Tanzania	Hyandye, C. B., Worqul, A., Martz, L. W., & Muzuka, A. N. (2018). The impact of future climate and land use/cover change on water resources in the Ndembera watershed and their mitigation and adaptation strategies. <i>Environmental Systems Research</i> , 7, 1-24.	This study was carried out in the Ndembera river watershed in Usangu basin, Tanzania, whereby the Soil and Water Assessment Tool was used to (i) assess the impact of near future (2010–2039) climate and 2013–2020 land use/cover change on the water balance and streamflow and (ii) evaluate the effectiveness of four land and water management practices as the mitigation and adaptation strategies for the impacts of climate and land use/cover changes. The 2020 land use/cover was predicted using Markov Chain and Cellular Automata models based on 2006 and 2013 land use/covers. The management practices such as filter strips can

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			reduce the annual evapotranspiration by 6%, and increase stream-flow by 38% in February. The study concludes that Land and water management practices have great potential to mitigate the impacts of future climate and land use/cover changes on water resource, thus increasing its availability.
85	Rwanda	Iiyama, M., Mukuralinda, A., Ndayambaje, J. D., Musana, B., Ndoli, A., Mowo, J. G & Ruganzu, V. (2018). Tree-Based Ecosystem Approaches (TBEAs) as Multi-Functional Land Management Strategies—Evidence from Rwanda. <i>Sustainability</i> (2071-1050), 10(5).	The article offers a framework to view tree-based ecosystem approaches (TBEAs) as multi-functional land management strategies and simultaneously as an integral part of sustainable agricultural intensification in densely populated area with sloping topography. It also identifies factors enhancing the adoption of heterogeneous TBEAs. The authors indicated that TBEAs were compatible with cropping/farming systems to better optimize resource use. Hence, TBEAs are part of land management options that can deliver multiple benefits, ecosystem goods such as food, energy and income sources; and services such as improving soil conditions, on the same land. The article also points out that TBEAs, when adopted at scale and supported by enabling secure tenure conditions, has the potential to contribute to sequestering carbon and improving system resilience to climate change. The authors suggest possibilities to achieve sustainable agricultural intensification by incorporating TBEAs, especially in an extremely densely populated highland systems where the environment is consequently being affected by various forms of land degradation such as soil erosion, reduction of organic matter, loss of soil nutrients, soil acidification, and loss of biodiversity mainly due to agricultural expansion. This article is suitable for farmers/farming communities, especially those who derive their livelihood from subsistence agriculture on small and fragmented sloppy lands less than 1 ha due to land scarcity.

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86	Ghana	Inkoom, J. N., Frank, S., Greve, K., & Fürst, C. (2018). A framework to assess landscape structural capacity to provide regulating ecosystem services in West Africa. <i>Journal of environmental management</i> , 209, 393-408.	This paper proposed an integrative assessment framework which combines remote sensing, geographic information systems, expert weighting and landscape metrics-based assessment to evaluate the landscape's capacity to provide regulating ecosystem services (ES) in this region, in the face of climate change. The Sudanian savanna landscapes of West Africa are amongst the world's most vulnerable areas to climate change impacts. Inappropriate land use and agriculture management practices continuously impede the capacity of agricultural landscapes to provide ES. The outcome of our study revealed that highly heterogeneous landscapes have a higher capacity to provide pest and disease control, while less heterogeneous landscapes have a higher potential to provide climate control. Further, we could show that the potential capacities to provide ecosystem services are underestimated by 15% if landscape structural aspects assessed through landscape metrics are not considered. We conclude that the combination of adapted land use and an optimized land use pattern could contribute considerably to lower climate change impacts in West African agricultural landscapes.
87	Africa	Jerneck, A. (2018). <i>Taking gender seriously in climate change adaptation and sustainability science research: views from feminist debates and sub-Saharan small-scale agriculture. Sustainability Science</i> , 13(2), 403-416.	From a gender perspective, and as a critical research initiative to support the building of sustainability science as an umbrella field, this article raises three pertinent questions on adaptation in the global South: what is its purpose, how can development inform it, and what institutions in terms of rights and responsibilities are core to it? Focusing on sub-Saharan small-scale agriculture, three main points emerge. Regarding the purpose, adaptation should be a transformative pathway out of poverty, ill-health, and food insecurity. Regarding development, adaptation can learn from how development theory, policy, and practice have addressed women, gender, and environment in varied settings and debates. Regarding core institutions, adaptation must address gender regimes that

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			regulate access to, use of, and control over resources, especially those defining land distribution, labour division, and strategic decision-making power. To conclude, I propose gender-informed research questions for further inquiry.
88	Global	Jorgenson, A. K., Fiske, S., Hubacek, K., Li, J., McGovern, T., Rick, T & Zycherman, A. (2018). Social science perspectives on drivers of and responses to global climate change. <i>Wiley Interdisciplinary Reviews: Climate Change</i> , e554.	This article provides a review of recent anthropological, archeological, geographical, and sociological research on anthropogenic drivers of climate change, with a particular focus on drivers of carbon emissions, mitigation and adaptation. The four disciplines emphasize cultural, economic, geographic, historical, political, and social-structural factors to be important drivers of and responses to climate change. Each of these disciplines has unique perspectives and makes noteworthy contributions to our shared understanding of anthropogenic drivers, but they also complement one another and contribute to integrated, multidisciplinary frameworks. The article begins with discussions of research on temporal dimensions of human drivers of carbon emissions, highlighting interactions between long-term and near-term drivers. Next, descriptions of the disciplines' contributions to the understanding of mitigation and adaptation are provided. It concludes with a summary of key lessons offered by the four disciplines as well as suggestions for future research.
89	Botswana	Kgosikoma, K. R., Lekota, P. C., & Kgosikoma, O. E. (2018). Agro-pastoralists' determinants of adaptation to climate change. <i>International Journal of Climate Change Strategies and Management</i> , 10(3), 488-500.	This study provides insights on what influences adaptation strategies and what should be targeted to build resilience in the agricultural sector. The purpose of this study is to analyse smallholder farmers' perceptions on climate change and its stressors, their adaptation strategies and factors that influence their adaptation to climate change. The study was conducted in Kweneng district, located in the south eastern part of Botswana. Multi-stage sampling was used to obtain a representative sample from three sub-districts in the district. A structured questionnaire was used to collect data by using face-to-face interviews. Majority

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			of farmers perceived an increase in mean annual temperature and the number of hot days and a decrease in mean annual rainfall and the number of rainfall days over the past 10 years as indicators of climate change. The prominent adaptation strategies included changes in planting dates for crops and supplementary feeding for livestock. The logistic regression results show that gender, age, household size, poverty, shortage of land, mixed farming and knowledge about climate change significantly influence adaptation. The findings indicate that climate change policy should target agricultural diversification at the household level and dissemination of information on climate change and adaptation strategies.
90	Ethiopia	Kidane, R., Prowse, M., & de Neergaard, A. (2018). Bespoke Adaptation in Rural Africa? An Asset-Based Approach from Southern Ethiopia. <i>The European Journal of Development Research</i> , 1-20.	This study examines differences across wealth groups based on principal component analysis and cluster analysis triangulated with participatory methods. Results indicate that perceptions of weather variability and extreme events are detected by most households regardless of wealth status. The most common responses using drought-resistant crops and changing planting dates are also similar across groups. However, there are significant differences in the type of adaptation options adopted by wealthier and poorer farmers: the former intensify agriculture through improved seed varieties, fertiliser and manure; the latter depend on craft activities, seasonal migration and support from relatives and neighbours. Overall, the findings suggest that measuring asset holdings could allow a differentiated approach to supporting adaptation across socio-economic groups in rural regions in Ethiopia and Africa more broadly.
91	Malawi	Kita, S. M. (2018). Barriers or enablers? Chiefs, elite capture, disasters, and resettlement in rural Malawi. <i>Disasters</i> .	This paper draws on a micro ethnographic evaluation conducted in two predominantly rural districts of Malawi in southeast Africa to assess two different manifestations of elite control. In the first case, a resettlement programme was implemented where chiefs were co-



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			<p>opted and took the lead. In the second case, a food insecurity response programme was designed to exclude chiefs. The study finds that neither co-opting nor countering chiefs prevents elite capture. Rather, the majority of chiefs oscillate between malevolent and benevolent capture. The findings require that states focus on the cultural and political dimensions of rural life when designing climate change adaptation and disaster risk reduction programmes</p>
92	Ghana	Koo, H., Kleemann, J., & Fürst, C. (2018). Land Use Scenario Modeling Based on Local Knowledge for the Provision of Ecosystem Services in Northern Ghana. <i>Land</i> , 7(2), 59.	<p>This study presented an assessment of potential impacts of land use scenarios on the provision of ES using local knowledge in northern Ghana. The integration of local knowledge, and the ES concept in a modelling process facilitated the spatially explicit simulation of local perceptions on the influence of different land use decisions related to ES provision. It includes stakeholders in the ecosystem services (ES) assessment in terms of understanding the perspectives of an ES beneficiary on the capacity of land use system as an ES supplier. The involvement of stakeholders allowed for the identification of locally feasible land use options which are expected to mitigate climate change impacts on agriculture. Identified trade-offs or synergies between locally important ES as potential scenario impacts can contribute to the suggestion of future land use strategies. Challenges in a stakeholder-oriented approach are related to ES where links between provision potential and land use types are difficult to be identified by stakeholders. In addition, simplification in a modelling approach is unavoidable, due to the lack of data and the insufficient capacity of the platform to address all interactions between humans and ecosystems. However, this context-based approach helps to give an insight into how to design viable land use alternatives and strategies to improve the current ES status in a local context.</p>

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93	Liberia	Lake Victoria Basin Commission, (2018). <i>Lake victoria basin Climate Change Adaptation Strategy and Action Plan 2018–2023</i> .	East Africa, and especially the Lake Victoria Basin (LVB), is among the regions most vulnerable to climate variability and change, a situation aggravated by the interaction of “multiple stressors,” occurring at various levels as well as the low adaptive capacity of the population. This is partly because of human and socioeconomic factors, but climate also makes it one of the most vulnerable regions in the world. Recent socioeconomic impacts of severe and prolonged droughts in the LVB states demonstrate the sensitivity and vulnerability of local populations. Over 10 percent of the basin’s population is gradually becoming chronically food insecure, requiring support for both short-term emergency food relief and sustainable long-term development programs. Addressing the current challenges from recent and future climate change will be challenging. This paper presents a Strategic Plan covering the period 2016–2021, which is anchored on the Protocol for Sustainable Development of December 2004. The plan adopts a programmatic approach aimed at implementing six program areas with an emphasis on management by results. The six program areas aim to: Enhance environmental and natural resources management; Promote and facilitate implementation of integrated water resource management (IWRM) and development; Enhance maritime transport safety and security on Lake Victoria; Promote social development services in the LVB; Improve investments and economic productivity in the LVB; and Strengthen the institutional and coordination capacity of the LVBC.
94	Tanzania	Lana M.A. et al. (2018). Is dry soil planting an adaptation strategy for maize cultivation in semi-arid Tanzania? <i>Food Security</i> , (10)897–910.	Agriculture has the greatest potential to lift the African continent out of poverty and alleviate hunger. Among the countries in sub-Saharan Africa, Tanzania has an abundance of natural resources and major agricultural potential. However, one of the most important constraints facing Tanzania’s agricultural sector is the

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			dependence on unreliable and irregular weather, including rainfall. A strategy to cope with climate uncertainty in semi-arid regions is to proceed with the sowing of the crop before the onset of the rainy season. The advantage is that when the rains start, seeds are already in the soil and can begin immediately the process of germination. The objective of this paper was to assess the effectiveness of dry-soil planting for maize as an adaptation strategy in the context of a changing climate in Dodoma, a semi-arid region in Tanzania. For this assessment, the DSSAT crop model was used in combination with climate scenarios based on representative concentration pathways
95	Africa	Leal Filho, W., Balogun, A. L., Ayal, D. Y., Bethurem, E. M., Murambadoro, M., Mambo, J. & Mugabe, P. (2018). Strengthening climate change adaptation capacity in Africa-case studies from six major African cities and policy implications. <i>Environmental Science &amp; Policy</i> , 86, 29-37.	This paper looks at how African countries struggle to adapt to climate change as well as a variety of measures that are being put in place to alleviate the resultant pressures on people's livelihoods and properties. In the study, some of the most important climate threats and synergic non-climate factors as well as recent progress made in respect of implementing climate change adaptation in African cities are outlined and investigated. The study concluded that there is a strong relationship between climate change and development. The authors suggested that, as African cities continue to grow, city authorities need to integrate current and future city development plans with climate change mitigation and adaptation strategies, while also enhancing the adaptive capacity of the vulnerable urban population.
96	Madagascar	Lemahieu, A., Scott, L., Malherbe, W. S., Mahatante, P. T., Randrianarimanana, J. V., & Aswani, S. (2018). Local perceptions of environmental changes in fishing communities of southwest	The study was conducted in two coastal fishing communities in the Toliara Province, Ambola and Ambotsibotsike. Using a free listing exercise, semi-structured interviews and focus group methods, local perceptions of environmental changes and responses to changes were documented. Results were compared, taking into account the differences in the degree of remoteness, market exposure and religiosity. Answers relating to the local

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		Madagascar. <i>Ocean &amp; Coastal Management</i> , 163, 209-221.	environment show that both villages identify with a sea culture, but the local ecological knowledge is arguably more accurate in the remote village of Ambola. In Ambotsibotsike God's intervention was predominantly identified as the source/cause of changes in the natural environment. Ambola also displayed a higher proportion of household members who participate in fishing from pirogues (at least one person per household). In both villages, the most reported change was a reduction of sea resources (64,2% of the answers in Ambola and 69.5% in Ambotsibotsike). Villagers' adaptation responses reflected the presence of NGOs in both villages. This influence was particularly strong in Ambola, where the establishment of reserves was found to be a predominant strategy to cope with change (54.8% of the answers). The study provides additional insights that can be used in relation to the discussion of the role of the market, of religion, and the influence of NGOs on local knowledge. It seeks to contribute to the need to implement sustainable conservation strategies and successful community-based management plans.
97	Global	Li, D., Wu, S., Liu, L., Zhang, Y., & Li, S. (2018). Vulnerability of the global terrestrial ecosystems to climate change. <i>Global change biology</i> .	In this study, the relative vulnerability of global terrestrial ecosystems to short-term climate variability was assessed by simultaneously integrating exposure, sensitivity, and resilience at a high spatial resolution (0.05°). The results show that vulnerable areas are currently distributed primarily in plains. Responses to climate change vary among ecosystems and deserts and xeric shrublands are the most vulnerable biomes. Global vulnerability patterns are determined largely by exposure, while ecosystem sensitivity and resilience may exacerbate or alleviate external climate pressures at local scales; there is a highly significant negative correlation between exposure and sensitivity. Globally, 61.31% of the terrestrial vegetated area is capable of mitigating climate change impacts and those areas are concentrated in polar

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			regions, boreal forests, tropical rainforests, and intact forests. Under current sensitivity and resilience conditions, vulnerable areas are projected to develop in high Northern Hemisphere latitudes in the future. The results suggest that integrating all three aspects of vulnerability (exposure, sensitivity, and resilience) may offer more comprehensive and spatially explicit adaptation strategies to reduce the impacts of climate change on terrestrial ecosystems
98	sub-Saharan Africa	Lindley, S., Pauleit, S., Yeshitela, K., Cilliers, S., & Shackleton, C. (2018). Rethinking urban green infrastructure and ecosystem services from the perspective of sub-Saharan African cities. <i>Landscape and Urban Planning</i> , 0–1. <a href="https://doi.org/10.1016/j.landurbplan.2018.08.016">https://doi.org/10.1016/j.landurbplan.2018.08.016</a>	<p>This study examines how green infrastructure and ecosystem service concepts are contextualized in African urban areas within the research arenas. The need to adopt these concepts in an integrated manner for both environmental and human health in a rapidly developing cities in Africa with various demands and conflicting interest on land use and water resources were discussed.</p> <p>This was a special issue on the review of several works that that have been done in the areas of ecosystem services management and green infrastructure incorporation in urban development planning and decision makings. Examples of ecosystem approaches highlighted in the paper includes among others urban agriculture management, city beautification greening as in the case of the initiative by Addis Ababa city beautification project which sought to establish new parks across the city with biodiversity conservation, ecosystem service provision, medicinal plant scheme, rehabilitation of the upper river catchment in the northern fringes of the city as major goals of the project. These tend to provide more resilience and enhance the adaptive capacity of urban dwellers to cope with the threats of climate change and environmental challenges.</p>
99	Benin	Lokonon, B. O., & Mbaye, A. A. (2018, February). Climate change	This paper examines the determinants of farmers' perceptions of climate change and subsequent adoption of sustainable land

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		and adoption of sustainable land management practices in the Niger basin of Benin. In <i>Natural Resources Forum</i> (Vol. 42, No. 1, pp. 42-53). Oxford, UK: Blackwell Publishing Ltd.	management practices in the Niger basin of Benin. Binary and multivariate probit models are applied in a two-stage regression procedure to cross-sectional data collected through a survey of 545 randomly selected farm households in 28 villages. The findings indicate that there are substitutability's among three pairs of sustainable land management practices being used by the farmers. Climate change perception is positively related to land tenure, experience in farming, number of relatives, tractor use, and membership in farmers' organizations, and negatively related to household size, remoteness, and plough use. Moreover, the findings reveal that the uptake of land management practices is related to assets, land tenure, education level of the household head, remoteness, social network, non-irrigated land size, having a farm located near a river/lake/stream, tractor and plough use, being a subsistence farmer or not, and memberships in farmers' organizations. The adoption of sustainable land management practices could be encouraged through improving access to markets, adequate roads, and technologies, as well as by promoting membership in farmers' organizations.
100	Kenya	M'mboroki, K. G., Wandiga, S., & Oriaso, S. O. (2018). Climate change impacts detection in dry forested ecosystem as indicated by vegetation cover change in—Laikipia, of Kenya. <i>Environmental monitoring and assessment</i> , 190(4), 255.	The objective of the study was to detect and identify land cover changes in Laikipia County of Kenya that have occurred during the last three decades. The main three, forest, shrub or bush land and grassland, changed during the period, of which grasslands reduced by 5864 ha (40%), forest by 3071 ha (24%) and shrub and bush land increased by 8912 ha (43%). The other three minor land use types were bare land which had reduced by 238 ha (45%), river bed vegetation increased by 209 ha (72%) and agriculture increased by 52 ha (600%) over the period decades. The opinion of the community on the change of land use and management was attributed to climate change and also adaptation strategies applied by the community over time. For example unlike the common

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			understanding that forest resources utilization increases with increasing human population, Mukogodo dry forested ecosystem case is different in that the majority of the respondents (78.9%) reported that the forest resource use was more in that period than now and also a similar majority (74.2%) had the same opinion that forest resource utilisation was low compared to last 30 years. In Yaaku community, change impacts were evidenced and thus mitigation measures suggested to address the impacts which included the following: controlled bush management and indigenous grass reseedling programme were advocated to restore original grasslands, and agricultural (crop farming) activities are carried out in designated areas outside the forest conservation areas (ecosystem zoning) all in consultation with government (political class), community and other stakeholders. Groups are organized (environmental management committee) to address conservation, political and vulnerability issues in the pastoral dry forested ecosystem which will sustain pastoralism in the ecosystem
101	Zambia	Makondo, C. C., & Thomas, D. S. (2018). Climate change adaptation: Linking indigenous knowledge with western science for effective adaptation. <i>Environmental Science &amp; Policy</i> , 88, 83-91.	The paper focuses on African traditional society, combining oral history with the available literature to examine traditional knowledge and awareness of climate change and related environmental risks. Interesting themes emerge from the knowledge holders themselves and our analysis uncovers a wide range of adaptive coping strategies applied with mixed success. From spotting and reading the position and shape of the 'new moon' to the interpretative correctness of its symbolism in "applied traditional climatology," and from rain-making rituals to conservation of wetlands and forests. Generally, findings seem to suggest that traditional African knowledge of environmental change may be as old as the society itself, with local knowledge transmitted from one generation to the next. Based on the

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			perceived vulnerability of indigenous communities, many scholars tend to argue generically for the integration of indigenous knowledge into climate change policies and implementation. The paper conclude that integration of such unique and specific indigenous knowledge systems into other evidence bases of knowledge, could be one of the best ways to the more effective and sustainable implementation of climate change adaptation strategies among target indigenous communities.
102	Zimbabwe	Makuvaro, V., Walker, S., Masere, T. P., & Dimes, J. (2018). Smallholder farmer perceived effects of climate change on agricultural productivity and adaptation strategies. <i>Journal of Arid Environments</i> , 152, 75-82.	This study was conducted in the semi-arid Lower Gweru Communal area of Central Zimbabwe to sensitize smallholder farmers on climate change and to establish their perceptions of the projected climate of Zimbabwe by 2050. Data were collected during 2011 from a total of 60 farmers drawn from six villages in Mdubiwa and Nyama Wards. Farmers were selected using systematic random sampling from a households list and grouped into three wealth groups: resource rich; resource poor and intermediate. Focus Group Discussions were conducted with each group to investigate their perceptions of the projected climate by 2050 and their proposed adaptive strategies. Farmers perceived the projected climate to have negative effects on their livelihoods and there were no outstanding differences in the nature of responses across the three categories of farmers. Farmers' responses showed that they were concerned about crop and livestock productivity as well as availability of water resources, food and nutrition security and about their general well-being. The intermediate wealth group, which had more than half of its members above 70 years of age provided the least number of ideas for adaptations. Farmers also suggested how they could possibly counteract some of the predicted negative effects or maximize on positive effects. Strategies that were suggested by the farmers were largely concerned with cropping and tended to address water shortages. It



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			was concluded that almost all strategies suggested by farmers were self-directed, rather than directed at authorities like government or donors to do something for them thus showing that farmers had the will power to deal with climate change themselves.
103	Ghana	Mango, N., Makate, C., Tamene, L., Mponela, P., & Ndengu, G. (2018). Adoption of Small-Scale Irrigation Farming as a Climate-Smart Agriculture Practice and Its Influence on Household Income in the Chinyanja Triangle, Southern Africa. <i>Land</i> , 7(2), 49.	This article presents an adoption of small-scale irrigation farming as a climate-smart agriculture practice and its influence on household income in a region that is increasingly experiencing mid-season dry spells and an increase in occurrence of drought, which is attributed largely to climate variability and change. This poses high agricultural production risks, which aggravate poverty and food insecurity. For this region, adoption of small-scale irrigation farming as a climate-smart agriculture practice is very important. The results show that off-farm employment, access to irrigation equipment, access to reliable water sources and awareness of water conservation practices, such as rainwater harvesting, have a significant influence on the adoption of small-scale irrigation farming. On the other hand, the farmer's age, distance travelled to the nearest market and nature of employment negatively influence the adoption of small-scale irrigation farming decisions. Ordinary least squares regression results showed that the adoption of small-scale irrigation farming as a climate-smart agriculture practice has a significant positive influence on agricultural income. We therefore conclude that to empower smallholder farmers to respond quickly to climate variability and change, practices that will enhance the adoption of small-scale irrigation farming in the Chinyanja Triangle are critical, as this will significantly affect agricultural income. In terms of policy, we recommend that the governments of Zambia, Malawi and Mozambique, which cover the Chinyanja Triangle, formulate policies that will enhance the adoption of sustainable small scale-irrigation farming as a climate-smart agriculture practice. This will

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			go a long way in mitigating the adverse effects that accompany climate variability and change in the region.
104	South Africa	Masonganye, M., & Mukonza, C. (2018). An evaluation of climate change response capabilities of local municipalities within the Waterberg District Municipality, Limpopo Province. <i>Business Strategy &amp; Development</i> , 1(3), 196-203.	The aim of the research study was to evaluate the climate change response capabilities of the local municipalities within the Waterberg District Municipality in Limpopo Province and their ability to achieve spatial resilience. A qualitative approach was followed. Interviews were conducted with municipal personnel, and a focus group discussion with a group of town planners at the Department of Public Works and a group of town planners from various local municipalities was conducted. Thematic analysis was used to analyse the results. The results show that local municipalities acknowledge the problems brought by climate change and their responsibility to respond. However, there is neither a clear mandate nor procedures on how the implementation processes should be carried out. Some of the challenges municipalities face are lack of knowledge, technical expertise, and funding for climate change responses. The country must first understand and develop clear channels of climate change response before making commitments to international transnational climate change response initiatives.
105	Zimbabwe	Mbereko, A., Chimbari, M. J., & Mukaratirwa, S. (2018). The political ecology of stakeholder-driven climate change adaptation: Case study from Ntalale ward, Gwanda district, in Zimbabwe. <i>Jàmbá: Journal of Disaster Risk Studies</i> , 10(1), 1-10.	According to this article, the household is a key stakeholder in developing adaptation strategies. It is recommended that cooperation between households and institutions is key in developing stakeholder-driven adaptation strategies. Vulnerable rural communities face climate change-related shifts in rainfall patterns, particularly droughts and floods. The study investigated how Ntalale ward households in Gwanda district of Zimbabwe interpret climate change and adapt to its stressors in the context of the Zimbabwean political economy. The community has experienced the following climate change-related risks: droughts, floods, heatwave and intra-seasonal rainfall variability. Droughts

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			were reported to be occurring more frequent in the past 25 years as compared to the period before 1991. Ntalale area experienced floods in the 2002–2003 rainy season only. Respondents generally perceived that the rainy season had changed in the past 5 years, with the season now beginning in December and ending in March. The households have resorted to shifting cultivation practices, replanting, use of wetlands in preference to upland fields, changing of seed varieties or crops, selling of livestock and informal trading as coping strategies. Although non-governmental organisations have assisted the community to set up irrigation schemes, a few selected community members have benefited from the initiative. It is recommended that cooperation between households and institutions is key in developing stakeholder-driven adaptation strategies.
106	East and West Africa	McKune, S., Poulsen, L., Russo, S., Devereux, T., Faas, S., McOmber, C., & Ryley, T. (2018). Reaching the end goal: Do interventions to improve climate information services lead to greater food security? <i>Climate Risk Management</i> .	Climate change is projected to have profound effects on nutritional outcomes, particularly among children under five in developing countries, where small-scale, subsistence farming and livestock production supports a majority of livelihoods. An underlying mechanism by which climate change will negatively affect nutrition is through increased food insecurity, as both crop and livestock production are threatened by changing patterns of rainfall and temperature. Climate information services (CIS) provide short and long-term weather and climate forecasts through a variety of means with the aim of increasing smallholder farmers' ability to cope and adapt to a changing environment. CIS can be used to increase climate-smart agriculture (CSA) practices, which in turn can increase agricultural productivity and farmer resilience, while simultaneously reducing greenhouse gas emissions. The findings are inconclusive, however, given the near complete coverage of CIS and widespread food insecurity across sites. Importantly, participants did not ascribe their knowledge of CSA practices to

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			CIS, and the important role of social and informal networks as a source of climate information emerges as an important area of additional exploitation for increased uptake of CSA for improved food security.
107	Ethiopia	Mekuyie, M., Jordaan, A., & Melka, Y. (2018). Understanding resilience of pastoralists to climate change and variability in the Southern Afar Region, Ethiopia. <i>Climate Risk Management</i> , 20, 64-77.	This study was conducted in the Southern Afar region in Ethiopia to understand the resilience of pastoralists to climate change and variability. A household questionnaire survey and focus group discussions were employed to collect primary data at household level. A total of 250 pastoral households were sampled using stratified random sampling. The data obtained were analysed using descriptive statistics and principal component analysis. The resilience of households to climate shocks and stresses was determined using a two-step modelling approach by clustering households into livelihood groups, gender and districts. The results indicated that agro-pastoral households were more resilient than pastoralists to climate-induced shock. Furthermore, households in the Gewane district were more resilient than those in the Amibara district. Female-headed households were less resilient than male-headed households. Enhancing livestock assets and productivity, social safety nets, access to market, credit, extension services and education, improving irrigation crop farming, and providing farm inputs significantly enhanced the resilience of pastoralists to climate change and variability.
108	Global	Mistage, O., & Bilotta, P. (2018). Decision support method for GHG emission management in industries. <i>International Journal of Environmental Science and Technology</i> , 15(6), 1331-1342.	Keeping temperature rise well below 2 °C is Paris Climate Agreement's main commitment and corporate-level participation will be crucial to achieve national mitigation targets. Hence, companies should adopt measures that allow them to adapt to upcoming scenarios where low-carbon production is expected to become mandatory and a great competitive advantage. However, mitigation strategies cannot be evaluated without consideration of subjective environmental criteria. Consequently, lack of decision

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			support methodologies for climate change evaluation in industries is a barrier for innovation. Aiming at consideration of non-monetary aspects, we develop a support method that incorporates costs, benefits, opportunities and risks related to climate change in manufacturing industries. First, we compared the most relevant multi-criteria decision analysis methodologies and identified an Analytic Hierarchy Process (AHP) as the most suitable for ranking corporate climate change strategies.
109	Ethiopia	Mohammed, Y., Yimer, F., Tadesse, M., & Tesfaye, K. (2018). Meteorological drought assessment in north east highlands of Ethiopia. <i>International Journal of Climate Change Strategies and Management</i> , 10(1), 142-160.	This paper detailed drought characterization and how it can be used as bench mark to take comprehensive drought management measures such as early warning system, preparation and contingency planning, climate change adaptation programs. The approach was investigating the patterns and trends of drought incidence in north east highlands of Ethiopia using monthly rainfall record for the period 1984-2014. Standard precipitation index and Mann – Kendal test were used to analyse drought incident and trends of drought occurrences, respectively. The spatial extent of droughts in the study area has been interpolated by inverse distance weighted method using the spatial analyst tool of ArcGIS. Most of the studied stations experienced drought episodes in 1984, 1987/1988, 1992/1993, 1999, 2003/2004 and 2007/2008 which were among the worst drought years in the history of Ethiopia. The year 1984 was the most drastic and distinct-wide extreme drought episode in all studied stations. The Mann–Kendal test shows an increasing tendency of drought at three-month (spring) timescale at all stations though significant ( $p < 0.05$ ) only at Mekaneselem and decreasing tendencies at three-month (summer) and 12-month timescales at all stations. The frequency of total drought was the highest in central and north parts of the region in all study seasons.

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110	Global	Mollaei, S., Amidpour, M., & Sharifi, M. (2018). Analysis and development of conceptual model of low-carbon city with a sustainable approach. <i>International Journal of Environmental Science and Technology</i> , 1-10.	Low-carbon cities have been the favorite subject of many societies with the aim of making a sustainable environment for life. The purpose of this study was to develop a conceptualized model of low-carbon city with a sustainable approach by applying life-cycle cost analysis as the methodology with secondary data from Iranian national report to the United Nations framework convention on climate change. This study attempts to examine the factors affecting the production and increase in carbon emission in urban areas and also provides some solutions to solve these problems and create low-carbon urban areas in order to promote environmental quality with a sustainable development approach. Then, some tools and methods are developed to improve the analytical rigor associated with climate action plans. With a focus on non-behavioral items, the cost and effectiveness of more than 30 action items are quantified. Finally, the scenario analysis was used to evaluate the cost and efficiency of various program designs. Results indicate that greenhouse gases mitigation takes remarkable initial investments.
111	Ethopia	Moroda, G. T., Tolossa, D., & Semie, N. (2018). Perception and adaptation strategies of rural people against the adverse effects of climate variability: A case study of Boset District, East Shewa, Ethiopia. <i>Environmental Development</i> , 27, 2-13.	This study explores the perception and adaptation strategies of rural households to the adverse effects of climate variability. The results revealed overwhelming that the majority (99.5%) of respondents noticed changes in temperature which was also confirmed by the meteorological data; and 97.5% of the respondents again acknowledged changes in rainfall. As a consequence, households experienced reduced yield, complete crop failure, shortage of water both for people and animals, soil erosion, and assets destruction. To offset such consequences, 91.5% of the respondents used an array of adaptation strategies which broadly comprised of crop management related strategies, land management strategies, and diversification into non-farm activities. Nonetheless, respondents were challenged by multiple

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			barriers such as lack of finance (73.8%), shortage of land (60.7%), lack of water (48.9%), and lack of access to modern inputs (45.1%). On the other hand, results from a multinomial logit model revealed that gender, farmland size, total annual income, access to a weather forecast, access to credit services, and distance to input/output markets have statistically significant effects on the choice of adaptation strategies. Hence, despite the wider awareness of climate variability, the multiple barriers to adaptation coupled with unmatched support from local authorities' complicate matters. The findings suggest the need for a collaborative approach that acts in a proactive manner to overcome adaptation barriers. This would improve effectiveness and pave the way to development.
112	Uganda	Mubiru, D. N., Radeny, M., Kyazze, F. B., Zziwa, A., Lwasa, J., Kinyangi, J., & Mungai, C. (2018). Climate trends, risks and coping strategies in smallholder farming systems in Uganda. <i>Climate Risk Management</i> .	Smallholder farmers in Uganda face a wide range of agricultural production risks. Climate change and variability present new risks and vulnerabilities. Climate related risks such as prolonged dry seasons are becoming more frequent and intense with negative impacts on agricultural livelihoods and food security. This paper examines farmers' perceptions of climate change, climate-related risks affecting crop and livestock production, including climate-risk management and adaptation strategies. Perceived changes in climate included erratic rainfall onset and cessation (which were either early or late), poor seasonal distribution of rainfall and decreased rainfall. In addition, farmers reported variations in temperatures. Drought, increasing disease and pest incidences, decreasing water sources, lack of pasture, bush fires, hailstorms, changes in crop flowering and fruiting times were the major climate-related risks reported. In order to cope with climate change and climate variability, farmers use a wide range of agricultural technologies and strategies. Mulching, intercropping and planting of food security crops were among the most commonly used

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			practices. Other strategies included water harvesting (mainly for domestic consumption), other soil and water conservation technologies and on-farm diversification.
113	Tanzania	Muchapondwa, E., & Komba, C. (2018). Adaptation to climate change by smallholder farmers in Tanzania. In <i>Agricultural Adaptation to Climate Change in Africa</i> (pp. 129-168). Routledge.	This study investigates whether these smallholder farmers in Tanzania recognize climate change and, consequently, adapt to it in their agricultural activities. The study also investigates the factors influencing their choice of adaptation methods. In order to achieve this, the study analyzed data from 534 randomly selected households in a sample of districts representing six of the seven agro-ecological regions of the country. The data shows that Tanzanian smallholder farmers have observed changes in mean and variance precipitation and temperature and have responded to it. The farmers have generally used short-season crops, drought-resistant crops, irrigation, changing planting dates and tree planting to adapt to the negative impacts of climate change on their agricultural yields. In this study, selection bias is corrected using a Heckman sample selection model. A binary probit model is used as a selection equation to investigate the factors influencing a farmer's decision to undertake any adaptation at all to climate change, while a multinomial probit model is used as an outcome equation to investigate the factors influencing farmers' choice of specific adaptation methods. The inverse Mill's ratio reported selection bias in choosing three of the adaptation methods. The findings of the study suggest that the Tanzanian government needs to help smallholder farmers overcome the constraints they face in their attempts to adapt. The government can play a significant role by promoting adaptation methods appropriate for circumstances, e.g., particular crops for different agro-ecological zones.
114	21 African countries	Muchuru, S., & Nhamo, G. Climate change adaptation and the African fisheries: evidence from the	This paper explores the challenges faced by both freshwater and marine fisheries sector in addressing climate change and teases out intervention measures from 21 African countries. The paper uses



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		UNFCCC National Communications. Environment, <i>Development and Sustainability</i> , 1-19.	document analysis and draws selected analysis parameters from the grounded theory. The data are obtained from the United Nations Framework Convention on Climate Change National Communication reports. Among the key adaptation measures emerging from the analysis are: fish breeding, integrated coastal management, putting in place appropriate policies, water and flood management as well as research and development. The study concludes that adaptation in the African fisheries sector should be prioritised, an aspect that could also apply elsewhere in the world to enhance food security.
115	Zimbabwe	Mugambiwa, S. S. (2018). Adaptation measures to sustain indigenous practices and the use of indigenous knowledge systems to adapt to climate change in Mutoko rural district of Zimbabwe. <i>Jambá: Journal of Disaster Risk Studies</i> , 10(1), 1-9.	This article examines adaptation measures used to sustain indigenous practices and the use of indigenous knowledge systems (IKS) to adapt to climate change in Mutoko rural district of Zimbabwe. Community-based adaptation is able to reduce the vulnerability as well as improve the resilience of the local people to climatic variability and change. Subsistence farmers have always adopted adaptive strategies to some of these changes over the years. The study discovered that there are numerous measures used to adapt to climate change and subsequently to sustain indigenous practices. The study also found that the community no longer grows maize in large quantities, having shifted to millet and sorghum in order to adapt to climate change. The community also provided various strategies to adapt to climate change. These strategies include mulching, creating large storage houses for produce and creating temporary walls on riverbanks in order to store water when the rivers dry up. This article concludes that climate change adaptation measures employed by the community have significantly helped them to sustain their indigenous practices in many ways. Also, the use of IKS, through activities such as crop type change from maize to traditional millet and sorghum (which facilitates traditional lifestyle and activities), re-establishes the

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			community's indigenous practices since they are made to observe the practices of yesteryear. In that regard, adaptation measures to sustain indigenous practices and the use of IKS to adapt to climate change in Mutoko rural district was explicitly and implicitly explored from the community's worldview and culture. Consequently, understanding indigenous adaptation methods employed by the community will significantly help to moderate and mitigate climate change impacts.
116	SSA	Muli, C., Gerber, N., Sakketa, T. G., & Mirzabaev, A. (2018). Ecosystem tipping points due to variable water availability and cascading effects on food security in Sub-Saharan Africa (No. 278230).	This paper is based on literature, which focuses on the impacts of increased variability in water availability on household's food security levels, and on the adaptation strategies that some households adopt to protect themselves from adverse effects of water variability. It is hypothesized that farmers adapt to higher production risks associated with increasing water variability by choosing any combination of strategies for reducing the hazard or improving their resilience. The paper aimed at looking at the characteristics and shifts of the socio-ecological system in relation with variable water availability, its effects on food crop producing households, how that can be related to regional and household food security, and the drivers connected to the potential tipping point(s) of food security. It is vital to help smallholder farmers to build resilience and adaptive capacity to cope with current weather induced risks. Activities that have shown to increase productivity such as facilitating access to fertilizers, irrigation, improved and drought tolerant seeds among other inputs should be supported. The most important is facilitating access to timely climate information. This would inform farmers on crop choice, planting dates and other management strategies to avoid losses like replanting due to rainfall delays. Additionally, access to irrigation infrastructure would reduce overreliance on rain-fed agriculture. Agroforestry techniques would also play various roles such as

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			enhancing the resilience of agricultural systems against increased temperatures, soil erosion, as well as act as carbon stocks. Agronomical practices and use of cultivars that are more suitable to the new climatic regimes remain to be the major adaptation strategies to the intensified and shortened rainy seasons in these areas.
117	Ghana	Musah-Surugu, I. J., Ahenkan, A., Bawole, J. N., & Darkwah, S. A. (2018). Migrants' remittances: A complementary source of financing adaptation to climate change at the local level in Ghana. <i>International Journal of Climate Change Strategies and Management</i> , 10(1), 178-196.	This paper underpins that adequate climatic information should be made available to local people to ensure that remittances are applied to the right adaptation option to avoid maladaptation. The much-trumpeted Green Climate Fund and several other official financial mechanisms for financing adaptation to climate change under the UN Framework Convention on Climate Change have fallen short in meeting adaptation needs. Many poorer people are still grappling with the scourge of climate change impacts. Consequently, there has been a dominant research focus on climate change financing emanating from official development assistance (ODA), Adaptation Fund, public expenditure and private sector support. However, there has been little attempt to examine how migrants' remittances can close adaptation financing gaps at the local level, ostensibly creating a large research gap. This paper aims to argue that migrants' remittances provide a unique complementary opportunity for financing adaptation and have a wider impact on those who are extremely vulnerable to climate change. The paper is aligned to the qualitative research approach. Both secondary and primary data acquired through interviews and focus group discussions were used for the study. Multiple sampling methods were also used to select the respondents. The findings show that remittances are used to finance both incremental costs of households' infrastructure and consumption needs, as well as additional investment needs to be occasioned by ongoing or expected changes in climate.

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118	Ghana	Musah-Surugu, I. J., Bawole, J. N., & Ahenkan, A. (2018). The “Third Sector” and Climate Change Adaptation Governance in Sub-Saharan Africa: Experience from Ghana. <i>VOLUNTAS: International Journal of Voluntary and Nonprofit Organizations</i> , 1-15.	This paper contributes to the emerging climate policy literature by drawing on experiences from three purposefully selected non-state actors’ adaptation program in Ghana. The paper observes that through tripartite mechanisms climate advocacy, direct climate service provision and local empowerment, NGOs significantly play a complementary role in building local adaptive capacities, especially among people who are already living at or close to the margins of survival. The paper again found that NGOs tacitly explore four interrelated “social tactics” (rulemaking, alliance brokerage, resource brokerage, and framing) to gain the cooperation of local actors for the implementation of adaptation interventions. In order to improve the performance and sustainability of adaptation interventions, the paper puts forward that NGOs should, among other things, harmonize their interventions to resonate with local interest and identity and also nurture capable project caretakers before community exit.
119	South Africa	Muswema, A. P., Chetty, P., Okem, P., & Oelofse, S. H. (2018). Impacts of severe weather events on implementing the waste hierarchy- the case of eThekwinini metropolitan municipality.	The study seeks to understand how extreme weather events affect the implementation of the waste hierarchy (an approach that emphasises that waste must firstly be avoided and if not avoided, minimised and diverted from landfill for beneficiation purposes). This case study is an overview investigating the interaction between severe weather incidents and solid waste management. There is robust scientific evidence linking the frequency of extreme weather events to climate change. Climate change models demonstrate the likelihood that extreme weather events are likely to become more frequent in the current, near- and long-term. Similarly, the socio-economic impacts of these extreme weather events are projected to become increasingly severe. The study is located in the broader context of climate change and its implications for solid waste management in eThekwinini metro. Additional consequences to extreme weather events for the

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			vulnerable (especially those located in informal settlements) including the negative impact on informal housing, mortality and the loss of assets and livelihood is discussed. The paper argues that there are a number of options to manage waste from severe weather events, including the application of the waste hierarchy (as well as options to stimulate job creation) as a tool to manage wastes. Additionally, there is a need for the individual sector plans from each of the line departments to be finalised, completed and made available (to public and officials).
120	West African countries	Muthee, K. W., Mbow, C., Macharia, G. M., & Leal-Filho, W. (2018). Ecosystem services in adaptation projects in West Africa. <i>International Journal of Climate Change Strategies and Management</i> , 10(4), 533-550.	The study assesses the extent to which adaptation projects have incorporated ecosystem services, as well as their redesigning options. The projects selected are listed under National Adaptation Programme of Action in West African region. The adaptation initiatives are dominated by actions in the agricultural sector accounting for 32 per cent of the total. Further, they were characterized by small grants consideration with 63 per cent falling under US\$1m budget, short-term implementation duration with 46 per cent having three years' execution period. A large portion of projects (55 per cent) mentioned directly one or more ecosystem services, with provisioning services being referred to in 50 per cent of the cases.
121	Madagascar	National Bureau for Coordination of Climate Change (2018) <i>Madagascar's Strategic Programme for Climate Resilience</i> . Republic of Madagascar.	The paper identifies the need for ecosystem-based strategies for climate change in Madagascar. The approaches include; Enhancing risk preparedness (E.g. EWS) and promoting climate adaptation measures (E.g. Introducing drought resistant species); introducing risk transfer or risk sharing mechanism such as agricultural insurance schemes or the establishment of regional contingency funds.
122	West Africa	N'dri, A. B., Kone, A. W., Loukou, S. K., Barot, S., & Gignoux, J. (2018). Carbon and nutrient losses through	Biomass burning has links with a number of global concerns including soil health, food security and climate change. In central Côte d'Ivoire (West Africa), we conducted a field study to compare

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		biomass burning, and links with soil fertility and yam ( <i>Dioscorea alata</i> ) production. <i>Experimental Agriculture</i> , 1-14.	nutrient losses, soil fertility and yam yield in slash-and-burn versus slash-and-mulch agriculture. Trials involved five sites established in the dominant <i>Chromolaena odorata</i> fallows of the region, each consisting of paired plots: slash and burnt biomass (SB) versus slashed and unburnt biomass but left to serve as mulch (SM). Carbon and five elemental nutrients were assessed in the aboveground biomass prior to burning and in ash after fires; losses were assessed by subtraction. The key finding was that the elements lost in greatest proportion during burning were those mostly influencing yam yields. Because a clear negative relationship between biomass burning and yam production has been established the promotion of the more productive, alternate slash-and-mulch system compared to slash-and-burn system, is warranted. The findings of the research can be used in support of developing a sustainable yam production system in the region and in West Africa more generally.
123	Ghana	Nero, B., Callo-Concha, D., & Denich, M. (2018). Structure, Diversity, and Carbon Stocks of the Tree Community of Kumasi, Ghana. <i>Forests</i> , 9(9), 519.	This paper describes the structure, diversity, and composition of an urban forest and its potential to store carbon as a means of climate change mitigation and adaptation in Kumasi. Urban forestry has the potential to address many urban environmental and sustainability challenges. Yet in Africa, urban forest characterization and its potential to contribute to human wellbeing are often neglected or restrained. Urban forestry is emerging as a means to enhance urban environmental sustainability and resilience, especially in developing countries. The species richness and diversity of the city is similar and sometimes higher than that of other landscapes and national parks within the same ecoregion in the country. The modification was due to the inclusion of palms and non-traditional timber species that are a rudimentary part of the urban forest. It is concluded that the urban forest structure is unique and different from that of other forest types. While species

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			richness and diversity decrease with increasing diameter class, carbon storage increases with increasing diameter class. The selective preservation of certain species and natural processes in the urban spaces accounts for these trends. Carbon storage is a function of tree size and not necessarily tree density. Hence, a few large trees stored more carbon than a bunch of small trees. These findings provide baseline information about the forest structure and species composition and should be the basis for urban planning decision making regarding green urbanism in Kumasi and other cities in Ghana and Africa. The urban forest structure and composition is quite unique. The practice of urban forestry has the potential to conserve biological diversity and combat climate change. The introduction of policies and actions to support the expansion of urban forest cover and diversity is widely encouraged.
124	Nigeria	Ngozi, N. F., Okey, A. C., Chukwunwike, O. M., & Chinyere, A. E. (2018). Issues of Climate Change, Impact, and Adaptation Strategies in Nigeria. In <i>Climate Change and Environmental Concerns: Breakthroughs in Research and Practice</i> pp 591-603. IGI Global.	Climate change is a global problem affecting agricultural production, a good adaptation strategy for this phenomenon should be sought for increase agricultural production. The study was conducted in Nigeria to assess the Impact of Climate Change on root and tuber crops production among farmers in Nigeria. Secondary data were used for the study, they were collected from NRCRI Umudike and other individual publications. The result shows that climate change had negative impact on root and tubers crops production including potato. Adaptation of Agriculture to climate change in the areas of crop and animal production, post-harvest activities and capacity building, diversification of livelihood sources through the use of different farming methods and improved agricultural practices will help to reduce the impact of climate change. Examples are establishment of forestry, generation of improved and disease resistance crop varieties addition of value into agricultural products and post-harvest

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			activities for climate change adaptation and sustainable development.
125	sub-Saharan Africa	Nkengla-Asi, L., Babu, S. C., Kirscht, H., Apfelbacher, S., Hanna, R., & Tegbaru, A. (2017). Gender, climate change, and resilient food systems: lessons from strategic adaptation by smallholder farmers in Cameroon.	This study aims to understand how men and women in Cameroon's Southwest region differ in their vulnerability to and their coping strategies for climate change impacts. Data collected through focus group discussions and in-depth interviews from four rural communities in the Southwest region showed that most respondents (both male and female) had observed a change in the climate in the previous 10 years. Climate change has major impacts on the food security and livelihoods of smallholder farmers in Africa south of the Sahara. Vulnerable to the vagaries of weather and to being chronically poor, women farmers are unequally and more negatively affected by climate change and seasonal changes than male farmers. According to respondents, climate variables such as the timing and length of the rainy season had changed, affecting crop production of both men and women. Women were shown to be more vulnerable than men, as the changes led to a reduction in yields, which affected family well-being. Men and women in the researched communities strive to cope with climate change and related seasonal variations in different ways. Other coping strategies for men and women in the research communities include income diversification, planting of early-maturing crops, and use of pest-resistant seeds. Men and women have different experiences and different adaptation strategies to climate change and seasonal variations in weather patterns.
126	Zambia	Nkhata, B., Breen, C., & Chomba, M. (2018). Why Southern Africa Needs More than an Adaptation Strategy to Build Climate Resilient Floodplains: A Call for Transformative Water	This chapter seeks to illustrate why efforts to build climate resilient floodplains in Southern Africa require long-term transformative water security interventions. The authors argue that a transformative water security approach that is generative of change is needed to deal with the many adaptation challenges experienced



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		Security on the Kafue Flats of Zambia. In <i>Climate Resilient Water Resources Management</i> (pp. 77-91). Palgrave Pivot, Cham.	by floodplain systems. They call for transformative water security that emphasises continuous experimentation and learning in an ongoing process of defining and balancing thresholds. This is particularly important given that most Southern African societies undeniably need to develop capacities to adapt to the impacts of climate change. The authors contend that societal efforts need to be directed towards building transformative capacities. This, however, will require a shift towards a functional balance between adaptation and transformation.
127	Cameroon	Nkiaka, E., & Lovett, J. C. (2018). Mainstreaming climate adaptation into sectoral policies in Central Africa: Insights from Cameroun. <i>Environmental Science &amp; Policy</i> , 89, 49-58.	This paper presents an in-depth analysis of the progress made in mainstreaming climate adaptation into sectoral policies in CA based on insights from Cameroun. To achieve this, 30 strategic policy documents published by the government of Cameroun covering different aspects of climate adaptation were exploited. Additional information was obtained from interviews with 27 stakeholders working in relevant government ministries/institutions and international organizations. Results show that significant progress has been made to mainstream climate adaptation into the forestry and energy sectors. This has been facilitated by the putting in place of national policies that consider climate change impacts and mitigation/adaptation in these sectors. Overall results show that the National Adaptation Plan of Action has played a key role in enhancing the mainstreaming of climate adaptation into sectoral policies in Cameroun. Notwithstanding the progress recorded, many obstacles such as the lack of human and financial resources still exist. Stakeholders proposed a series of potentially useful solutions to tackling obstacles hindering cross-sectoral mainstreaming initiatives. This paper contributes to contemporary debates on the extent to which adaptation mainstreaming is happening at national level in sub-Saharan Africa, and reveals the obstacles that need to

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			be addressed in order to sustain this initiative in CA and other regions of the continent
128	Mali and Nigeria	Nkonya, E., Koo, J., Kato, E., & Johnson, T. (2018). Climate Risk Management through Sustainable Land and Water Management in Sub-Saharan Africa. In <i>Climate Smart Agriculture</i> (pp. 445-476). Springer, Cham.	Using Mali and Nigeria as case study countries, this study shows that climate change may reduce the yield of staple food crops—namely maize, rice, and millet – by 20% in 2050 compared to their levels in 2000. Sustainable land and water management (SLWM) – which includes a combination of organic soil fertility, inorganic fertilizer, and water managements – will more than offset the effect of climate change on yield under the current management practices. Additionally, SLWM is more profitable and could therefore increase household income and address poverty. Unfortunately, adoption rates of SLWM remain low. Policies and strategies for increasing their adoption includes improvement of market access, enhancing the capacity of agricultural extension service providers to provide advisory services on SLWM, and building an effective carbon market that involves both domestic and international buyers. The recent United Nations Framework Convention on Climate Change (UNFCCC) provides one of the opportunities for reducing climate risks and achieving sustainable agricultural production under climate change.
129	Benin	Noulèkoun, F., Khamzina, A., Naab, J. B., Khasanah, N. M., van Noordwijk, M., & Lamers, J. (2018) <i>Climate Change Sensitivity of Multi-Species Afforestation in Semi-Arid Benin. Sustainability</i> , 10(6), 1-23.	The early growth stage is critical in the response of trees to climate change and variability. However, it is not clear, what climate metrics are best to define the early-growth sensitivity in assessing adaptation strategies of young forests to climate change. Using a combination of field experiments and modelling, this research assessed the climate sensitivity of two promising afforestation species, <i>Jatropha curcas</i> L. and <i>Moringa oleifera</i> Lam., by analysing their predicted climate–growth relationships in the initial two years after planting on degraded cropland in the semi-arid zone of Benin. WaNuLCAS model (version 4.3, World Agroforestry Centre, Bogor, Indonesia) was used to simulate

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			aboveground biomass growth for each year in the climate record (1981–2016), either as the first or as the second year of tree growth. The process-based Linear mixed models related the annual biomass growth to climate indicators, and climate sensitivity indices quantified climate–growth relationships. In the first year, the length of dry spells had the strongest effect on tree growth. In the following year, the annual water deficit and length of dry season became the strongest predictors. Simulated rooting depths greater than those observed in the experiments enhanced biomass growth under extreme dry conditions and reduced sapling sensitivity to drought. Projected increases in aridity implied significant growth reduction, but a multi-species approach to afforestation using species that are able to develop deep-penetrating roots should increase the resilience of young forests to climate change. Based on the observed species-specific responses to climate variability and the importance of root depth in buffering the negative effects of extreme drought on sapling growth, a multi-species afforestation system with species that are able to develop deep-penetrating root systems may increase the resilience of plantations to climate change.
130	Uganda	Nsubuga, F. W., & Rautenbach, H. (2018). Climate change and variability: a review of what is known and ought to be known for Uganda. <i>International Journal of Climate Change Strategies and Management</i> .	The study is to review what has been documented, thus it gives an overview of what is known and seeks to explain the implications of a changing climate, hence what ought to be known to create a climate resilient environment. In view of the consensus that climate change is happening, scientists have documented several findings about Uganda’s recent climate, as well as its variability and change. The climate of Uganda is tropical in nature and influenced by the Inter-Tropical Convergence Zone (ITCZ), varied relief, geo-location and inland lakes, among other factors. The impacts of severe weather and climate trends and variability have been documented substantially in the past 20-30 years. Most

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			studies indicated a rainfall decline. Daily maximum and minimum temperatures are on the rise, while projections indicate a decrease in rainfall and increase in temperature both in the near and far future. The implication of these changes on society and the economy are discussed herein. Varied forms of adaptation to the impacts of climate change are being implemented, especially in the agricultural sector and at house hold level, though not systematically. This review of scientific research findings aims to create a better understanding of the recent climate change and variability in Uganda and provides a baseline of summarized information for use in future research and actions.
131	Zimbabwe	Nyamwanza, A. M. (2018). Local institutional adaptation for sustainable water management under increasing climatic variability and change: A case in the mid-Zambezi Valley, Zimbabwe. <i>International Journal of Climate Change Strategies and Management</i> , 10(3), 453-471.	This study aimed to explore institutional adaptation for sustainable water resources management at the local level in the context of increasing climate-related challenges in Zimbabwe using the case of a semi-arid area in the mid-Zambezi Valley, north of the country. Inspired by the critical institutionalism approach, the study uses qualitative methods (i.e. key informant interviews, semi-structured interviews, community workshops and documentary review) to understand the role of different formal and informal water-related institutions vis-à-vis responding to climate-related challenges in the case study area, and how the identified institutions can improve their efforts in the context of national water and environmental policy and regulation frameworks. Thematic analysis was used for data analysis. Findings are that climatic challenges in the case study area, as in most of rural Africa, have raised the stakes in local water management with respect to regulating access to and balancing competing interests in, and demands for, water. It ultimately argues for the embracing of complexity thinking and flexibility in local water management as well as clear coordination of institutions across scales in the face of increasing climate-related challenges. The study adds to case

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			studies and evidence-based analyses focused on institutional alternatives for climate adaptation vis-à-vis water resources management in water-stressed rural African communities.
132	West Africa	Nyasimi, M., Ayanlade, A., Mungai, C., Derkyi, M., & Jegede, M. O. (2018). <i>Inclusion of Gender in Africa's Climate Change Policies and Strategies</i> . In Handbook of Climate Change Communication: Vol. 1 (pp. 171-185). Springer, Cham.	This book chapter aims at reviewing climate change related policies and strategies in East and West Africa through a gendered lens. The countries are Kenya, Uganda, Tanzania in East Africa, and Ghana and Nigeria in West Africa. Drawing upon a common framework/guideline, commonality in policies were examined, while recognizing the complexity in the social, economic and ecological systems of each country. The chapter further assesses the importance of integrating and mainstreaming gender into Africa's national adaptations plans of actions (NAPAs), and Intended Nationally Distributed Contributions (INDCs), and the need for better gender-oriented climate change policies, programs and plans.
133	SADC	Oberholster, P. J., Cheng, P. H., Genthe, B., & Steyn, M. (2018). The environmental feasibility of low-cost algae-based sewage treatment as a climate change adaption measure in rural areas of SADC countries. <i>Journal of Applied Phycology</i> , 1-9. .	In the present study domestic waste water was treated using inoculated algae strains in two rural waste water pond system treatment plants. Employing specific algae treatment to treat municipal domestic waste water effluent presents an alternative practice to improving water quality effluent of existing rural pond systems in Southern Africa. The novelty of the technology is the consortium of specific algae that were selected on the bases of robustness, maximum abortion of nutrients. Other algae and conventional technologies on the market currently required high cost investment, requires electricity for mixing of algae and need skill labours to maintain the system. The objective of the current study was to determine through field pilot studies, if algae nutrient treatment efficiencies in prevailing traditional waste stabilization ponds can be optimize through the manipulation of the existing natural consortium of alga by the mass inoculation of specific algae strains. One of the mean concerns using specific strains of

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			algae in SADC countries, are temperature requirements of the selected strains. Temperature variations due to climate change can affect biochemical reactions and subsequently biochemical composition of algae. The current study did show that inoculations of specific algal strain can potentially enhance the treatment efficiencies of existing rural domestic sewage pond systems.
134	SADC	Oberholster, P. J., Cheng, P. H., Genthe, B., & Steyn, M. (2018). The environmental feasibility of low-cost algae-based sewage treatment as a climate change adaption measure in rural areas of SADC countries. <i>Journal of Applied Phycology</i> , 1-9.	This study treated domestic wastewater by using existing infrastructure and inoculated specific selected algae strains in a pond system treatment plant. The objective was to determine through a field pilot study if algae nutrient treatment efficiencies in current traditional water-stabilisation ponds can be optimised by manipulating the existing natural consortium of algae through mass inoculation of specific algae strains of <i>Chlorella</i> spp. The reduction of total phosphorus in the unfiltered water (contain algae) after specific algae treatment was 74.7 and 76.4% for water-stabilisation ponds 5 and 6, while total nitrogen removal was 43.1 and 35.1%, respectively. <i>Chlorella protothecoides</i> was the dominant algal species in ponds 4, 5 and 6 after specific algae treatment. The maximum algae abundance ( $4.6 \times 10^6$ cells mL <sup>-1</sup> in pond 4 and $6.1 \times 10^6$ cells mL <sup>-1</sup> in pond 5) were observed in August 2016, while the maximum chlorophyll-a concentration of 783 µg L <sup>-1</sup> was measured in pond 5 after 2 months of specific algae inoculation. Although the present study showed that inoculation of specific algal strains can potentially enhance the treatment efficiencies of existing rural domestic sewage pond systems, it was also evident from the algae-treated effluent analysis that the algae biomass in the upper surface water layer must be harvested for maximum treatment results.
135	Kenya	Oeba, V. O., Otor, S. C. J., Kung'u, J. B., Muchiri, M. N., Mahamane, L., Desta, K. N. & Mkong, C. J. (2018).	This study, therefore, sought to determine soil carbon sequestration differentials among selected key forest plantations in Kenya and their future implications on sustainable development

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		Soil Carbon Sequestration Differentials among Key Forest Plantation Species in Kenya: Promising Opportunities for Sustainable Development Mechanism. <i>Agriculture, Forestry and Fisheries</i> , 7(3), 65.	mechanism. The study in conclusion reveals that soil carbon potentials in forest plantations that need to be considered in the development and implementation of afforestation and reforestation activities under Clean/Sustainable Development Mechanism (SDM). Equally, differences on soil carbon sequestered among species need to be considered when evaluating carbon stocks under certified and voluntary carbon offset markets in order to promote trees with high potential of carbon sequestration for sustainable development. This is important because, introduction of Reducing Emissions from Deforestation and forest Degradation (REDD+) and forest based Clean Development Mechanisms (CDM) have provided impetus to African governments in implementing afforestation and reforestation (AR) programmes to enhance carbon stock and improve resilience of biophysical and social systems against impacts of climate of change. This study therefore recommends setting up reliable baseline emissions scenario from the forest sector that considers the contribution of SOC as source and sink. In this manner, appropriate quantification/measurement, monitoring, reporting and verification will be institutionalized. This will ensure total valuation of the contribution of forest sector in climate change mitigation as reflected in various implementations options of Nationally Determined Contributions.
136	South Africa	Ofoegbu, C., Chirwa, P. W., Francis, J., & Babalola, F. D. (2018). Assessing local-level forest use and management capacity as a climate-change adaptation strategy in Vhembe district of South Africa. <i>Climate and Development</i> , 1-12.	This paper examines the local-level forest use and management capacity of rural households in Vhembe district of South Africa with respect to their adaptation strategy to climate change using the concept of livelihood resilience. Community-based forest management is a key climate change adaptation initiative in South Africa. It is aimed at enhancing the sustainability of rural household livelihoods and livelihood resilience against climate

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			variability and change. However, lack of capacity at local household level could negate the intended benefits of community-based participatory forest management initiatives. The results showed that households' capacity to participate in, and community leadership ability to mobilize people for participatory forest management was low. Nevertheless, the results revealed a widespread aspiration in the study communities to take part in forest management and development initiatives. This calls for the need for significant technical support for households and community leaders towards promoting participatory forest management as a way of ensuring efficiency and effectiveness of forest-based adaptation interventions.
137	Nigeria	Osasogie, D., & Omorogbe, I. (2018). Socioeconomic Determinants of Farmers Adaptation Strategies to Climate Change Hazards in Benue state, Nigeria. <i>Journal of Biodiversity, Bioprospecting and Development</i> , 5(169), 1-6.	The study examined the factors that influenced the quality of adaptation strategies of farmers to climate change hazards in Benue state Nigeria. Multi-stage and Probability Proportional to Size sampling technique were adopted to select 360 farmers across the three agro-ecological zones in the state. Data were collected using interview schedule. Descriptive and inferential statistics were used in data analysis. The results showed that the farmers adopted strategies with the mean vales as Mixed cropping system (4.41), Use of irrigation (1.60), Use of drought tolerant crops (2.60), Diversification (2.59), Use of improved variety (3.41), non-agricultural income (2.80), Increased use of fertilizer (2.61), Land ownership (43.60%), Membership of an association (2.21), livestock ownership (2.20), supply of pesticide (1.79). The result of logistic regression showed that the educational level of the farmers is a significant.
138	Senegal	Ouedraogo, I., Diouf, N. S., Ouédraogo, M., Ndiaye, O., & Zougmore, R. B. (2018). Closing the Gap between Climate Information	West Africa is a very vulnerable part of the world to the impacts of climate change due to a combination of exposure and low adaptive capacity. Climate change has induced an increase in rainfall variability which in turn has affected the availability of



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		Producers and Users: Assessment of Needs and Uptake in Senegal. <i>Climate</i> , 6(1), 13.	water resources, ecosystem services and agricultural production. To adapt to the increased aridity, farmers have used indigenous and modern coping strategies such as soil and water conservation techniques, the use of drought-tolerant crops and varieties, crop diversification, etc., and lately, climate information services (CIS). The latter, according to the discourses, has positively contributed to suitable decision-making in terms of farming, pastoral and fishing management systems. However, the scientific documentation of the engagement approaches, the uptake of the CIS and the ways the delivered information is being used, as well as feedback from the users, is lacking. Additionally, in most of the cases where CIS are introduced, the disconnect between the users and producers of the CIS seems to undercut large-scale uptake.
139	Ghana, Mali and Niger	Ouédraogo, M., Partey, S. T., Zougmore, R. B., Nyuor, A. B., Zakari, S., & Traoré, K. B. (2018). Uptake of Climate-Smart Agriculture in West Africa: What can we learn from climate-smart villages of Ghana, Mali and Niger?	This study focused in West Africa, the CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS) has been working since 2011 with various local partners to develop Climate-Smart villages (CSV) through participatory action research (PAR) at pilot sites in Burkina Faso, Ghana, Mali, Niger and Senegal. Various Climate Smart Agriculture (CSA) technologies and practices have been identified and tested in these CSVs. Some of these technologies and practices include: improved varieties of crops, soil and water conservation techniques (e.g. Zaï, half-moon, tie ridging), tree planting (agroforestry), farmer managed natural regeneration (FMNR), integrated soil fertility management techniques (micro-dosing, use of organic manure /compost, crop association), etc. In West Africa, adoption of agricultural innovations is thought to be constrained by several socioeconomic, institutional, infrastructural, biophysical and political factors. Therefore, from the perspective of scaling up proven CSA technologies and practices at the CSVs, it is crucial to understand the determinants of their adoption.

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140	Morocco	Ouraich, I., Dudu, H., Tyner, W. E., & Cakmak, E. H. (2018). Agriculture, trade, and climate change adaptation: a global CGE analysis for Morocco and Turkey. <i>The Journal of North African Studies</i> , 1-31.	The study looks at how agricultural trade liberalisation can be an adaptation strategy in the face of climate. It set out to answer this question in the context of Morocco and Turkey by taking into account the impact of climate change on agricultural international markets at the global level. The GTAP model, combined with a newly developed global database on climate change impacts on agricultural crop sectors by 2050 as captured by yield projections were used. Results suggest that the more trade is liberalised, the higher global welfare gains are. However, the gains are not large enough to offset the loss from climate change impacts on agricultural productivity globally. In Morocco, agricultural trade liberalisation, on average, induces additional welfare losses.
141	Africa	Owusu-Daaku, K. N., & Diko, S. K. (2018). Climate Change Mitigation and Adaptation Initiatives in Africa: The Case of the Climate and Development Knowledge Network “Working with Informality to Build Resilience in African Cities” Project. <i>Smart, Resilient and Transition Cities: Emerging Approaches and Tools for A Climate-Sensitive Urban Development</i> .	African cities are significantly characterized by informality and often have climate change adaptation as a greater focus than climate change mitigation. Thus, this chapter focus on how such cities meet their needs of sustainable urban development while focusing on implementing mitigation and adaptation strategies to adapt to climate change. The authors argue that the Climate and Development Knowledge Network “Working with informality to build resilience in African cities” project provides an illustrative example of a multipurpose strategy that employs resilience as a convening concept through which to address both climate mitigation and adaptation goals while promoting sustainable urban development.
142	Ghana	Partey, S. T., Avornto, F., Ouédraogo, M., & Zougmore, R. (2018). Candidate fodder species for goat production in Northern Ghana.	This article assessed the top fodder species selected by farmers and characterized them for the nutritional composition and intake by farmer preferred livestock. Livestock production employs over 60% of rural house-holds in the three northern regions of Ghana, making investment in this industry critical for alleviating poverty and enhancing food security. Among other factors, the Ministry of Food and Agriculture reports access to sustainable feed supply as

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			<p>one of the livestock industry's key constraints. As most livestock are kept on a free-range system, forage of fair nutritive value is normally scarce in the dry season due to recurrent droughts, continuous over-grazing and lack of range improvement interventions. Recent research has been directed to using tree leaves as fodder for livestock due to many advantages such as supply of good quality green fodder even in the dry season as well as high crude protein and minerals contents. In the Lawra and Jirapa Districts of the Upper West Region of Ghana, the CGIAR Research Program on Climate Change and Agriculture (CCAFS) established a Climate-Smart Village (CSV), an agriculture research for development site where various agricultural innovations are tested on their potential to deliver on any of the 3 pillars (productivity, adaptation and mitigation) of climate-smart agriculture (CSA). Among many CSA options at the CSV, the integration of multipurpose trees on farmlands is promoted as a CSA practice for improving fodder availability, increasing overall farm productivity, improving ecological resilience and providing farmers with important safety net opportunities against climate-related risks. In this study, we used a participatory approach to document and characterize fodder trees and shrubs that are prioritized by farmers for livestock production.</p>
143	Tanzania	<p>Pauline, N. M., &amp; Grab, S. (2018). Whose knowledge matters in climate change adaptation? Perceived and measured rainfall trends during the last half century in south-western Tanzania. <i>Singapore Journal of Tropical Geography</i>, 39(2), 266-280.</p>	<p>The study explores the extent to which local place-based knowledge is used and is relevant to understanding and appropriately responding to place-based climate variability and change (specifically rainfall) in an area of considerable rainfall variability in south-western Tanzania. Primary data were collected using focus group discussions and household questionnaire surveys, and secondary data obtained from government institutions. Various changes associated with the frequency, intensity and consistency of rainfall during the period 1960 to 2014</p>

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			were explored. Findings indicate that knowledge and perceptions associated with climate operate at a local level, and that these are not necessarily applicable to neighbouring regions. Smallholder farmers in the Great Ruaha River Sub-Basin rely on incremental adaptations of agricultural practices, in response to climatic stresses which have long-term implications. Incremental adaptations ought to be supplemented by more transformative changes of existing agricultural practices, such as using more climate-adapted crops and livestock. Moreover, caution is required when examining human perceptions and responses to climate variability and change at the site-specific scale, as such findings may not necessarily be applicable to broader regions in all cases.
144	Nigeria	Pelling, M., Leck, H., Pasquini, L., Ajibade, I., Osuteye, E., Parnell, S. & Boubacar, S. (2018). Africa's urban adaptation transition under a 1.5 climate. <i>Current Opinion in Environmental Sustainability</i> , 31, 10-15.	The paper outline observed pathways of transition in development and risk management relevant for a 1.5 °C warmer world; review assessments of the barriers and opportunities for integrating risk management into development; and use Lagos as an illustrative case-study of capacity for transition towards a more equitable and sustainable future. results show that understanding development as a core concern for risk management is constrained by existing donor priorities, fragmented city governance and data and monitoring gaps. Improvement is observed where risk data forecasting, and community networks collaborating with city authorities, are found. Drawing from insights across parallel policy domains, transitions theory emphasizes change being connected to innovation in relationships between governance actors. For risk reduction in sSA the emergence of multi-level governance arrangements, where strong networked civil society organisations act in concert with local and city authorities, provides a specific opportunity for risk reduction. These lessons reveal practical and achievable mechanisms through which reducing risk can also help meet SDG target

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145	Africa	Pettinotti, L., de Ayala, A., & Ojea, E. (2018). Benefits from Water Related Ecosystem Services in Africa and Climate Change. <i>Ecological Economics</i> , 149(August 2017), 294–305. <a href="https://doi.org/10.1016/j.ecolecon.2018.03.021">https://doi.org/10.1016/j.ecolecon.2018.03.021</a>	This study was conducted to understand some of the benefits that countries in sub Saharan Africa derived from water related ecosystem services. The paper highlighted the vulnerability and the adaptive capacity of the study countries and indicated their level of vulnerability depending on the several factors. The findings indicated that countries face synergies and trade-offs in terms of how valuable water related ecosystem services are and their potential vulnerability and adaptive capacity. The results indicated that higher ecosystem services availability is related to low vulnerability to climate change reinforcing the case for ecosystem based adaptation in Africa. The study highlighted that countries in Sub Saharan Africa with higher readiness to adapt are rather with low benefits from ecosystem services value and vice versa. However, certain gaps were identified for further research. They recommended that further research should be conducted to address the drivers of ecosystem values at the local scale by combining observed values with spatial information.
146	global	Prober, S. M., Doerr, V. A., Broadhurst, L. M., Williams, K. J., & Dickson, F. (2018). Shifting the conservation paradigm: a synthesis of options for renovating nature under climate change. <i>Ecological Monographs</i> .	To evaluate and progress the development of ecological renovation and related intervention options, the paper reviewed the literature and established a typology of options that have been proposed. The study explored how these options address emerging principles underpinning climate-adapted conservation goals, and whether the balance of approaches reflected in our typology are likely to be sufficient given expected rapid rates of climate change. Typology recognizes a matrix of 23 intervention option types arranged on the basis of underpinning ecological mechanisms ('ameliorate changing conditions' or 'build adaptive capacity') on one axis, and the nature of the tools used to manipulate them ('low-regrets' or 'climate-targeted') on the other. Despite a burgeoning literature since 2008, we found that the majority of effort has consistently focused on 'low-regrets' adaptation approaches that aim to build

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			adaptive capacity. This is in many ways desirable, but a paradigm shift enabling greater attention to ‘climate-targeted’ approaches is likely to be needed as climate change accelerates. When assessed against five emerging principles for setting nature conservation goals in a changing climate, only one option type could deliver to all five, and identified a conflict between ‘climate-targeted’ options and ‘wildness’ values that calls for deeper evaluation. To address these limitations and help shift the paradigm towards humans as ‘renovators’ rather than ‘restorers’ of a prior world, the study propose that ecological researchers contribute by (1) informing societal discourse towards adapting nature conservation goals to climate change, (2) adjusting and upscaling conservation planning to accommodate this suite of climate-adapted goals, and (3) reconceptualizing experimental approaches to increase empirical evidence and expedite innovation of tools to address change.
147	Mozambique	Quinn, C. F., Howard, J. F., Chen, C., Coffee, J. E., Quintela, C. E., Parker, B. A., & Smith, J. B. (2018). Adaptation and poverty reduction in Mozambique: an opportunity for developing countries to lead. <i>Climate Policy</i> , 18(2), 146-150.	Climate change disproportionately impacts the world’s poorest countries. A recent World Bank report highlighted that over 100 million people are at risk of falling into extreme poverty as a result of climate change. There is currently a lack of information about how to simultaneously address climate change and poverty. Climate change challenges provide an opportunity for those impacted most to come up with new and innovative technologies and solutions. This article uses an example from Mozambique where local and international partners are working side-by-side, to show how developing countries can simultaneously address climate change and poverty reduction using an ecosystem-based adaptation approach. Using ecosystem-based adaptation, a technique that uses the natural environment to help societies adapt to climate change, developing countries can lead the way to improve climate adaptation globally. This paradigm shift would

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			help developing countries become leaders in ecosystem-based adaptation and green infrastructure techniques and has implications for climate policy worldwide.
148	Egypt	Radwan, S. M. A., & Abdel-Aziz, R. A. (2018). Evaluation of microbial content of indoor air in hot arid climate. <i>International Journal of Environmental Science and Technology</i> , 1-10.	Air quality, both indoor and outdoor, is closely linked to a range of diseases, including respiratory, cardiovascular and vascular diseases. Therefore, indoor air pollution becomes a very important factor affecting the human health. The study was carried to evaluate the microbial content of indoor pollution in Al-Obour city in the hot arid climate of Greater Cairo, Egypt. The obtained results show that the number of different microorganisms in all dust samples was higher in the spring season as well as in the first months of the summer compared to winter or autumn seasons in different locations. It is worthy to state that the higher microbial content in falling dust samples was always associated with the high traffic effects from tested points. The higher microbial content was recorded in industrial district compared to other sites of living districts. In addition, microbial content was always higher in indoor samples compared to outdoor samples. Spore-forming bacteria were more common, followed by <i>Staphylococcus</i> , while the least value was reported by <i>Pseudomonas aeruginosa</i> . The predominant fungi genera were Ascospore followed by <i>Cladosporium</i> , <i>Aspergillus/Penicillium</i> . It should increase the application of phytoremediation technology for CO <sub>2</sub> mitigation. On the other hand, various factories should be transferred outside the scope of residential blocs, especially in cities with high population density.
149	Malawi	Ragasa, Catherine; Mazunda, John; and Kadzandira, John. (2018). The impact of agricultural extension services in the context of a heavily subsidized input system: The case of	This paper aims to test this hypothesis and to contribute to better understanding of strategies to revitalize the agricultural extension system in Malawi. Specifically, it examines the interplay between the fertilizer subsidy and access to extension services, and their impact on farm productivity and food security in Malawi. Results

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		Malawi. IFPRI Discussion Paper 1498. Washington, D.C.: International Food Policy Research Institute	show that the fertilizer subsidy has inconsistent impact on farm productivity and food security; at the same time, access to agricultural advice was consistently insignificant in explaining farm productivity and food security. Further analysis, however, shows that when access to extension services is unpacked to include indicators of usefulness and farmers' satisfaction, these indicators were statistically significant. Households who reported that they received very useful agricultural advice had greater productivity and greater food security than those who reported receiving advice that they considered not useful. This result implies the need to ensure the provision of relevant and useful agricultural advice to increase the likelihood of achieving agricultural development outcomes
150	South Africa	Rankoana, S. A. (2018). Community perceptions of climate change and initiatives for the conservation of endemic plants in Limpopo Province, South Africa. <i>Weather</i> .	This study was conducted to examine how climate change is perceived by a rural community in Limpopo Province, South Africa, and to investigate how such changes affect endemic plant species upon which community members depend for their livelihoods. The initiatives employed by community members to preserve endemic plants which have cultural value are also examined. The results of the study were obtained from semi-structured interviews with traditional health practitioners and other community members. It was found that participants' perceptions of the current state of climate change were linked to their observations of changes in temperature and rainfall patterns. Interviewees reported having experienced rising temperatures in the form of an increased frequency of excessively hot summers, as well as warmer winters. Rainfall was described as scarce, and rain episodes were characterised by more frequent thunderstorms. These observations have been confirmed in an independent analysis of meteorological observations by Ziervogel et al. (2014), who found that the mean annual temperature has increased by at



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			least 1.5-fold over the past five decades, and that extreme rainfall events have increased in frequency. The consequences of these changes in temperature and rainfall are significant and mostly negative, including poor plant growth, the withering of immature plants and the total loss of some useful species. However, members of this rural community have adopted indigenous conservation practices to limit the risk of indigenous plant loss and to maintain their cultural usage. Conservation practices adopted in the study area include the observance of cultural taboos, as well as other traditional customs, which restrict the harvesting and collection of useful plant materials.
151	Kenya	Reid, H. and Orindi, V. (2018) Ecosystem-based approaches to adaptation: Strengthening the evidence and informing policy - Research results from the supporting counties in Kenya to mainstream climate change in development and access climate finance project, Kenya, International Institute for Environment and Development (IIED)	The article recognizes that the global climate is changing rapidly, and as nations and the international and bilateral organisations and processes that support them plan how best to adapt to climate change, they need evidence on where to focus adaptation efforts and direct financial resources accordingly. It indicates how investments helped build local resilience to climate change while providing a number of co-benefits that promote wellbeing in Kenya. The authors showed clearly how the investments helped enhance the capacity of rangeland ecosystems to continue to produce services for local communities and withstand climate change impacts and other stressors. However, sustained financial inputs is required. The article will help climate change policymakers recognize the effectiveness of ecosystem-based adaptation (EbA) and where appropriate, integrate EbA principles into national and international climate adaptation policy and planning processes.
152	Tropics	Sabri, N. S. A., Zakaria, Z., Mohamad, S. E., Jaafar, A. B., & Hara, H. (2018). The use of soil cooling for growing temperate crops	Global climate changes have been reported to be affecting the already stressed agricultural ecosystem, especially temperate agriculture which is highly dependent on low soil temperature for optimum growth performance. The current trends of temperate

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		under tropical climate. <i>International Journal of Environmental Science and Technology</i> , 1-8.	agriculture include enclosed greenhouses or hydroponics techniques but shown to be inadequate to produce temperate crops under hot and humid weather of tropical climate. This urges the need for a more sustainable farming system which is soil cooling method as described in this study. The aim of the study is to confirm the usefulness of soil cooling for growing temperate crops under tropical climate.
153	Africa and other	Sakaue, S., Yamaura, K., & Washida, T. (2018). Economic Analyses of Regional Impacts with Adaptation to Climate Change for the Paris Agreement. <i>American Journal of Climate Change</i> , 7(03), 452.	This study measures regional impacts of adaptation to climate change for the Paris Agreement under the Shared Socio-Economic Pathways and Representative Concentration Pathways scenarios. We develop a global economic model with adaptation to climate change. Simulated results indicate that: 1) Asian and African adaptation costs exceed more than one percent of GDP in the year 2100 under the business as usual scenario; 2) adaptation costs under the 2.0°C target are higher in Asia and Africa than other regions; and 3) adaptation costs amount to one percent of GDP in Japan, EU and Latin America under the 1.5°C target scenario by adaptation.
154	Lake Victoria region	Sayer, C. A., Máiz-Tomé, L., & Darwall, W. R. T. (2018). Freshwater biodiversity in the Lake Victoria Basin: Guidance for species conservation, site protection, climate resilience and sustainable livelihoods.	In this document, guidelines were developed to provide new and updated information and insights that will motivate actions to help safeguard the high diversity of life within freshwaters of the Lake Victoria Basin in the face of climate change. The Lake Victoria Basin is internationally recognised for its high freshwater species diversity and endemism, which are of critical importance to local livelihoods and national economies within the basin. However, freshwater ecosystems within the region are highly threatened, with current safeguards proving inadequate and the focus of much past and ongoing conservation work in the region focussing on terrestrial ecosystems. Systematic conservation planning analysis was used to identify a critical sites network for freshwater biodiversity in the Lake Victoria Basin, based on the existing

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			protected area, KBA (including the newly delineated freshwater KBAs) and Ramsar site network. Guidelines were developed to provide new and updated information and insights that will motivate actions to help safeguard the high diversity of life within freshwaters of the Lake Victoria Basin. Key Biodiversity Areas (KBAs), which are sites contributing to the global persistence of biodiversity, were identified through this project for freshwater species, including a number of freshwater plants. Once these sites have been identified, management actions should be targeted at the catchment scale, following methods such as Integrated River Basin Management (IRBM) or Environmental Flows (E-Flows), as many threats to aquatic species can spread rapidly through a catchment due to the high levels of hydrological connectivity.
155	Africa	Schut, M., Kamanda, J., Gramzow, A., Dubois, T., Stoian, D., Andersson, J. A. & Brouwer, H. (2018). Innovation platforms in agricultural research for development: Ex-ante Appraisal of the Purposes and Conditions Under Which Innovation Platforms can Contribute to Agricultural Development Outcomes. <i>Experimental Agriculture</i> , 1-22.	Innovation platforms are fast becoming part of the mantra of agricultural research for development projects and programmes. Their basic tenet is that stakeholders depend on one another to achieve agricultural development outcomes, and hence need a space where they can learn, negotiate and coordinate to overcome challenges and capture opportunities through a facilitated innovation process. The study makes clear that not all constraints will require innovation platforms and, if there is a simpler and cheaper alternative, that should be considered first. Based on the review of critical design principles and plausible outcomes of innovation platforms, this study provides a decision support tool for research, development and funding agencies that can enhance more critical thinking about the purposes and conditions under which innovation platforms can contribute to achieving agricultural development outcomes.
156	Ghana	Sekyi-Annan, E., Tischbein, B., Diekkrüger, B., & Khamzina, A. (2018a). Performance evaluation of	This paper examined two (one small- and one medium-scale) irrigation schemes shared by multiple users in the Upper East region of Ghana, including the water reservoir, water conveyance

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		reservoir-based irrigation schemes in the Upper East region of Ghana. <i>Agricultural Water Management</i> , 202, 134-145.	and distribution network, cropping fields, and the management entity. The design of relevant adaptation strategies for water users in irrigation schemes in the drylands of Sub-Saharan Africa requires up-to-date information about the current performance of these schemes in view of rapid changes in climate and land use, population growth, and competing water demands. Previous assessments focused primarily on field-level crop irrigation; however, information on the performance of schemes as a whole and considering multiple water users remains scarce. Multi-level performance indicators with relevance to water delivery and utilization as well as to agricultural production during two consecutive dry seasons were used. Technical factors, such as underutilized reservoir storage capacity and deteriorated conditions of water delivery infrastructure, strongly undermined the performance. Overall system efficiency can be increased from 50% to 68% by reducing water conveyance network losses and by eliminating over-irrigation of fields. A holistic approach considering all competing water demands is needed for the performance evaluation of reservoir-based irrigation schemes in drylands.
157	Ghana	Sekyi-Annan, E., Tischbein, B., Diekkrüger, B., & Khamzina, A. (2018b). Year-Round Irrigation Schedule for a Tomato–Maize Rotation System in Reservoir-Based Irrigation Schemes in Ghana. <i>Water</i> , 10(5), 624.	This research established that, year-round irrigated crop production may be feasible, using water saved during dry season tomato cultivation for supplemental irrigation of maize in the rainy season. Improving irrigation management in semi-arid regions of Sub-Saharan Africa is crucial to respond to increasing variability in rainfall and overcome deficits in current irrigation schemes. In small-scale and medium-scale reservoir-based irrigation schemes in the Upper East region of Ghana, the study explored options for improving the traditional, dry season irrigation practices and assessed the potential for supplemental irrigation in the rainy season. The AquaCrop model was used to (i) assess current water

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			management in the typical tomato-maize rotational system; (ii) develop an improved irrigation schedule for dry season cultivation of tomato; and (iii) determine the requirement for supplemental irrigation of maize in the rainy season under different climate scenarios. The improved irrigation schedule for dry season tomato cultivation would result in a water saving of 130–1325 mm compared to traditional irrigation practices, accompanied by approximately a 4–14% increase in tomato yield. The supplemental irrigation of maize would require 107–126 mm of water in periods of low rainfall and frequent dry spells, and 88–105 mm in periods of high rainfall and rare dry spells.
158	Ethiopia	Shumetie, A., & Alemayehu, M. (2018). Effect of climate variability on crop income and indigenous adaptation strategies of households. <i>International Journal of Climate Change Strategies and Management</i> , 10 (4), pp. 580-595, <a href="https://doi.org/10.1108/IJCCSM-04-2016-0039">https://doi.org/10.1108/IJCCSM-04-2016-0039</a> .	This research examined the effect of climate variability on smallholders' crop income and the determinants of indigenous adaptation strategies in three districts (Mieso, Goba-koricha and Doba) of West Hararghe Zone of Ethiopia. These three districts are located in high-moisture-stress areas because of crop season rainfall variability. The study used ordinary least square (OLS) regression to examine the effect of climate variability. Given this, binary logit model was used to assess smallholders' adaptation behaviour. Finally, the study used multinomial logistic regression to identify determinants of smallholders' indigenous adaptation strategies. The OLS regression result shows that variability in rainfall during the cropping season has a significant and negative effect, and cropland and livestock level have a positive effect on farmers' crop income. The multinomial logistic regression result reveals that households adopt hybrid crops (maize and sorghum) and dry-sowing adaptation strategies if there is shortage during the cropping season. Variability in rainfall at the time of sowing and the growing are main factors in the area's crop production. Cropland increment has positive and significant effect on employing each adaptation strategy. The probability of adopting

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			techniques such as water harvesting, hybrid seeds and dry sowing significantly reduces if a household has a large livestock.
159	Sudan	Siddig, K., Stepanyan, D., Wiebelt, M., Zhu, T., & Grethe, H. (2018). <i>Climate change and agriculture in the Sudan: Impact pathways beyond changes in mean rainfall and temperature</i> (Vol. 13). Intl Food Policy Res Inst.	This study not only analyses the economy-wide impacts of climate change, but also consults national policy plans, strategies, and environmental assessments to identify interventions which may mitigate the effects. Climate forcing, water demand, and macro-socioeconomic trends were fed into a modelling suite that includes models for global hydrology, river basin management, water stress, and crop growth, all connected to the International Model for Policy Analysis of Agricultural Commodities and Trade (IMPACT). Several environmental changes have occurred in the Sudan in the past; several are ongoing; and others are projected to happen in the future. The Sudan has witnessed increases in temperature, floods, rainfall variability, and concurrent droughts. In a country where agriculture, which is mainly rain-fed, is a major contributor to gross domestic product, foreign exchange earnings, and livelihoods, these changes are especially important, requiring measurement and analysis of their impact. The outcomes of this part of the modelling suite are annual crop yields and global food prices under various climate change scenarios until 2050. The effects of such changes on production, consumption, macroeconomic indicators, and income distribution are assessed using a single country dynamic Computable General Equilibrium (CGE) model for the Sudan.
160	Africa	Silva, R. A., de Oliveira Afonso, A. A., Francescony, W., & da Silva, A. M. (2018). Technical assessment and decision making for the environmental recovery of waterways and their banks: a science-based protocol. <i>International Journal</i>	The poor management of aquatic ecosystems often results in environmental degradation, which requires actions for its recovery. A field protocol was elaborated to guide users (restorationists) to assess degraded areas and provide site- and situation-specific interventionist actions. The protocol was developed following the plant or animal taxonomy framework by Linnaeus, considering that the first character has two mutually

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		<i>of Environmental Science and Technology</i> , 1-8.	exclusive possibilities. It was elaborated in three parts: (1) a technical glossary, (2) a hierarchical key, and (3) a set of intervention actions that are indicated according to the case. Complementarily, ten degraded sites (lentic or lotic ecosystem), all located in continental regions of the Brazilian territory, and were evaluated using this key. The protocol was thought to be applied to continental and superficial water bodies. It starts separating the lotic and lentic ecosystems, and after each part goes for specific ways, all of them finishing in one or more interventionist action(s). The set of actions presented is composed of fourteen scenarios, seven of them to be implemented on-site, five to be implemented off-site, and two to be implemented on- and/or off-site. The intervention actions range from simply monitoring, to revegetation of the riparian zone, to activities that target the reoxygenation of hypolimnion. The study cases exemplify the use of the key and provide insight into the required adjustments for the implementation of intervention actions. The protocol and guidelines presented here will allow in a systematic manner, assess and compare the outcomes and efficiency of river restoration projects, locally, regionally and internationally.
161	Africa	Sterl, S., Liersch, S., Koch, H., van Lipzig, N. P., & Thiery, W. (2018). A new approach for assessing synergies of solar and wind power: implications for West Africa. <i>Environmental Research Letters</i> , 13(9), 094009.	In this study, an assessment of synergies of solar PV and wind power was carried out in West Africa (WA) down to hourly scales. Both of these sources play an important role in many West African countries' energy policy and projected power mixes. We demonstrate that, even though the average wind power potential is not very high across WA, being concentrated in the sparsely-populated north, wind could still be a useful resource in hybrid power systems in a much more extended area, close to centres of population and existing grids in the Soudano-Sahelian zone. This is because at hub heights of large wind turbines, winds blow stronger during night-time than daytime, especially during the dry

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			season. Wind power could thus provide diurnal stability to hybrid power systems with a substantial solar PV component and limited hydropower resources. This research can help inform policymakers in WA about their countries' RE potential and allay fears of a spatial mismatch between renewable resources on one hand, and population and existing grids on another. It can also help provide a framework for generating high-resolution input for energy models for WA (countries) to assist power systems planning. The methods and datasets used in our research are globally applicable and could hopefully contribute to enhancing climate services for sub-Saharan Africa, which are in short supply.
162	Africa	Sylla, M. B., Faye, A., Giorgi, F., Diedhiou, A., & Kunstmann, H. (2018). Projected Heat Stress Under 1.5° C and 2° C Global Warming Scenarios Creates Unprecedented Discomfort for Humans in West Africa. <i>Earth's Future</i> , 6(7), 1029-1044.	The study applied heat and discomfort indices to the multimodel ensemble mean of Coordinated Regional Climate Downscaling EXperiment-Africa regional climate model projections to investigate future changes in heat stress and the proportion of human population at risk under 1.5 °C and 2 °C global warming scenarios over West Africa. The results show that heat stress of category Extreme Caution is projected to extend spatially (up to 25%) over most of the Gulf of Guinea, Sahel, and Sahara Desert areas, with different regional coverage during the various seasons. It should be noted that not everyone reacts to the heat stress in the same way. The response differs from person to person depending on medical condition, level of fitness, body weight, age, and economic situation (National Institute for Occupational Safety and Health, 2016). In any case, protective measures need to be implemented to mitigate and to adapt to the projected heat stress, even under the Paris scenario targets. These can be either engineering and/or work practice controls designed to decrease heat stress. Engineering control measures consist of implementing cooling systems, air conditioning, using reflective or heat-absorbing shielding or barriers and reducing steam leaks, wetness,



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			and humidity. Work practice control measures include acclimatization, hydration, and decrease of metabolic demands of activities through regular and longer breaks or rescheduling of activities to cooler period of the day.
163	Nigeria	Takeshima, H. (2018). Distributional Effects of Agricultural Infrastructure in Developing Countries: Large Irrigation Dams and Drought Mitigation in Nigeria. <i>The Journal of Developing Areas</i> , 52(3), 1-13.	Despite the past investments and continued interests in public infrastructure like large irrigation dams, there has been limited evidence for their effects on household level consumptions and agricultural production, and how these effects are spatially distributed, depending on the locations of households in relations to the dams. Using a panel household survey, information of the locations of large irrigation dams, drainage basins, and drought index, the study assessed how large irrigation dams benefit households' consumptions and agricultural production, mitigate the effects of drought, and how these effects are distributed across drainage basins in Nigeria. Households were classified into dam-basins (basins that contain large irrigation dams), downstream basins (those located downstream of dams), and other non-dam basins. Multinomial inverse-probability weighting method, combined with difference-in-difference methods, construct appropriate counterfactual samples, through which the effects of large irrigation dams and their variations across drainage basins are identified. We find that large irrigation dams largely benefit the downstream basins, rather than dam-basins or other basins. Households in downstream basins, for whom suitable matches can be found in other types of basins, are less affected by the drought and enjoy relatively stable growth rates of real per capita income and food consumption, compared to what they would experience if they were in other types of basins. Such relative stability in incomes and food consumption in downstream basins, despite the droughts, are partly due to the stable food production that is enabled by the supply of irrigation waters from the dams in the

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			event of drought. These findings are robust against the effects of drought on water supply to the dams, proxy of state level political factors, and drought timing.
164	Ethiopia	Tessema, Y. A., Joerin, J., & Patt, A. (2018). Factors affecting smallholder farmers' adaptation to climate change through non-technological adjustments. <i>Environmental development</i> , 25, 33-42.	Smallholder farmers often employ inputs and practices they are traditionally well acquainted with to adapt to climate change. These types of adjustments, henceforth referred to as non-technological, are not only more feasible in the resource-constrained situation of smallholder farmers but also have a potential to significantly reduce the negative impact of climate change. However, a systematic study of these types of adaptations isolating them from technological ones is still lacking. While technological adaptations can benefit from the extensive literature on the adoption of agricultural technologies, non-technological adaptations still need further examination as one distinct group of adjustments. The study hypothesize that this group of adaptations strongly depend on farmers' accumulated experience rather than financial resources and level of schooling. To test this hypothesis, the study compared the determinants of changing planting date and changing crop type as non-technological adaptations, with the determinants of two technological adaptations: fertilizer use and rainwater harvesting. The hypothesis is supported by a positive relationship between farm experience and changing planting date, while fertilizer and rainwater harvesting showed a positive correlation with access to credit and level of schooling respectively. Study findings suggest that targeting non-technological farm-level adaptations through interventions focused on experience sharing can alone play an important role in reducing the impact of climate change in agriculture.
165	Nigeria	Ugochukwu, O. R. (2018). Challenges of Adaptation to Climate Change by Farmers Anambra State,	The study analysed the challenges farmers face in adapting to climate change in Anambra State, Nigeria. The study adopted the multistage sampling technique in selecting a cross section of two

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		Nigeria. <i>International Journal of Biosciences, Agriculture and Technology</i> , 9(1), 1-7.	hundred and forty farmers. Cross-sectional data collected with the aid of a structured questionnaire was collected was analysed using descriptive statistics. The result revealed that the average farm size, years spent in school, and age of the farmers was 0.85 ha, 11.35 years and 57.82 years respectively. The major adaptation measures of farmers to climate change were mixed cropping (100%), crop rotation (86.7%), applications of fertilizers (82.1%), use of sand bags (83.3%). There are fifteen major challenges to agricultural adaptation to climate change. The most common constraints include lack of finance, inadequate information and absence of early warning systems, and lack of capacity of extension service to build the resilience of farmers on climate change. The study suggests that farmers' access to credit should be increased to enhance their ability to respond to climate change
166	Nigeria	Umeh, O. J., & Nwachukwu, I. (2018). Behavioural Approaches of Rural Women Farmers to Mitigation and Adaptation Measures of Climate Change in Abia State, Nigeria. In <i>University Initiatives in Climate Change Mitigation and Adaptation</i> (pp. 111-129). Springer, Cham.	The purpose of this paper is to assess the behavioural approaches of rural women farmers to adaptation measures of climate change in Abia State, Nigeria. Specifically, this paper ascertains perceived effects of climate change in the study area and adaptation measures practised by the women in the study area and identifies farmers' behavioural responses to adaptation measures to climate change and factors that influence farmers' behavioural approach to adaptation measures to climate change in the study area. Results show that high sunshine intensity, increased drought, inadequate access to water and crop losses are major perceived changes to climate change, while change of planting time , enterprise diversification and crop rotation are major adaptation measures practised by the women in the study area. Seeking for information based on observed changes, reverting to indigenous or self-help methods and changing cropping style and time were identified as major behavioural responses of the women to climate change, while Tobit regression result indicated that age, household size,

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			level of education and income were major factors that influence the women farmers' behavioural approach to adaptation measures to climate change in the study area. Pearson's correlation analysis shows that there is a significant relationship between the women's behavioural responses to adaptation measures to climate change and adoption of adaptation measures by the women. It is therefore recommended among others that targeted and timely information be provided to the women through agricultural extension and mass media, the most effective and sustainable indigenous technologies used by the farming communities could be incubated with a view to upscale and out scale them in other to enhance adaptation to climate change and variability by the resource-poor farmers. ICT-driven virtual platform that provides weather advisory services for small-scale farmers should be made available through rural advisory services (RAS). This will help farmers handle climate risk situation promptly.
167	Africa	Vink, M., & Schouten, G. (2018). Foreign-Funded Adaptation to Climate Change in Africa: Mirroring Administrative Traditions or Traditions of Administrative Blueprinting? <i>Review of Policy Research</i> . .	Climate change impacts are most severe in developing countries with limited adaptive capacity. Accordingly, in Africa, climate change adaptation has become an issue of international funding and practice. As suggested in the Introduction to this special issue, administrative traditions could play a role in how adaptation plays out. This, however, raises questions about how foreign funding regimes coincide with recipients' administrative traditions, especially on the African continent where administrative traditions are often meagerly established. To address these questions, this article takes an explorative approach. From a literature review of African state governance and development aid approaches, colonial legacy is the most distinctive factor responsible for African administrative traditions. In addition, the article define three ways in which foreign aid programs have dealt with Africanadministration: (1) aligning with donor administration, (2)

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			blueprinting administration, and (3) ignoring administration. Using 34 African countries' National Adaptation Programmes of Action (NAPAs), the article analyzes how African governments actually frame adaptation as a governance challenge. The study contrast these frames with: (1) administrative traditions based on colonial legacy and (2) the ways in which development aid programs have historically dealt with recipient African administrations. These findings indicate that NAPAs only meagerly refer to the administrative tradition that could be expected based on colonial legacy, but extensively refer to blueprint ideas common among international donors, or ignore administration altogether. The implications for adaptation to climate change is discussed.
168	Mali	Waldman, K. B., & Richardson, R. B. (2018). Confronting Tradeoffs Between Agricultural Ecosystem Services and Adaptation to Climate Change in Mali. <i>Ecological Economics</i> , 150, 184-193.	Changing climatic conditions present new challenges for agricultural development in sub-Saharan Africa. Sorghum has proven to be an adaptable and resilient crop despite limited funding for crop development. Recent breeding efforts target hybrid and perennial technologies that may facilitate adaptation to climate change. Advantages of perennial crops over their annual counterparts include improved soil quality and water conservation and reduced inputs and labor requirements. In contrast, hybrid crops are often bred for improved grain yield and earlier maturation to avoid variable conditions. We use discrete choice experiments to model adoption of sorghum as a function of attributes that differ between these technologies and traditional varieties in Mali. Overall, the main perceived advantage of perennial crops is agricultural ecosystem services such as soil improvement, while adoption of hybrid crops is hampered by the inability to reuse seed. Women farmers are less concerned about higher labor requirements associated with perennial crops and the ability to reuse hybrids seeds than male farmers. Farmers prefer

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			traditional sorghum to perennial sorghum and are indifferent between traditional and hybrid sorghum. These findings have important policy implications for understanding tradeoffs that are central to farmer decision making when it comes to breeding technologies for climate adaptation.
169	Tanzania	Wangui, E. E., & Smucker, T. A. (2018). Gendered opportunities and constraints to scaling up: a case study of spontaneous adaptation in a pastoralist community in Mwanga District, Tanzania. <i>Climate and Development</i> , 10(4), 369-376.	This paper identifies the range of autonomous adaptive practices undertaken by a Maasai pastoralist community and examines existing opportunities and constraints to adaptation. Field data were collected at three complementary levels: community, household and individual. Results indicate that many adaptive practices used in this community have been modified from past risk management strategies drawn directly from pastoralists' experience in dry-land environments. However, not all pastoralists are able to engage in these adaptive practices. Gender and wealth inequality pose a challenge to scaling up as they influence access to land and water for irrigation as well as financial assets required to access adaptive practices that are available in the wider community. This research concludes that planned adaptation should take into consideration the full range of existing adaptive practices and inequality in access as this provides information on opportunities and barriers to scaling up.
170	Africa and others	Weiler, F., Klöck, C., & Dornan, M. (2018). Vulnerability, good governance, or donor interests? The allocation of aid for climate change adaptation. <i>World Development</i> , 104, 65-77.	This paper analyse data on bilateral adaptation aid from 2010 through 2015 to assess to what extent adaptation aid is provided in response to recipient need (that is, vulnerability to climate change impacts) as opposed to recipient merit (that is, good governance) and donors' interests. In contrast to previous research, we find that donors partly take into account vulnerability to climate change. Countries that are physically more exposed to climate change tend to be more likely to receive some adaptation aid and also receive more adaptation aid per capita, as do poorer countries, small island developing states and—to a lesser extent—least developed

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			countries. Countries with lower adaptive capacity, however, do not receive more adaptation aid; instead, donors reward well-governed countries with adaptation aid as well as use adaptation aid to promote their own economic interests. Furthermore, adaptation aid flows very closely follow general development aid flows. The extent to which adaptation aid is new and additional thus remains unclear
171	Kenya	Wetende, E., Olago, D., & Ogara, W. (2018). Perceptions of climate change variability and adaptation strategies on smallholder dairy farming systems: Insights from Siaya Sub-County of Western Kenya. <i>Environmental Development</i> , 27, 14-25.	This study aimed to bridge some of the existing gaps in adaptation strategies on Smallholder Dairy Farming Systems in Siaya Sub-County of Western Kenya. Survey results obtained from 100 households and Focused Group Discussions revealed that the climate of the study location was perceived to have changed, with droughts singled out as the most frequent. These perceptions were consistent with long-term climate data analysis which affirmed that all seasons, i.e. MAM, JJA, and DJF with the exception of SON showed longterm drying trends. Similarly, environmental temperature showed upward trends in both maximum and minimum temperatures that were perceived to be the cause of proliferation of noxious weeds previously associated with hotter areas of the Sub-County. Typologies of adaptation strategies used in the study showed that adaptation options were limited since these were viewed through a narrow lens of disease control by regular spraying and maize stovers as supplementary livestock feed during fodder dearth periods. This study recommends that besides awareness creation of adverse impacts of climate change and variability, facilitation for ease of access to technologies that ameliorate its adverse effects ought to be put in place. Additionally, empirical studies on consequences of biome range shifts on pasture and fodder productivity, and future possible impacts of diseases on Bos taurus breeds associated with climate change and variability should be undertaken

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172	Niger	Wouterse, F. (2018). Chapter 3. Empowerment, climate change adaptation and agricultural production: evidence from Niger. In <i>Fostering transformation and growth in Niger's agricultural sector</i> (pp. 347-366). Wageningen Academic Publishers.	The objectives of this study were to analyse the driving forces behind the decision of farm households in the Tahoua region of Niger to adapt to climate change by implementing zaï pits and to investigate the productive implications of this decision. We find that households that perceived increased drought were more likely to have employed zaï pits but that important human capital-related obstacles to adaptation exist. The results reveal that productivity is higher in households that had implemented zaï pits. Heterogeneity effects imply that yield gains would be particularly large for non-adopting households if they were to adopt. Our findings have considerable implications for policy measures aimed at enhancing and facilitating climate change adaption in rural Niger and elsewhere. They suggest that the perception of an increase in drought frequency can prompt households into adaptative action. Climate change adaptation can thus take place autonomously and rather than planning climate change adaptation strategies, programs and interventions could more usefully focus on alleviating barriers to adaptation.
173	Mozambique	Zacarias, D. A. (2018). Understanding community vulnerability to climate change and variability at a coastal municipality in southern Mozambique. <i>International Journal of Climate Change Strategies and Management</i> .	The study identified the need to improve the overall process of natural resources appropriation and utilization and the improvement of the governance capacity at the local targeting infrastructure, community structure and networks and capacity building that might enhance community livelihoods in changing scenarios
174	Sub-Saharan Africa	Zougmore, R. B., Partey, S. T., Ouédraogo, M., Torquebiau, E., & Campbell, B. M. (2018). Facing climate variability in sub-Saharan Africa: analysis of climate-smart agriculture opportunities to manage	This paper discussed the prospects for climate-smart agriculture technologies and enabling policies in dealing with climate change and variability at different sub-regional levels of sub-Saharan Africa to sustain farm productivity and livelihoods of agrarian communities. In literature, a lot of information is available about climate change perceptions and impacts in sub-Saharan Africa.



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		climate-related risks. <i>Cahiers Agricultures (TSI)</i> , 27(3), 1-9.	However, there is limited attention in the region to emerging initiatives, technologies and policies that are tailored to building the adaptive capacity of agricultural systems to climate change and variability. The review provides substantial information suggesting that without appropriate interventions, climate change and variability will affect agricultural yields, food security and add to the presently unacceptable levels of poverty in sub-Saharan Africa. Although some of them were already existing, the past decades have seen the development and promotion of climate-smart agriculture innovations such as the use of high yielding drought tolerant crop varieties, climate information services, agricultural insurance, agroforestry, water harvesting techniques, integrated soil fertility management practices, etc. In the context of climate change, this appears as a stepping up approach to sustainably improving farm productivity, rural livelihoods and adaptive capacity of farmers and production systems while contributing to mitigation.