

A compilation of good practices, tools and available data collection initiatives for the use of local, indigenous and traditional knowledge and practices for adaptation

The compilation was undertaken in April 2016 under the Nairobi work programme on impacts, vulnerability and adaptation to climate change (NWP), in collaboration with the Adaptation Committee and the Least Developed Countries Expert Group with inputs from NWP partner organizations and other relevant organizations.

Overview

Considering the [recommendations of the Adaptation Committee \(AC\)](#) in relation to the joint [meeting](#) on best practices and available tools for the use of indigenous and traditional knowledge and practices, best practices and needs of local and indigenous communities and the application of gender-sensitive approaches and tools for understanding and assessing impacts, vulnerability and adaptation to climate change, the Subsidiary Body for Scientific and Technological Advice (SBSTA), at its [forty-first session](#), requested the secretariat, under the guidance of the Chair of the SBSTA, in collaboration with the AC and the Least Developed Countries Expert Group, and with contributions from relevant partner organizations from the Nairobi work programme on impacts, vulnerability and adaptation to climate change (NWP), to make publicly available a compilation of good practices and tools and available data collection initiatives for the use of local, indigenous and traditional knowledge and practices for adaptation, for consideration at [SBSTA 44](#), building on existing knowledge-sharing platforms, including the database on best practices and available tools for the use of indigenous and traditional knowledge and practices for adaptation.

In terms of methodology, this compilation of good practices, tools and available data collection initiatives includes inputs from NWP partner organizations and expert organizations, research undertaken by the secretariat, and builds on the database of 18 best practices and available tools for the use of indigenous and traditional knowledge and practices for adaptation, which was generated under the NWP in 2013¹ and has been largely updated. Following a call for contributions of the secretariat, 16 of the 315 NWP partner organizations and 8 expert organizations provided 39 submissions based on detailed questionnaires. In addition, the compilation also includes 7 entries prepared through the research undertaken by the secretariat and verified by the corresponding lead authors or expert organizations. The table below displays the number of entries by organization. The entries are based on the information provided by NWP partner organizations and other relevant organizations, with only minor editorial amendments.

Parties, NWP partner organizations and other relevant expert organizations are encouraged to send additional inputs to the secretariat and update the existing entries, so as to further the knowledge support work on local, indigenous and traditional knowledge and practices for adaptation, which has been undertaken under the NWP since 2011.²

All the entries that are part of this compilation, as well as additional relevant inputs contributed by Parties or organizations on a rolling basis, are available and easily searchable on the adaptation knowledge portal.³ This online knowledge-sharing and learning tool will contribute to widely disseminating the wealth of information contained in this compilation, so that local, indigenous and traditional knowledge and practices are better taken into account in the design and implementation of adaptation plans and actions.

¹ The database is available at <unfccc.int/7769>.

² The overview of relevant activities under the NWP are available in a synopsis on Indigenous and traditional knowledge and practices for adaptation: overview, available tools, good practices and lessons learned, available at <<http://unfccc.int/6997.php>>.

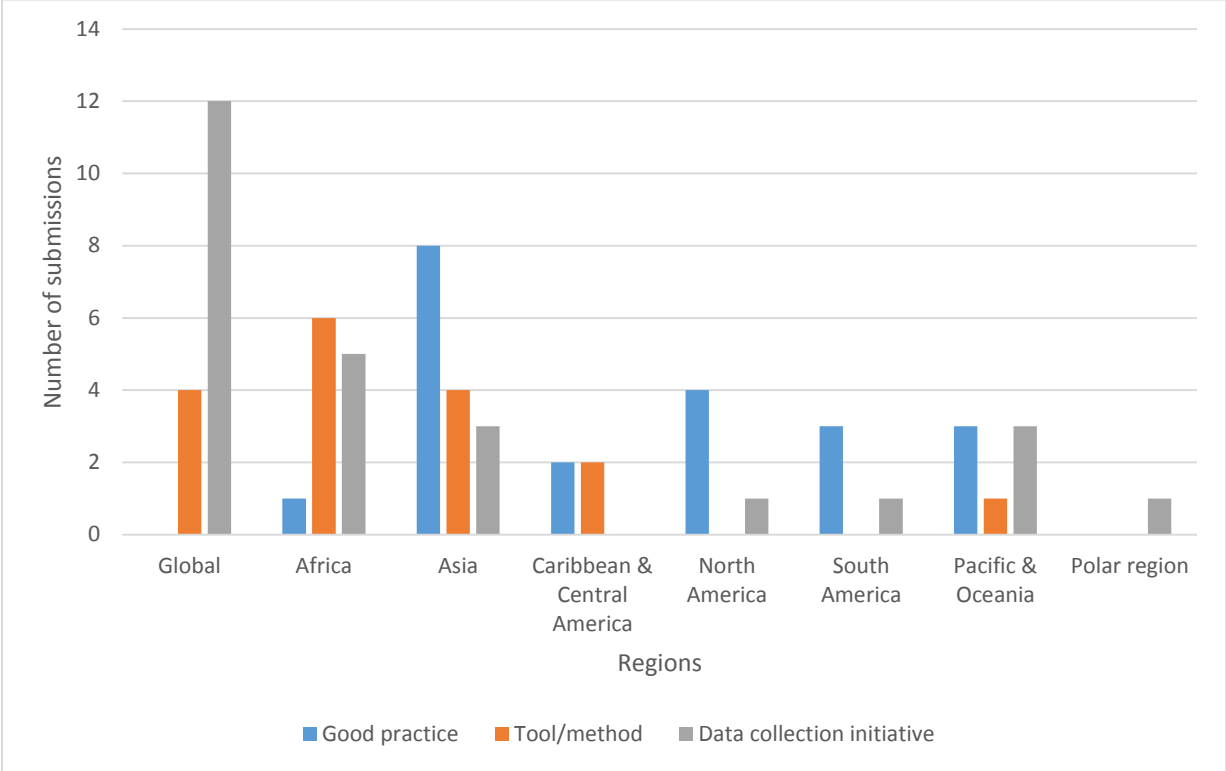
³ The portal also includes the entries contained in an older database of the NWP on local coping strategies developed, which, in many instances, address the use of local, indigenous and traditional knowledge and practices for adaptation. <<http://www4.unfccc.int/sites/NWP/Pages/Home.aspx>>

Number of entries by organization

Organization	Number of entries
Active Remedy Ltd.	1
Adaptation at Scale in Semi-Arid Regions (ASSAR)	1
Asia-Pacific Network for Global Change Research (APN-GCR)	4
Amazon Environmental Research Institute (IPAM)	1
BBC Media Action	1
Caribbean Natural Resources Institute (CANARI)	2
CARE International	3
Center for International Forestry Research (CIFOR)	1
Center for People and Forests (RECOFTC)	1
Convention on Biological Diversity (CBD)	1
Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	2
Food and Agriculture Organization of the United Nations (FAO)	10
Global Fire Monitoring Center (GFMC)	1
International Centre for Integrated Mountain Development (ICIMOD)	1
International Fund for Agricultural Development (IFAD)	2
Instituto Nacional de Ecología y Cambio Climático (INECC)	3
Indigenous Peoples of Africa Coordinating Committee (IPACC)	3
Isuma Distribution International Ltd (Isuma TV)	1
Jimma University	1
Korea Adaptation Center for Climate Change (KACCC)	3
Makerere University	2
McGill University	2
Rockies Institute	2
Rural Development Institute (INDER)	1
Sri Lankan Youth Climate Action Program	1
Secretariat of the Pacific Regional Environment Program (SPREP)	3
GeoData Institute, University of Southampton	1
United Nations University (UNU)	4
United Nations Educational, Scientific and Cultural Organization (UNESCO)	1
World Overview of Conservation Approaches and Technologies (WOCAT)	1
World Wildlife Fund (WWF)	1

The entries contained in this compilation are organized in three categories: good practices; tools and methods; and data collection initiatives. The compilation gathers examples from different regions and sectors. The figure below shows the distribution of entries by category and by region.

Number of entries by category and by region



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I. Good practices

A. Africa

1. **KENYA** | Joto Afrika: Climate communications for adaptation – agro-meteorology advice

CARE International

Sectors	Adaptation element	Climate hazard
Agriculture, crops, indigenous and traditional knowledge	Adaptation planning and practices, climate scenarios, communication and outreach/awareness, knowledge management, stakeholder involvement	Shift of seasons
Description of the activities	<p>Communicating climate information in ways that local farmers and pastoralists can understand and apply is a critical resource to support effective adaptation to climate change. This publication profiles a range of programmes in Ghana, Kenya and Niger that are developing approaches to incorporating communication of climate information into their work with vulnerable farmers and pastoralists. Using a range of innovative communication mechanisms, they demonstrate how climate information has reached and supported communities to enable them to make decisions about dealing with climate risks and vulnerabilities, such as diversifying livelihoods and protecting their assets. Effective communication of climate information allows community members to incorporate such information in their existing traditional and local knowledge and develop appropriate adaptation strategies.</p> <p>In Niger, where seasonal rainfall is minimal and erratic, agro-pastoralists determine planting dates based on rainfall records acquired from their own community rain gauges.</p> <p>In Kenya and Ghana, locally relevant seasonal climate advisories have been developed collectively among communities, service providers and meteorological departments and disseminated widely. Seasonal and, in some cases, short-range, forecasts prepared by advisories are disseminated to farmers and livestock keepers in Kenya and Ghana through community-held seminars, chiefs’ meetings, radios and mobile telephones, churches and mosques, governmental and non-governmental extension services, and local early warning systems.</p>	

Outcomes	These experiences clearly demonstrate how access to and use of weather and climate forecasts can empower vulnerable communities to make their own calculated and climate-informed decisions regarding risk management choices and forward-looking strategies. Climate communication and information services are thus an essential component for enabling adaptive capacity and effective adaptation.
Good practice and lessons learned	<p>The participatory process involving farmers, extension workers, local community leaders and project coordinators allows traditional knowledge to be taken into account.</p> <p>The sequencing of this participatory process can be seen as a good practice:</p> <ul style="list-style-type: none"> ▪ Previous seasonal forecasts are evaluated. ▪ Scientific and traditional forecasts are then shared and harmonized. ▪ Advisories developed by the agro-meteorologist from IGAD Climate Predictions and Applications Center (ICPAC) are then presented and discussed based on the performance of the previous season's forecast, the current forecast and technical advice from agricultural and livestock extension workers. ▪ Final climate-based agro-advisories provide advice on seasonal farming activities, as agreed upon by participants, with emphasis on gender perspectives. ▪ The content of the advisories includes: planting time; good farm management practices; choice of inorganic fertilizers and use of farm manure; suitable crop types and varieties to be planted; weeding regimes; available seed suppliers; prevention and control measures for crop pests and diseases; pasture management and measures that community members could use to exploit the forecasted seasonal climate; and other agronomic practices.
Implementing partners	Christian Aid; the Kenya Meteorological Department (KMD) and the ICPAC, all of which are located in Kenya. Learning in relation to climate science and how to use such information practically has been enhanced by the provision of support from the Humanitarian Futures Programme, the United Kingdom Met Office, the World Meteorological Organization and associated research.
Date of submission	2013
Further information	<ul style="list-style-type: none"> ▪ CARE International. 2013. <i>Climate Communication for Adaptation. Joto Afrika</i>. Issue 12. Available at

- http://www.careclimatechange.org/files/JotoAfrika12_FINAL.pdf
- CARE International website: <http://www.care-international.org/>

B. Asia

1. ASIA | Community-based forestry and livelihoods in the context of climate change adaptation

Asia-Pacific Network for Global Change Research

Sectors	Adaptation element	Climate hazard
Biodiversity, crops, farm systems, ecosystem-based adaptation, food security, water	Adaptation planning and practices, communication and outreach/awareness; education and training; institutional arrangements; socioeconomic data and information	Drought, land and forest degradation, loss of biodiversity
Description of the activities	<p>This project was undertaken in the rural agrarian villages dependent on the forest resources of Bangladesh, Nepal, Thailand and Viet Nam, with a view to understanding and documenting climate change trends, as well as the adaptation measures to cope with the adverse situations that might arise as a result of climate change in the near future. The study was conducted through an intensive survey of households in each country and analyses of a long-term (over a period of nearly 30 years) meteorological database.</p> <p>The results showed that resources, particularly natural resources and agriculture, have either been reduced or have experienced pattern changes. The increasing climate change trends, along with anthropogenic activities, are the main reasons for the decreasing natural resources and livelihood options of the pilot communities. The results of the analysis of the long-term climatic database, particularly the changing trend in temperature and rainfall, have been strongly supported by the perceptions and opinions of the communities. In the face of challenges related to climate change and livelihoods, communities have strongly suggested undertaking some new adaptation measures, such as construction of water reservoirs, strengthening of afforestation programmes through community approaches, development of strong institutional mechanisms, introduction of pest- and disease-resistant varieties, supply of high-quality planting materials, etc., for the conservation of resources and better livelihoods, which need strong public and private support.</p>	
Outcomes	<p>The major outputs of the project were:</p> <ol style="list-style-type: none">1. The documented traditional knowledge of rural people in relation to climate change adaptation, which will contribute to policy development based on	

the context of individual project partner countries.

2. A training manual on climate change and adaptation (in Nepali) has been published for climate change trainers to help them train rural villagers, community forest users, farmers, teachers and students.
3. A special edition of the peer-reviewed *Journal of Forestry and Livelihood* on climate change adaptation has been published, including four papers from current APN research and another four papers from different scientists.

**Good
practice and
lessons
learned**

The consequences of climate change have caused an increase in extreme climatic events, such as floods drought, erratic rainfall and cyclones, among others. These have further negative implications on water availability, agricultural production and food security in the context of project research sites. Agrarian households that depend on the agriculture sector for their livelihoods are vulnerable to the impacts of climate change. To adapt to extreme events, communities adopted measures to manage resources, harness opportunities provided by technology and practices, and traditional and indigenous knowledge. The role of governments and external agencies has been found to be vital for empowering local people and strengthening local institutions in the process of adapting to climate change.

Several of the key findings from and outcomes of some of the individual case studies are highlighted below:

BANGLADESH

In Bangladesh, the study revealed that the increasing climate change trends, particularly temperature and erratic rainfall patterns, and anthropogenic activities (e.g. deforestation) could be the reasons for the decreasing natural resources, particularly forest. The community has adopted several adaptation measures, such as changing the planting time and using new technologies. However, the community strongly opined that the authorities concerned should take appropriate measures, such as construction of water reservoirs, afforestation through community approaches/partnerships, and development of pest- and disease-resistant varieties. These measures might have considerable positive benefits in efforts to combat the impacts of climate change and create better livelihood opportunities.

NEPAL

In Nepal, rural communities are highly dependent on forest products for their livelihood. The effect of climate change can be seen in the form of reduced forest product availability for harvesting. Institutions play a vital role in climate change adaptation and enhance the capacity of local people to cope with extreme events. The success of all adaptation practices depends on the efficiency of the support provided by institutions. Even governments have recognized the role of local communities in designing and implementing

adaptation-based approaches.

THAILAND

In Thailand, it has been realized that the climate is changing and that this has had an impact on the cropping system, water availability and traditional forest harvesting patterns. The direct impacts from the changing climate on crop yields and natural resources have not yet been fully noticed, but it has been reported that such impacts are difficult to distinguish from effects due to deforestation and land-use change. Local wisdom and traditional knowledge could be useful to help respond to environmental changes. However, this knowledge has been lost by the introduction of modern technology, in some cases. Local research to compile and conserve traditional wisdom is critical for the community and province to strengthen their capacity to adapt and respond to future environmental impacts, including climate change.

VIET NAM

In Viet Nam, in order to adapt to climate change, local people have been changing their agricultural activities, the number of livestock reared, cultivation techniques, crop composition, vaccinations, pest- and disease-prevention measures and applying new techniques. Most of the climate change adaptation activities of local people are developed from their own experiences or by learning from their individual practices. There were no programmes from the government/local authorities to help local people adapt to climate change. The focus of the Government is in the coastal areas, where the impacts of climate change are much more serious.

Implementing partners

Dr. Naya Sharma Paudel: ForestAction Nepal

Date of submission

April 6, 2016

Further information

- Further information on the special edition of the peer-reviewed *Journal of Forestry and Livelihood* on climate change adaptation, mentioned in the outcomes of the project, is available at www.forestation.org
- “Community Based Forestry and Livelihoods in the Context of Climate Change Adaptation”. APN E-Lib. April 6, 2016. See <http://www.apn-gcr.org/resources/items/show/1585> for more detailed information on the outputs of the project
- Paudel NS, Khatri DB, Ojha H, Karki R and Gurung N. 2013. Integrating climate change adaptation with local development: exploring institutional options. *Journal of Forestry and Livelihood*. 11(1): pp.1–13. Available at <http://forestation.org/publications/view/136>
- APN-GCR website: www.apn-gcr.org

2. **CHINA** | Agrodiversity as a tool for adaptation: the case of the Hani rice terraces
 United Nations University Institute for Sustainability and Peace (UNU-ISP)

Sectors	Adaptation element	Climate hazard
Agriculture, biodiversity, disaster risk reduction, ecosystems, water	Adaptation planning and practices	Drought

Description of the activities

Agrodiversity refers to the many ways in which farmers use the natural diversity of the environment for livelihoods, including their choice of crops and animals, but also their management of land, water and biota as a whole. It broadens the concept of agricultural biodiversity from meaning simply genetic resources to meaning the landscape-level biodiversity and the diversity of local social organizations and technologies that support biodiversity and reduce agricultural and ecological risks. Agrodiversity integrates biological, technological and organizational elements that offer resilience and flexibility to rural communities in the face of climate change.

The case of the Hani rice terraces illustrates well that agrodiversity is an important tool in adaptation. The Hani rice terrace agriculture is extensively practised by the Hani ethnic minority and other ethnic peoples in the Ailao Mountain to the south of the Red River in Yunnan Province, China. The monsoon climate in Yunnan Province consists of the wet season from June to October and the dry season from November to May. Drought is a major risk for agriculture. The recent drought from 2009 to 2012 resulted in a huge loss of agricultural production in many parts of Yunnan Province. Nevertheless, the Hani people have long embraced agrodiversity as a means of dealing with the risk of drought and their agriculture was therefore not greatly affected by the recent drought.

Outcomes

The recent inclusion of the Hani rice terraces in the United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage List will further raise awareness not only of the Hani rice terraces' cultural landscape, but also of the associated agrodiversity.

Currently, UNU-ISP is carrying out an APN-funded research project on developing ecosystem-based adaptation strategies for enhancing the resilience of rice terrace farming systems against climate change, with the Hani rice terraces as an important case to build on traditional wisdom for climate change adaptation.

Good practice and lessons learned

The Hani people understand the importance of forests in water regulation and have adopted a variety of forest management methods. The Hani proverb says that “Forests are the lifeblood of water; water is the lifeblood of rice terraces, and rice terraces are the lifeblood of the Hani people”. Extensive natural forests are protected on the mountaintop as water sources. Forests intercept rainfall and enhance soil water storage and groundwater recharge during the wet season in summer. During the dry season, with little rainfall in winter, forests help harvest dew from the heavy fog.

The Hani people have bred hundreds of rice varieties to suit the varied locations, with different regimes related to elevation, water and soil conditions in the Ailao Mountains developed over centuries. When the water supply is not sufficient, local famers switch from rice cultivation to dry farming (e.g. maize, beans and vegetables).

With regard to the technological element, local communities have constructed thousands of canals and ditches to divert water from water sources to the rice terraces. The communities establish the villages below the water source forests and build rice terraces below the villages so that the water used in the villages can be re-used in the rice terraces. The millions of rice terraces situated below the villages, as well as the numerous fish ponds in the water source forests, conserve water, recharge groundwater and prevent erosion. Unlike other communities, the Hani people flood their rice terraces year-round to minimize the risk of water shortage.

Lastly, the Hani communities have established an institution for water management and distribution. Each village has a forester to look after the water source forests and each canal has a manager to maintain it. The water is distributed with a fee (often in the form of rice) by a water-dividing stone or piece of wood placed in the canal. Small openings of different sizes are made in the stone or wood. The size of the opening determines the amount of the fee charged to the area of rice terraces below the opening.

Implementing partners

Yunnan Normal University and the local government in the Honghe Prefecture, Yunnan Province, China

Date of submission

2013

Further information

There are other examples of rice terraces, similar to the Hani rice terraces, such as the Ifugao rice terraces in the Philippines, that have the same function. See:

- http://www.apn-gcr.org/resources/items/show/1594#.Ue9_YCSmqUk
- <http://ourworld.unu.edu/en/enhancing-indigenous-knowledge-in-rice-terraces/>

Other relevant papers:

- Brookfield et al (eds.). 2002. *Cultivating Biodiversity: the Understanding, Analysis and Use of Agrodiversity*. ITDG Publishing
- Jiao Y, Li X, Liang L, Takeuchi K, Okuro T et al. 2012. Indigenous ecological knowledge and natural resource management in the cultural landscape of China's Hani Terraces. *Ecological Research*. 27: pp.247–263

UNU- ISP website: <http://isp.unu.edu/>

3. **INDONESIA, THE PHILIPPINES, TIMOR-LESTE** | Local and indigenous knowledge for community resilience: hydrometeorological disaster risk reduction and climate change adaptation in coastal and small island communities
[Asia-Pacific Network for Global Change Research \(APN-GCR\)](#)

Sectors	Adaptation element	Climate hazard
Coastal areas/zones, community-based adaptation	Adaptation planning and practices, education and training, stakeholder involvement	Storm surges, sea level rise, tropical cyclones/typhoons
Description of the activities	<p>The goal of the project was to increase the resilience of coastal and small island communities in Indonesia and the Philippines against hydrometeorological hazards and climate change impacts by building the capacities of scientists and non-scientists to integrate local and indigenous knowledge with scientific knowledge.</p> <p>The project took place in the second phase of a larger project funded by the Japanese Government and implemented in Indonesia, the Philippines and Timor-Leste. In the APN project, the focus was on developing information, education and communication materials in local languages targeting coastal and small island communities in Indonesia and the Philippines that integrate scientific knowledge with local and indigenous knowledge. It is expected that this will in turn result in the development of policies, community action plans and climate change adaptation measures that incorporate local and indigenous knowledge. Through this project, scientists and non-scientists in all countries involved – Indonesia and the Philippines, as well as Japan and Timor-Leste – learned to work with local and indigenous knowledge related to climate change and hydrometeorological hazards and climate change adaptation, and jointly developed a tool to integrate local and indigenous knowledge with scientific knowledge. The project concluded with a regional workshop, during which the materials, experiences and lessons learned were shared.</p>	
Outcomes	<ul style="list-style-type: none"> ▪ Documentation of local and indigenous knowledge and practices that help communities to predict, mitigate and adapt to hazards. ▪ Production of tools for integrating local and indigenous knowledge with science. ▪ Publication of information, education and communication materials that integrate local and indigenous knowledge and science on hydrometeorological hazard risk reduction and climate change impacts. 	

**Good
practice and
lessons
learned**

THE PHILIPPINES

A number of lessons and action points can be drawn from the project conducted in the Philippines. The project:

1. Reminds us of the risks faced by and vulnerabilities of the Philippines and its coastal and small island communities; it is located in a region that is most affected by climate change impacts and hydrometeorological hazards.
2. Highlights the rich local and indigenous knowledge used for disaster mitigation, preparedness, response and recovery in communities.
3. Affirms the significance of legislative mandates that support institutionalization and measures to sustain disaster risk reduction and climate change adaptation initiatives.
4. Highlights that it is possible and feasible to incorporate local and indigenous knowledge in education and training, both in formal and non-formal settings.
5. Illustrates how local and indigenous knowledge can be mainstreamed and integrated into various policies, functions, roles, programmes and services of local government units and national agencies to build the resilience of communities.

INDONESIA

Specific strategies at different levels are needed to promote the use of local and indigenous knowledge for disaster risk reduction and climate change adaptation in Indonesia in order to ensure that this will accelerate the process of increasing the resilience of coastal and small island communities without adding further complexity to the country's disaster risk reduction and climate change adaptation efforts. In this regard, the following points are recommended:

1. Take into consideration the new disaster management structure in Indonesia that was introduced in 2007, in order to fully understand the different tasks and responsibilities mandated to different government entities responsible for disaster risk reduction, and to target each organization at the appropriate level.
2. Fully consult and discuss interventions with related official agencies, in order to confirm that LINK promotion activities (see relevant literature) are relevant to the existing disaster management road maps and to prevent further complexities in these efforts.
3. Include local communities, especially traditional and religious leaders, in local and indigenous knowledge promotion in order to accelerate the process of mainstreaming, disseminating and teaching local and indigenous knowledge for disaster risk reduction and climate change adaptation in coastal and small island communities, helping to ensure that the process is

locally appropriate.

TIMOR-LESTE

To promote the use of local and indigenous knowledge for disaster risk reduction and climate change adaptation in Timor-Leste, it is important to note that:

1. Timor-Leste is a country where customary laws (Tara Bandu) to protect and conserve natural resources and maintain social relationships are strongly supported by the national government; thus, local and indigenous knowledge is well-entrenched and practised daily in many parts of the country.
2. At the same time, government entities at the national and district levels are still in the process of building their capacity to formulate programmes, plans and activities to deal with multiple hazards in addition to climate-related hazards.
3. Actions at this point would be best directed at supporting the formation of disaster risk reduction entities at different levels and developing the capacities of these, as well as government entities and national and local non-governmental organizations (NGOs) that play a central role in disaster risk reduction and climate change adaptation, in order to include local and indigenous knowledge in their disaster risk reduction plans.
4. Local and indigenous knowledge can also be incorporated into broader planning processes, for example during the revision of the National Disaster Risk Management Policy.
5. It is equally as important to secure the strong support of development partners and international NGOs to promote the recognition of local and indigenous knowledge (and its identification, documentation, validation and integration) as an important resource in development programmes.

Implementing partners Japan Funds-In-Trust, UNESCO

Date of submission April 5, 2016

Further information

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- APN-GRC website: <http://www.apn-gcr.org/>

4. **NEPAL** | Climate-change adaptation practices of smallholder farmers in Himalaya: case from Koshi Basin

International Centre for Integrated Mountain Development (ICIMOD)

Sectors	Adaptation element	Climate hazard
Community- and ecosystem-based adaptation, agriculture	Vulnerability assessment, adaptation planning and practices, capacity-building, financial support, knowledge management, socioeconomic data information	Drought, increasing temperatures, land and forest degradation, shift of seasons
Description of the activities	<p>The climate-smart village concept was introduced with an objective to understand local and indigenous practices in order to enhance the adaptive capacity of smallholder farmers, while increasing both market access and the leadership of women at the local level.</p> <p>The farmers are introduced to a variety of techniques to improve their agricultural production and livelihoods. They learn to produce and use a biofertilizer and biopesticide (referred to locally as jholmol), which not only provides nutrients but is also effective in disease and pest control and supports improved plant health. To address water scarcity, the farmers built small plastic ponds that collect wastewater and rainwater; the Village Development Committees (VDCs) are also working on the conservation of water resources. They are testing different crops for variable rainfall patterns, climatic conditions, and locations. Villagers equip their households with biogas plants and crop residue trial plots, and they provide one day per month for community work in addition to keeping the village clean and collecting waste on a regular basis. Lastly, the communities involved received information and support for risk mitigation through insurance and other measures, and accessed an SMS notification system that informs them on weather and market prices, as well as technical issues such as pest management, land preparation, irrigation, weeding, fertilizers and harvesting. Three local schools have also been equipped with meteorological stations, and climate-smart village communities have direct access to government advisory services at district level.</p>	
Outcomes	<p>Soil fertility improved owing to the jholmol technology – produced by the farmers themselves – which reduces the use of chemical fertilizers and pesticides. Other techniques, such as crop rotation, mixed cropping and nitrogen fixation by intercropping, are also playing a part in improving soil fertility. Water stress diminished because harvesting methods and the use of wastewater for kitchen gardens are making water resources more reliable. In addition, the wide adoption of mulching, by improving soil moisture, reduces</p>	

the needs for watering. As a consequence of greater water availability and soil fertility, agricultural production is increasing sustainably.

Energy requirements are reduced by crop residue trials and family-sized biogas plants, which also provide the slurry as biofertilizer. The replacement of chemical fertilizers and pesticides also has a beneficial impact on the health of both farmers and consumers. Furthermore, thanks to the critical information made available to them, farmers are enabled to better manage their resources and assets.

In short, the resilience of households was enhanced: many are now insured, reducing their future risks and securing vulnerable assets; and, owing to various technologies, households are relieved from the respective costs of commercial fertilizers and pesticides, and extra energy needs. Lastly, by raising the awareness and understanding of the community on climate change and its impacts on local agriculture and ecosystems, the project ensures the sustainability of the outreach and better environmental management in the future.

Good practice and lessons learned

This practice is fully owned and led by local people and is positively supported by institutions at various levels: district development committees, agro-vets, village development committees, district agricultural development offices, the Alternative Energy Promotion Centre and insurance companies. This rich collaboration broadens ownership of the climate-smart village model and helps to ensure the sustainability of the project's impacts.

Key lessons learned include, but are not limited to:

- Ownership of local government is crucial for successful replication.
- There is a need to streamline traditional practices in district-based adaptation plans and programmes.
- Cross-sectoral planning is necessary to avoid duplication, and also to ensure ownership from various departments at the district and local levels.

Implementing partners

The Centre for Environmental and Agricultural Policy Research, Extension and Development (CEAPRED) is responsible for overall implementation of activities in the field, including the provision of technical support to farmer groups; the District Agriculture Development Office mainly provides technical inputs; the District Development Committee (DDC) supports planning; and the local government is primarily responsible for guiding overall planning and monitoring of activities.

Date of submission

April 18, 2016

**Further
information**

ICIMOD website: www.icimod.org

5. **NEPAL** | Indigenous methods of seed storage in Nepal
 Food and Agriculture Organization of the United Nations (FAO)

Sectors	Adaptation element	Climate hazard
Agriculture, community-based adaptation, food security	Adaptation planning and practices, knowledge management	Drought, extreme cold, extreme heat, floods, increasing temperatures, shift of seasons
Description of the activities	The local community-based organizations (CBOs), farmer cooperatives and farmer groups at the local level practice traditional methods of seed storage. The project of the Food and Agriculture Organization of the United Nations is focused on identifying and implementing such methods at the community level for further evaluation and promotion. The aim of the project is also to bring locally relevant improvements to these traditional practices in order to meet the emerging challenges, such as increased fluctuation of weather and climatic conditions.	

Background

The traditional seed storage practices include: heap and kunio storage of maize, mat bin or Bhakari, mud bins (Deri or Kothi), earthen clay pots (Ghyampo), metal pots (Gagro), urmi or suli method (Maize), plastic bags/containers, and jute bags. The local materials used in seed storage are neem, bojo, timur, marich or titepati leaves/powders for controlling stored grain pests; sun drying of seeds and cleaning through winnowing; rinsing containers with oil/kerosene; and covering the mouth of seed containers with ash and chaitaune (e.g. farmers of Kapilbastu). The improved seed storage structures/practices include: improved metal bins; split bamboo bins (Chitrako Bhakari); pusa bin (an improvement in mud bins); sealed storage containers; super grain bags; non-conditioned ventilated godowns; potato seed storage under diffused light; cellar stores for storing fruit; and zero-energy storage of vegetables/potatoes.

Sun drying is practised by farmers for drying seeds before storing. Farmers dry seeds between about four and six times depending on the moisture content. Some farmers use storage containers cleaned with oil or kerosene, while others treat the seeds with indigenous plant materials such as ash, neem, titepati, marich, and bojo powders to protect seeds from storage pests.

The CBOs, cooperatives and farmers’ groups often follow traditional methods of seed storage. These organized groups face multiple difficulties, however. They possess non-conditioned store houses to store large quantities of seeds on a commercial basis; seed-producing farmers’ groups or cooperatives are limited, both in number and capacity, and can serve farmers in accessible districts only to

a limited extent. Agro-vets and some private dealers are the only agencies providing seeds in remote districts. However, due to road- and transportation-related problems, they are not able to provide timely and required amounts of seeds of improved varieties to farmers in those districts. At the moment, agro-vets are concentrating on vegetable seeds (mostly imported hybrids) while the National Seeds Corporation meets only 10 per cent of the seed demand of farmers.

FAO project:

With the objective of creating a local knowledge base on seed storage, the FAO pilot project has facilitated the identification and promotion of traditional outdoor and indoor storage methods.

It has also introduced improvements to the traditional methods to increase resilience and improve livelihoods:

- Poly-lined bags or polythene sacks: field demonstrations were carried out on improvements in the use of poly-lined bags or polythene sacks inside the storage bins to eliminate the difference between internal and external environments.
- Traditional seed storage containers such as dehari (indoor structures made from a mixture of mud, straw and dung) are modified with the use of polythene sheets on both sides of the structures and by painting the external body with bitumen to disrupt the influence of changes in external weather. The rodent problem is reduced by placing a strip of metal all around the base of the structures (about 10 inch in height).
- The “Ghyampo” earthen clay pots for storing seeds are improved by painting the external body of the pot with white enamel and installing a double-walled lid to control moisture content.
- Overall recommendations to farmers included: drying seeds to an 8–10 per cent moisture level in order to reduce the incidence of storage pests; and placing storage containers in a dry, damp-proof area with proper sanitation. In addition, storage containers should be located at least 30 cm away from the house walls and 30 cm above the ground, placed on a wooden plank.
- These demonstration projects were carried out for rice in Kapilbastu and Siraha and for potatoes in Arghakhanchi; those for wheat were conducted in Kapilbastu, Siraha and Udaipur.

Outcomes The FAO pilot project strengthened the capacity and know-how of local producers on local seed storage through the identification and promotion of traditional outdoor and indoor storage methods, namely:

Traditional outdoor storage structures/containers:

- Bery/Bhakari (made of bamboo splits and timber).

- Muja-ko Bhakari (made of straw/reeds).
- Thungki (a wooden granary with roofing).
- Thangro (a timber/bamboo drying/storage rack).
- Dhansar (a separate house made of timber and planks for storage, only a few larger farms are using it).

Traditional indoor storage structures/containers:

- Kath-ko Bhakari (made of wooden planks and a platform).
- Gundari-ko Bhakari (made of straw/bamboo mats).
- Chitra/Choya-ko Bhakari (made of bamboo splits and stripping).
- Kotho (made of bamboo splits and stripping).
- Doko (made of bamboo stripping and splits).
- Dalo/Bamboo basket (made of bamboo stripping and splits, as well as reeds).
- Dehari and Kothi (mud bins, smaller and bigger in size, respectively).
- Gagro and Ghyampo (earthen clay pots, smaller and bigger in size, respectively).
- Dhukuti (a masonry structure with a brick wall Bhakari).

Good practice and lessons learned

Farmers have improved food security with improved traditional storage structures and the adoption of improved storage practices. Farmers have been able to reduce loss and deterioration during seed storage by about 10–15 per cent.

Date of submission

April 19, 2016

Further information

- FAO. *Managing Climate Risks and Enhancing Resilience in Nepal*. Available at <http://www.fao.org/climatechange/56995/en/>
- FAO website: <http://www.fao.org/>

6. **THE PHILIPPINES** | Capacity development on integration of science and local knowledge for climate change impacts and vulnerability assessments
 Asia-Pacific Network for Global Change Research (APN-GCR)

Sectors	Adaptation element	Climate hazard
Coastal areas/zones, community-based adaptation, indigenous and traditional knowledge, water	Adaptation planning and practices, capacity-building, climate scenarios, impact assessment, vulnerability assessment	Sea level rise
Description of the activities	<p>Water-related risks are attributed not only to escalating global and local changes, but also to a high extent to failures in good water governance. The reality of climate change calls for a need to understand how climate change might affect a range of natural and social systems, and to identify and evaluate options to respond to these effects. However, the capacity to conduct vulnerability and adaptation assessments in the Philippines is still limited, particularly with gaps in relation to downscaling simulated scenarios and mainstreaming research findings into decision-making.</p> <p>The project was completed in 2009. It aimed to build the capacity of local government officials and researchers, and the provincial government of Albay, in the Philippines as a whole, in assessing the impacts of and their vulnerability to climate change with the use of a computer-based modelling system, complemented by the local knowledge of the people in the province. It served as a pilot site for the assessment of climate impacts and vulnerability using SimCLIM, a computer-based modelling system for examining the effects of climate variability and change over time and space which is also designed to support decision-making and climate-proofing.</p>	
Outcomes	<p>The APN project trained key stakeholders from the local government unit in Albay Province on impacts, vulnerability and adaptation assessments using a computer-based modelling system and participatory approaches.</p>	
Good practice and lessons learned	<p>SimCLIM was used and developed for Albay Province (AlbayClim) as an innovative tool for assessing and creating climate change scenarios. This aided in characterizing future risks specific to the province. Case studies were conducted in upland and coastal communities to demonstrate the assessment of impacts, vulnerability and adaptation to climate change, and sea level rise. The AlbayClim system was complemented with participatory techniques to solicit the knowledge and experiences of the local people. This placed the source of vulnerability into context and facilitated the mainstreaming of adaptive responses.</p>	

The success of this project was made possible through a strong collaboration and partnership between the implementing scientists and government officials concerned.

However, there is a need for science and local knowledge to be further integrated for more robust assessments of climate change, impacts, vulnerability and adaptation.

Implementing partners SimCLIM, New Zealand and the University of Los Banos, Philippines

Date of submission April 13, 2016

Further information

- Training manual. Available at <http://www.apn-gcr.org/resources/items/show/1699>
- APN-GCR website: www.apn-gcr.org

7. **THE PHILIPPINES** | Strengthening capacities for climate risk management and disaster preparedness in Bicol Region

Food and Agriculture Organization of the United Nations (FAO)

Sectors	Adaptation element	Climate hazard
Agriculture, community-based adaptation, freshwater fisheries, gender	Adaptation planning and practices	Drought, land and forest degradation, storm surges, sea level rise, tropical cyclones/typhoons
Description of the activities	<p>The Government of the Philippines and the Food and Agriculture Organization of the United Nations embarked on a joint technical cooperation project to enhance capacities for climate risk management and disaster preparedness in agriculture (2009–2011). Among other outputs, agricultural practices for improved disaster risk reduction and management were identified, pilot-tested and disseminated through the district administration (DA) and local government unit extension services. Further, the project promoted community participation as a critical element of sustainable disaster risk management. Action research based pilot-testing of selected good practice options (GPOs) for disaster risk reduction (DRR) was undertaken during three cropping seasons. Before pilot field testing, the GPOs were pre-evaluated according to their agro-ecological suitability, economic and social feasibility, resilience against impacts of climate hazards, and estimated carbon balance. Only those which passed the evaluation process were implemented by selected farmer-cooperators. During the three cropping seasons, five different GPOs were tested in the lowland irrigated rice area with 198 farmer-cooperators; three preselected GPOs were tested by 278 farmers in the upland/rain-fed agro-ecological zone and four GPOs were field-tested in the fisheries/aquaculture sector for one cropping season, with 70 farmer-cooperators. GPOs for the lowland agro-ecological zone included: (a) use of an early-maturing rice variety; (b) use of a submergence rice variety; (c) use of a salt-tolerant rice variety; (d) timing of planting and rice rationing; and (e) implementation of a rice and duck farming system. GPOs for the upland agro-ecological zone included: (a) strip intercropping; (b) coconut leaf pruning; and (c) goat raising. GPOs for the fisheries/aquaculture zone included: (a) backyard tilapia farming; (b) small-scale seaweed farming; (c) freshwater prawn farming; and (d) use of squid pot technology.</p> <p>The overarching project objective was capacity development for proactive DRR in the agriculture sector in the Bicol Region. More specifically, the immediate project objectives were to: (i) enhance the institutional and technical capacities within the DA and the Philippine Atmospheric</p>	

Geophysical and Atmospheric Services Administration (PAGASA), and those of local institutions to better manage climate-related risks and promote local-level preparedness against recurrent natural hazards such as typhoons, floods and drought; and (ii) improve the livelihood resilience and food security of farmers and fishermen and women who are highly vulnerable to the frequent occurrence of extreme climatic events.

Outcomes

Agro-ecological suitability of the good practice options

GPOs that were pilot-tested in the lowland irrigated rice areas demonstrated a high degree of agro-ecological suitability based on farmers' feedback/perceptions and the results of the field testing. Both farmer-cooperators and non-cooperators shared a favourable perception of the use of rice varieties which could adapt to climate-related hazards (e.g. the early-maturing, submergence and saline-tolerant varieties), the timing of planting and ratooning, and the integration of a duck and rice farming system. This is evidenced by the number of farmer-cooperators and non-cooperators who opted to adopt these technologies after the trial period. It is noteworthy that part of the seed requirement for the second and third cropping seasons was sourced from the farmer-adopters. Although no fertilizer was applied, the yield performance was comparable to, if not higher than, the rice crops that were fertilized. This is a good indication of the suitability of the GPOs to the existing soil types/conditions in the pilot communities.

Except for some crops, the GPOs in the upland areas showed a high degree of agro-ecological suitability. This is due to the fact that the crops chosen as intercrops (e.g. sweet potato, cassava, squash, corn, peanut and aubergine) under coconut plantations were the same crops as those being grown by the farmers in the pilot communities, except that improved varieties were used instead of the local varieties. The GPOs for the fisheries/aquaculture areas had a medium to low degree of agro-ecological suitability. The squid pot technology was found to have a medium degree of agro-ecological suitability. However, cooperators reported that there were days when they did not have any catches, especially during adverse weather conditions.

Economic feasibility of the good practice options

The economic feasibility of the GPOs was determined by comparing the costs and benefits against existing practice of farmers.

Use of the early-maturing rice variety

By using an early-maturing rice variety, farmers were able to obtain an additional yield of 375 kg/ha. The increase in yield is equivalent to 4.5 cavans of milled rice as food for the household during the lean season and adverse weather conditions. The farmers may also sell this additional yield as fresh

palay, which could provide the household with an additional income of 4,500 Philippine pesos (PHP).

Use of the submergence rice variety

The results tend to indicate that the NSIC Rc-194 rice variety was able to tolerate the above normal rainfall from December 2010 to March 2011 due to La Niña event. The submergence rice variety outperformed the existing variety used by farmers in terms of yield in the project sites during the second and third cropping seasons. Statistical tests indicate that the yield difference between the submergence rice variety (GPO) and the existing variety is significant at 5 per cent, with a t-value of 2.88. The records also showed that farmer-cooperators would spend around PHP 18,000.00 per hectare for this GPO. An additional 1,700 kg/ha can be realized per cropping season using the submergence rice variety. This means that a farmer could earn PHP 20,400.00 per hectare per cropping season, which is 38 per cent higher than the amount that a farmer can earn using the existing rice variety.

Use of the salt-tolerant rice variety

The results of the pilot testing revealed that the average yield of the GPO of 2.28 t/ha, 2.93 t/ha, and 4.15 t/ha in the three sites for the first, second and third cropping seasons, respectively, was higher than the Existing variety used by farmers. The yield difference between the GPO and the existing variety was also found to be statistically significant. The use of the NSIC Rc-108 variety was productive and more cost-efficient than the existing variety. On average, farmer-cooperators spent PHP 15,027.00 to establish a hectare of the GPO and obtained an additional yield of 1.14 t/ha, which is approximately equivalent to PHP 13,738.00. Planting rice varieties which are not suited to saline-affected rice areas only increases the cost of production, which could range from PHP 18,000.00 to PHP 20,000.00 per hectare and affects the food security of farming households due to the low yield.

Timing of planting and rice ratooning:

The field trials for three cropping seasons revealed that the early-maturing rice variety outyielded the existing local variety being used by the farmers in the project sites. Moreover, the rice ratooning gave the farmer-cooperators an additional rice yield of 550 kg/ha within 45 days. The yield difference was significant at 5 per cent.

Rice and duck farming system:

Farmers observed that by allowing 10 ducks to freely range in the rice field, the population of golden apple snails was reduced within eight months. Moreover, farmer-cooperators did not have to use molluscide and insecticide sprays. Lastly, protein-rich food (eggs) has become one of the household's

daily food items. Excess eggs were sold to shops in the locality and provided the household with an additional source of income. The project conducted an exploratory trial of the rice and duck farming system during the second cropping season with one farmer-cooperator in each of the project sites to determine the feasibility of this GPO. The results of the trial revealed that farmer-cooperators not only obtained a higher yield, but the ducks raised also produced eggs which the farmers either consumed or sold. During the second cropping season, the farmer-cooperators from Buhi and Guinobatan reportedly produced 720 eggs each, while the farmer-cooperator from Gubat produced 480 eggs. The number of eggs produced during the third cropping season was relatively lower because the ducks that were distributed did not immediately produce eggs. The results of this pilot testing indicate that the rice and duck farming system will not only enhance the livelihood resilience of rice farming households but will also improve their food security. The farming household can sell a portion of the eggs produced to generate additional income while consuming the remainder, thereby improving their nutritional status. The increment in rice yield can provide for the food requirements of the household during adverse weather conditions.

Strip intercropping

The data showed that strip intercropping of varying growth durations yielded higher marginal benefit and cost ratio (MBCR) values compared with a crop combination of the same growth duration. Across sites and locations, a combination of long duration (LD) and short duration (SD) crops had a higher MBCR value of 3.16 than LD + medium duration (MD) (3.04), MD + SD (2.85) and SD + SD (2.04). The lowest MBCR value of 1.37 was obtained from the LD + LD combination. Although tested only once during the 2011 wet season cropping in Gubat, Sorsogon, combining strips of LD + MD + SD in the same plot produced the highest MBCR of 4.98. The high MBCR obtained from combining crops of different growth duration demonstrated the agro-ecological suitability and resilience of the GPO. Despite the abnormal climatic conditions (above normal rainfall) that occurred during the three cropping seasons, the GPOs produced an acceptable yield. Furthermore, strip intercropping of crops of different growth duration contributed to the management of risk impacts in terms of improving the resilience of the household.

Coconut leaf pruning

The results of the MBCR analysis for three seasons in three pilot municipalities revealed that planting improved crop varieties under coconut leaf pruning technology resulted in an increase in revenue for the farmer-cooperators. Across seasons and sites, shifting from the traditional/local varieties to improved varieties of sweet potato, cassava and corn resulted in a

higher MBCR. Los Baños Lagkitan, an early-maturing composite corn variety which can be harvested within 70 to 75 days after planting, had the highest mean MBCR of 2.90 across seasons, followed by the Golden Yellow cassava variety, with a mean MBCR value of 2.39. The two sweet potato varieties, namely SP 30 and SP 23, yielded MBCR values of 2.19 and 2.07, respectively. Glutinous Composite # 2 or ‘Lagkitan’ is a white, glutinous open-pollinated corn variety, grown primarily for table use, local delicacies and ‘kornik’. It has small to medium to large soft kernels with excellent eating quality. It has an average marketable ear yield of 40 t/ha that can be harvested in 72 days. The data showed that this corn variety can be grown in any soil type during wet and dry seasons.

Goat raising

The goat raising project was expected to provide additional income to the farmer-cooperators from the sale of goat milk and/or goat offspring. A mature doe is capable of producing two kids in three to five months and goat milk for at least two months. The animals, however, were yet to deliver their kids at the time of project termination.

Good practice and lessons learned

The project demonstrated the potential of the selected GPOs to enhance livelihood resilience under variable climatic conditions as manifested by their performance and the results of field evaluation. With regard to the performance of validated technologies, the project showed that a better understanding of climate/weather forecasts and the timely delivery of advisories to local government units and farmers are essential to enhance local disaster preparedness. During the first cropping season, GPOs established in the upland/rain-fed areas were mostly destroyed by extreme weather events due to inadequate weather advisories. Seasonal weather forecasts provided by PAGASA and farm weather bulletins prepared by DA-RFU V enabled farmers to take strategic decisions on appropriate crop choice, cropping schedules, adoption of cultural management practices, and use of mitigating measures. Damage to the field demonstration projects established during the second and third cropping seasons was averted because of the farm weather bulletins provided by DA-RFU V to the local government units and farmers.

Implementation of tilapia backyard farming in the municipality of Gubat was a failure due to the heavy rainfall brought by the cold front in December 2010–January 2011, which severely damaged all pilot farms in the municipality of Gubat. This was not the case, however, for the rice farmers in Guinobatan, who established backyard tilapia farming adjacent to their rice fields; they were spared the flooding despite experiencing the same rainfall pattern. Although seaweed is already being grown in Barangay Bagacay in the municipality of Gubat, the cooperators who took part in this project were not successful due to the damage brought by the typhoon and heavy rainfall. Aside

from the typhoon, the seaweed pilot farms were also affected by ‘ice-ice’ disease, which is believed to be caused by changes in salinity seawater temperature and light intensity brought about by heavy rain, causing stress to seaweed.

Implementing partners	Department of Agriculture Regional Field Unit No.5 (DA RFU-5) Central Bicol State University of Agriculture (CBSUA) Bicol University (BU) Philippine Atmospheric Geophysical and Atmospheric Services Administration (PAGASA) Local government units (LGUs)
Date of submission	April 19, 2016
Further information	<ul style="list-style-type: none">▪ <i>Strengthening Capacities for Climate Risk Management and Disaster Preparedness in Bicol Region, Philippines</i>. Available at http://www.fao.org/docrep/field/009/aq197e/aq197e.pdf▪ FAO Bicol project: http://www.fao.org/climatechange/ph/bicol/en/▪ Technologies and Practices for Small Agricultural Producers (TECA). 2013. <i>Rice and Duck Farming as Means for Contributing to Climate Change Adaptation and Mitigation, in the Bicol Region, Philippines</i>. Available at http://teca.fao.org/technology/rice-and-duck-farming-means-contributing-climate-change-adaptation-and-mitigation-bicol▪ TECA. See http://teca.fao.org/technology-categories/climate-change-and-disaster-risk-reduction▪ FAO website: http://www.fao.org/

8. SRI LANKA | Traditional irrigation systems, Sri Lanka

United Nations University Institute for Sustainability and Peace (UNU-ISP)

Sectors	Adaptation element	Climate hazard
Agriculture, biodiversity, disaster risk reduction, ecosystems, water	Adaptation planning and practices	Drought
Description of the activities	<p>There are many traditional agricultural production systems in Asia that have resulted not only in outstanding landscapes, maintenance of agricultural biodiversity, indigenous knowledge and resilient ecosystem development but have also provided economic, environmental and social goods and services over thousands of years. With growing population and economic aspirations, many of these systems are being replaced by modern agriculture systems that are designed for efficiency and large-scale development. However, there is also a growing realization of the need to preserve in some form these valuable repositories of indigenous knowledge for climate change adaptation, biodiversity conservation and land management and the rich culture they have generated. Different approaches, such as the Cultural Heritage Systems of the United Nations Educational, Scientific and Cultural Organization (UNESCO), or the Globally Important Agriculture Heritage Systems of the Food and Agriculture Organization of the United Nations (FAO) attempt to preserve and showcase representative production sites from these systems. However, they cannot be upscaled to cover the vast populations still engaged in them. In this study, investigations were conducted into the feasibility of fusing the traditional and modern systems through building mosaics of the two systems to enhance resilience and productivity.</p> <p>The aim of the Deduru Oya reservoir in Sri Lanka, which was commissioned in 2014, is primarily to improve the livelihood of farmers in parts of the north-western province of Sri Lanka by increasing the productivity of its land and water resources by regulating and diverting water to irrigation systems through two main canals in both river banks. The left bank canal supplements water needs for paddy cultivation from existing ancient rain-fed small reservoir-based irrigation systems. The right bank canal is a transbasin canal conveying excess water from the reservoir to the adjacent Mee Oya Basin. The Deduru Oya irrigation project provides an ideal ground for research and experimentation related to integrating modern and ancient irrigation systems to improve cropping intensity and resilience. The analysis covered hydrological and water resource planning through detailed simulations and the development of both physical infrastructure mosaics for water conveyance and social management mosaics for macro–micro integration.</p>	

Outcomes

The simulation carried out over the past 10 years revealed that the Deduru Oya reservoir project, which aimed to operate left bank canal irrigation management incorporating the existing small irrigation tanks, will be able to supply the water demand for the left bank development area for paddy cultivation without failure. While the modern system can adequately meet the irrigation demand, the integration of existing distributed small tanks provides resilience to extreme drought conditions and the much-needed macro–micro-scale integration with autonomy at micro scale.

Good practice and lessons learned

By developing mosaic structures of the traditional and modern systems, it is possible to develop systems that are resilient to shocks and at the same time improve the livelihoods of farmers.

The new modern reservoir built across Deduru Oya in Sri Lanka will provide water resources many times greater than the existing ancient irrigation tanks in the left bank canal side of the Deduru Oya area dating back thousands of years. The main focus therefore would be to provide social and cultural cohesion, harmony with nature and resilience to extreme events by incorporating the ancient irrigation network into the new system. The enhanced water resources provide opportunities to improve the livelihoods of the farmers in the region. Thus, a holistic approach towards empowering the farming communities through integrated water management practices is necessary to make full use of the Deduru Oya irrigation project.

The analyses of inflows to both the new and ancient irrigation systems show that the reservoir alone will have around 15–20 times the water resources available compared to the ancient system, and is capable of supporting year-round irrigation and additional coverage for rice farming. However, the ancient irrigation system can play a major role in providing resilience to the system to absorb shocks from an extremely dry climatic year. With the enhanced inflows from the modern reservoir, the system will be able to provide water for year-round cultivation of existing farmland and will also provide opportunities for growing other food crops to enhance income.

The challenge facing the system is the design of an appropriate water allocation system and implementation of a robust water management system. The Water Evaluation and Planning (WEAP) model employed showed feasible water allocation scenarios and can be used to construct appropriate operation rule curves for the main reservoir, combining with the joint irrigation and operational demands. In addition, the various inlet structures, such as level crossings and cascade supplement structures, can be individually accounted for in the detailed water allocation model constructed for the combined new and ancient irrigation systems.

For water management, the Bulk Water Allocation (BWA) model adopted elsewhere was studied and found to be a promising model for use in the system. In this approach, irrigation canals are treated as small reservoirs, where farmers use a fixed amount of water. The assessment of implementing the BWA model through a detailed survey of the Deduru Oya Basin was carried out and showed that the farming community had a positive attitude to its use. In implementing the BWA model, it is important to: (a) establish clear and measurable water entitlement; (b) incorporate ‘risk management’ in comprehensive capacity-building that includes social, technical and financial aspects; and (c) provide transparency in decision-making and appropriate power-sharing.

The study provided a unique opportunity to combine the operation of efficient large-scale modern systems with resilient localized ancient systems promoting social cohesion and harmony with nature through the building of mosaic systems. These mosaics should cover both physical (structural mosaics) and social (management mosaics) aspects. Further analysis of economic aspects, in terms of linking micro production with the macro economy through crop and livelihood diversification, should be conducted in future.

Implementing partners University of Peradeniya, Sri Lanka; Irrigation Department, Sri Lanka

Date of submission April 20, 2016

Further information

- The study is included in the chapter titled “Mosaic of traditional and modern agriculture systems for enhancing resilience” in *Resilient Asia: Fusion of Traditional and Modern Systems for Sustainable Future*, to be published by Springer
- The experiences of this project led to the development of a framework for trans-disciplinary incubation projects as feasibility studies for large-scale development projects. This concept was adopted at the 2015 United Nations World Conference on Disaster Risk Reduction by a network of universities that led to the establishment of the International Network for Advancing Transdisciplinary Education (INATE). The first project under this framework titled “Groundwater recharge for improving livelihoods and enhancing resilience in the dry zone of Sri Lanka” is now under way
- Herath S. 2015. *Groundwater Recharge for Improving Livelihoods and Enhancing Resilience in the Dry Zone*. Inception workshop report. Available at http://inate.info/system/files/inate_sl_project-inception.pdf
- International Network for Advancing Transdisciplinary Education (INATE): <http://www.inate.info/inate>
- UNU- ISP website: <http://isp.unu.edu/>

C. Caribbean and Central America

1. **COSTA RICA** | Food security support for the indigenous population of the Talamanca – La Estrella Valley territory in the face of climate change effects by fomenting resilient family agriculture through the recovery of local indigenous traditions

Rural Development Institute (INDER)

Sectors	Adaptation element	Climate hazard
Agriculture, biodiversity, farm systems, crops, ecosystem-based adaptation, food security, food systems, human settlements, indigenous and traditional knowledge	Adaptation planning and practices, capacity-building, communication and outreach/awareness, education and training, knowledge management, stakeholder involvement	Drought, floods, increasing temperatures, land and forest degradation, loss of biodiversity, shift of seasons
Description of the activities	Home of the Bribri and Cabecar indigenous peoples, with an approximate population of 50,000, the Talamanca – La Estrella Valley territory is characterized by having the country’s lowest human development index and being one of the most vulnerable cantons (a type of Costa Rican socioeconomic division) to climate change, thereby creating a range of conditions affecting agricultural production (one of the activities on which the population depends the most).	
	Given the area’s vulnerability to climate change, extreme rainfall, temperature and drought events, among others, are occurring more and more frequently. Faced with this situation, the recovery and implementation of integrated production systems are being proposed as an adaptation strategy for the area’s Bribri and Cabecar indigenous communities under the traditional farming model for these Talamanca canton communities in the Costa Rican Caribbean Huetar region. The recovery of integrated production systems has been accomplished through the project entitled “Food security support for the indigenous population of the Talamanca – La Estrella Valley territory in the face of climate change effects by fomenting resilient family agriculture”, implemented by the Rural Development Institute (INDER) with the support of the Ministry of Planning, the Ministry of Agriculture and Livestock, the Spanish Agency for International Development Cooperation (AECID) and the Adaptation Fund through the Climate Change Directorate of the Ministry of the Environment and Energy and Fundcooperación para el Desarrollo Sostenible, hand in hand with the Bribri and Cabecar indigenous communities. This project is framed within a larger intervention called “The rural environment in the face of climate change challenges” funded by INDER and AECID and will be in the	

implementation phase until 2019.

Sustainable production models are part of the indigenous cosmovision of the Bribri and Cabécar peoples, who use a variety of ancestral diversified production and ecological farm management practices. The project therefore proposes, first, to recover and enhance the value of the ecological farm management knowledge, establishing best practices for the coexistence and reinforcement of different economic activities on a single farm. Although these practices are native to the indigenous culture, a significant proportion of the population has been abandoning them, establishing monoculture plantations that generate faster and more abundant income in the short term but which are not economically and socially sustainable in the long term.

The best practices compiled in the manual have served as a basis for training aimed at indigenous families so that such families can design management plans for their farms. These plans constitute strategies for improving management of their farms and resources, thereby reducing vulnerability to the effects of climate change.

It has been necessary to work together with the indigenous peoples to create the manual and implement the measures on the farms, since it is these people who have identified the measures and who, with technical support, are implementing the actions. The organizations involved have conducted workshops with the help of cultural spokespersons hired by the project. The manual and management plans are aimed at increasing the resilience of agricultural production systems and fostering food and nutritional security, hand in hand with the recovery of traditional and local indigenous adaptation knowledge and practices.

Outcomes

The project facilitates the creation of farm management plans, inputs and technical assistance for at least 176 selected families, reaching 528 families altogether over three years by means of a cascading system up to a second replication. The project contributes to maintaining the indigenous culture, which is characteristically respectful of the earth. In this regard, the beneficiary families and their surrounding communities are ensured of the maintenance of ecosystem social services.

The project enhances the value of the integrated diversified farm model (based on the cosmogonic model) of the Bribri and Cabécar cultures as a more appropriate technological adaptation option for indigenous families, developing and implementing traditional agricultural production activities that help establish it as a replicable, sustainable model. In the interest of recovering key adaptation measures that are also traditional measures implemented by the indigenous peoples, one of the project's main outcomes in relation to traditional and local knowledge management is the *Manual of Bribri and Cabécar*

Ancestral Practices, which has helped to compile the knowledge of the indigenous communities and promote climate change adaptation measures, without restricting the appropriation of other measures.

The manual seeks to act as a guide to help strengthen the traditional indigenous farms, enhancing resource conservation, family economy, food security, environmental conservation and other climate change adaptation measures, basing itself on the indigenous cosmovision and reassessing the strategies used by this population to deal with climate change.

The manual's target readership is the producers, educators, youths and children of the Bribri and Cabécar indigenous territories, since it seeks to disseminate the ancestral knowledge and practices used in the area, which are gradually being lost.

The project's participating institutions have brought to light the fact that indigenous farms are the theoretical foundation of current agro-ecological farms, since they use impact- or damage-minimization mechanisms stemming from pressures on natural resources. Furthermore, it should be noted that the manual was created by the two indigenous territories themselves; in other words, they are the owners and creators of the document.

Expected outcomes:

- Retrieve Bribri and Cabécar ancestral knowledge, identifying and enhancing the value of the agricultural and forestry practices of those indigenous communities as an adequate technological option for dealing with climate change.
- Raise the awareness of indigenous community inhabitants regarding the effects of climate change and the need for technical capacity-building of the indigenous families involved in the project so that they can implement the adaptation measures.
- Implement the agricultural and forestry practices of traditional indigenous farming to establish integrated production systems on family farms.
- Manage knowledge through systematization of lessons learned and best recovered practices, and disseminate this knowledge through a manual.
- Incorporate the best agricultural practices identified in the planning of the production activities developed by families on their farms. This is the most significant outcome of the manual. To date, there are 76 farm management plans that show the implementation of the best identified practices in the daily work of the families involved in the project.

Good practice and lessons learned

To enhance the value of appropriate traditional practices, implementation of the project included the creation of a manual in which such practices are compiled and validated.

Seventeen adaptation practices, both traditional and non-traditional, have been developed in the *Manual of Bribrí and Cabécar Ancestral Practices*, as mentioned below:

1. Integrated farm conservation (traditional).
2. Evaluation of farms in the face of climate change risks and threats.
3. Reduction of greenhouse gas emissions.
4. Establishment of climate change records.
5. Protection and conservation of water sources.
6. Recovery of collective or communal work on farms.
7. Interplanting of trees and crops (Chamugrö).
8. Crop association and rotation (Teitö).
9. Use of traditional native (local) seeds.
10. Reinforcement of patio gardening (Witö).
11. Cultural and ancestral soil protection and crop management practices.
12. Rainwater capture.
13. Water resource conservation.
14. “Let’s not dump garbage”
15. Establishment of family gardens and family and community mini greenhouses.
16. Soil conservation.
17. Model farms.

Challenge

The biggest challenge to achieving the results has been in ensuring that the different institutions involved in the project’s implementation work in a coordinated manner between themselves and with the indigenous peoples’ authorities. This challenge has been overcome through dialogue and coordination, exploring all forms of negotiation between the parties and, specifically with respect to the indigenous peoples, encouraging the participation of cultural spokespersons.

Success factors/lessons learned for achieving the expected results

1. Indigenous community participatory construction and validation: 17 agricultural practices were compiled through participatory workshops and field days on model farms with Bribri and Cabécar producers, with identification and ownership being the main goals of this process, which will have repercussions on the use and implementation of such practices in traditional ancestral farming.
2. Identification and participation of cultural spokespersons in the consulting and construction processes: the participation of cultural spokespersons was necessary to ensure understanding among the parties and facilitate processes between the indigenous peoples and the institutions. The use of the knowledge of these spokespersons was suggested by the local indigenous government and was put into practice by the project as a reciprocal learning process.
3. Value enhancement of traditional production practices: the recovery of traditional production systems has facilitated the learning and implementation processes, since it goes from known to unknown, simple to complex, opening up the possibility that, over time, indigenous communities will adopt and take ownership of not only the production system of their forebears, but also the exploration and use of other production practices that will enable them to reduce their vulnerabilities and strengthen production opportunities without disparaging ancestral knowledge.
4. Joint work with the autonomous governance structures of indigenous territories: respect for the autonomous authorities and their governance mechanisms was a determining factor for progress, since the success of participatory construction is based not only on consultation with and participation of the local population, but also on the creation of forums for consensus, so that the actions of the project can transcend local policy guidelines.

Implementing partners Ministry of Planning, Ministry of Agriculture and Livestock, the Spanish Agency for International Development Cooperation (AECID) and the Adaptation Fund through the Costa Rican Climate Change Directorate of the Ministry of the Environment and Energy and Fundecooperación para el Desarrollo Sostenible, in association with the local indigenous Bribri (ADITIBRI) and Cabécar (ADITICA) governments in Talamanca.

Date of submission April 11, 2016

**Further
information**

- The project has received international cooperation funding from the Spanish Agency for International Development Cooperation (AECID) and the Adaptation Fund, which is implemented in Costa Rica through the Climate Change Directorate of the Ministry of the Environment and Energy and Fundecooperación para el Desarrollo Sostenible (Costa Rica's national implementing entity for the Adaptation Fund). The project also has national institutions that contribute counterparts and technical knowledge.
- *Manual of Bribri and Cabécar Ancestral Practices* (Manual de prácticas ancestrales Bribri y Cabécar). Available at <http://www.calameo.com/read/0047140859c1a66ce6402>
- INDER website: www.inder.go.cr/

2. **JAMAICA** | Enhancing drought resistance through guinea grass mulching
 Food and Agriculture Organization of the United Nations (FAO)

Sectors	Adaptation element	Climate hazard
Disaster risk reduction, indigenous and traditional knowledge	Adaptation planning and practices	Drought
Description of the activities	<p>Drought has become more frequent in some areas of Jamaica, which increases the vulnerability of farmers whose livelihoods depend on agriculture. While there is a general perception that negative effects of droughts can be mitigated through appropriate technologies, their actual adoption is often hampered by the availability of resources. One widely adopted agricultural practice is guinea grass mulching, by which land after it has been prepared for cultivation is covered with dried guinea grass. It is done before sowing to ensure that moisture is conserved, weed is controlled, soil erosion, run-off and soil temperature are reduced, soil structure is improved and volatile fertilizer material is retained.</p> <p>The objective of the activities is to allow crop production during the dry season without having to resort to irrigation. This technique enhances soil moisture for germinating seeds and allows for a better crop establishment and nutrient uptake.</p>	
Outcomes	The technology was tested in mixed coastal plantation farming systems in Jamaica.	
Good practice and lessons learned	<p>Some lessons learned include the following steps for the implementation of the technology:</p> <p>Step 1: Harvest guinea grass before flowering (seeding), because when the seeding begins, the guinea grass stem becomes more liquefied and thus more difficult to break down as mulch. There is also a higher proportion of stems to leaves after seeding, and it is the leaves that account for the bulk of the matting that forms mulch. Timing is therefore critical when harvesting the guinea grass.</p> <p>Step 2: Secure a sufficient amount of grass to adequately cover the area prepared for cultivation. To provide a mat that will not break down before the cropping season is over, it is recommended that 46 m²s of dried grass per hectare of prepared land are used.</p> <p>Step 3: Apply fertilizers and any other soil treatment, especially if fertilizers will be transmitted and incorporated into the soil.</p> <p>Step 4: Prepare holes for sowing seeds or for transplanting.</p>	

Step 5: For ease of preparation, the dried grass to be used should be piled in the vicinity of the land to be treated. Dried grass is to be removed from the heap, and the leaves arranged length-wise in a single direction over the prepared area, completely covering the soil. The process is to be repeated in the opposite direction, forming a mat.

Step 6: The mulching operation is now complete and crop production activities may proceed as usual.

Additional lessons learned focus on the advantages of mulching:

1. It allows crop production during dry periods in areas where this would not be possible without irrigation. The process reduces evapotranspiration and traps soil moisture within the mulch environment and makes it available for an extended period for the establishment of crops. In the early stages of seed germination, condensation on the mulch provides moisture for germinating seeds. Mulch also keeps the root environment cool, allowing better crop establishment and nutrient uptake.
2. It suppresses weed growth, reduces competition for soil nutrients and reduces the cost of weed control.
3. It reduces soil loss from wind erosion, when soil structure is disturbed during harrowing or other traditional forms of land preparation. Mulching protects the soil from splash and rill erosion by reducing the impact of rainfall on the surface and prevents the development of rills.
4. The presence of mulch on the surface helps to deflect direct sunlight from the root zone of crops, thus resulting in a lower temperature in the root zone and more efficient utilization of soil nutrients.
5. It facilitates improvement in soil structure by preventing deterioration of soil surface incorporation of organic matter into the soil structure. This helps to bind soil particles together, thus improving structure and moisture-holding capacity.
6. It reduces the exposure to high temperatures by the application of mulch, thus allowing greater availability of nutrients to plants. Many inorganic fertilizers, especially those with a high nitrogen content and some organic manures (such as poultry manure), volatilize if left exposed to high temperatures.
7. It ensures a more even colouration between the parts of vine crops, such as melons and pumpkins that rest on the ground and the rest of the crop and mulching thus improves their marketability. Mulching also prevents scarring of crops by providing a cushion for vine crops.
8. The improvement of soil properties achieved will benefit the resilience of farmers against climate variability and adverse climate events (droughts, floods, etc.). Also, it will improve the potential of the soil to increase the crop yield.

Implementing partners Ministry of Planning, Ministry of Agriculture and Livestock, the Spanish Agency for International Development Cooperation, and the Adaptation Fund through Costa Rica's Climate Change Directorate of the Ministry of the Environment and Energy and Fundecooperación para el Desarrollo Sostenible, in association with the local indigenous Bribrí (ADITIBRI) and Cabécar (ADITICA) governments in Talamanca.

Date of submission April 19, 2016

Further information

- For further information on the technology testing in mixed plantation farming systems in Jamaica, see: <ftp://ftp.fao.org/docrep/fao/010/ai147e/ai147e00.pdf>
- *Assistance to Improve Local Agricultural Emergency Preparedness in Caribbean Countries Highly Prone to Hydro-Meteorological Disasters*. April 2007. Jamaica. Available at <ftp://ftp.fao.org/docrep/fao/010/ai147e/ai147e00.pdf>
- Spence B et al. 2005. *Experiences and Behaviour of Jamaican Residents in Relation to Hurricane Ivan*. 2005. Report submitted to the Japan International Corporation Agency
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- Burton T. 2001. *Dry Farming Techniques: the Use of Grass Mulch*. Rural Agricultural Development Agency: Jamaica
- Sherman S., *Grass Mulch: An Innovative Way of Gardening in the Dry Tropics*
- Morrison BJM, Gold M and Latange D. 1996. Incorporating indigenous knowledge of fodder trees into the small-scale silvopastoral systems in Jamaica. *Agroforestry Systems*. 34(1). Available at www.springerlink.com/index/N34521681460K234.pdf
- FAO website: www.fao.org

D. North America

1. CANADA | Building Climate Resilience and Adaptation in the Kainai First Nation The Rockies Institute

Sectors	Adaptation element	Climate hazard
Community-based adaptation, gender, indigenous and traditional knowledge, food security, water	Capacity-building, adaptation planning and practices, communication and outreach/awareness, education and training, institutional arrangements, vulnerability assessment	Drought, glacier retreat and related impacts, increasing temperatures, wildfire
Description of the activities	<p>Phase I of the project is scheduled for 2016–2018 and focuses on capacity-building through information-gathering and education. The objectives of this phase include:</p> <ol style="list-style-type: none"> 1. Broadly increasing tribal climate change knowledge and skills. 2. Determining the immediate, medium- and long-term climate risks to the Tribe. 3. Developing an initial Climate Adaptation Plan that can be further built upon. <p>The method involves making use of local, indigenous and traditional knowledge and practices.</p> <p>The method for engagement with the Tribe includes a participatory approach that extends to co-authoring each part of the project. Through in-person meetings and dialogue, the immediate and long-term concerns of the Tribe regarding climate change are discussed, a baseline is established of the educational requirements and the specific stakeholders in the group are identified. Knowledge about traditional plant use is sacred, but it is also important to be collected, as this information will influence land-use decisions in the future. How to move forward with collecting, identifying and storing information about traditional plants is a delicate subject. This process is moving forward through in-person dialogue, as well as a commitment to confidentiality. The Tribe has also shared its ways of meeting, including opening and closing prayers and the use of stories as examples of even complicated data. Work has also been carried out with the Tribe Council to ensure that the female members of the Tribe have a voice in the process and in the decision-making. This has resulted in one of the women taking the lead in the project. It is hoped that she can be further engaged in the project by introducing her to the global climate</p>	

change arena at the next UNFCCC session as a co-presenter.

The purpose of the use of local indigenous and traditional knowledge and practices is to build trust and enable all stakeholders to work together as partners, to understand how to communicate climate change knowledge to various stakeholder groups within the Tribe, and to ensure that land-use decisions in the future take account of traditional practices, including spiritual, medicinal and other practices such as hunting.

Outcomes The participatory approach has allowed the projects to be officially established, as well as the co-signing of funding proposals with the provincial government, and to show leadership in a new partnership between a Canadian First Nation and an outside not-for-profit organization. It has also enabled the development of tribal-specific climate education tools that are needed now in order to build their knowledge capacity for more in-depth work in the future in relation to climate risk assessment and adaptation planning.

Good practice and lessons learned Good practices include the participatory approach that involves the co-authoring of the project design, co-applying for funding and openly stating the partnership as a way forward. While the project is noted as being tribal-led, it is in partnership with knowledge experts from The Rockies Institute. This approach has allowed all stakeholders to seamlessly move through meetings and progress with the project at an encouraging rate. It was found to be effective to bring forward some of the climate concerns at the local and global levels as talking points, then to listen to the needs of the Tribe before designing a path forward. Phase I continues to evolve as the dialogue with members of the Tribe is built upon. Some of the challenges currently experienced are that there are different levels of climate knowledge within tribal decision makers and different actors have different agendas. The Tribe is very large, so identifying the best actors to bring to the table has been slightly difficult. This obstacle is being overcome by stakeholder mapping and then identifying members within the Tribe to champion invitations to future meetings with key players.

Implementing partners The Kainai First Nation: co-authoring the community approach and helping to source funding.

All One Sky Foundation: co-developing a community approach to climate risk assessment.

Date of submission April 11, 2016

Further information The Rockies Institute website: www.rockiesinstitute.com

2. MEXICO | Adaptation to climate change impacts on the coastal wetlands in the Gulf of Mexico

Instituto Nacional de Ecología y Cambio Climático (INECC)

Sectors	Adaptation element	Climate hazard
Coastal areas/zones, ecosystem-based adaptation, gender	Adaptation planning and practices, capacity-building, communication and outreach/awareness, education and training, vulnerability assessment	Increasing temperatures, ocean acidification, tropical cyclones/typhoons
Description of the activities	<p>The objective of the project is to promote adaptation to the consequences of climate impacts in the coastal wetlands of the Gulf of Mexico, through the implementation of pilot measures that would provide information on the costs and benefits of alternative approaches to reduce their vulnerability. It is implemented in three coastal wetlands of the Gulf of Mexico: the lagoon of Alvarado in the state of Veracruz, the Carmen-Pajonal-Machona lagoon system in the state of Tabasco and the Punta Allen Wetlands in the state of Quintana Roo. This project is developed under the ecosystem-based approach, which uses biodiversity and ecosystem services as part of an overall adaptation strategy to help people and communities adapt to the negative effects of climate change.</p> <p>Adaptation measures</p> <p>Veracruz:</p> <ul style="list-style-type: none"> ▪ Alvarado municipality under land-use planning incorporating climate change impacts as well as adaptation and conservation measures. ▪ Reforestation of mangrove ecosystem and riparian zones for a target of at least 30 hectares. ▪ Infrastructure and equipment (cleaning, de-silting and rehabilitation of at least 3 km of water fluxes; and one tide gauge and meteorological instruments) to reduce vulnerability to climate change. ▪ A management plan for Wildlife Conservation, Management and Sustainable Utilization Units (UMA) in mangrove ecosystems. <p>Tabasco:</p> <ul style="list-style-type: none"> ▪ Land-use planning updated incorporating climate change impacts as well as adaptation and conservation measures. ▪ Reforestation of mangrove ecosystem and riparian zones for a target of at least 20 hectares. ▪ Infrastructure and equipment (cleaning, de-silting and rehabilitation of at least 3 km of water fluxes; one tide gauge and meteorological instruments; and at 	

least two stilt houses and one rainwater harvesting) to reduce vulnerability to climate change.

- A management plan for Wildlife Conservation, Management and Sustainable Utilization Units (UMA) in mangrove ecosystems.

Quintana Roo:

- Protected area monitoring system strengthened, including climate change parameters.
- Protected area management programme revised to include climate change considerations.
- A target of repopulating genetically diverse temperature-resistant coral genotypes in six areas.
- Infrastructure and equipment (one tide gauge and meteorological and oceanographic instruments) to reduce vulnerability to climate change.
- Rehabilitation of water fluxes in the El Playón mangrove ecosystem for a target of at least 70 hectares.

Outcomes

- Increase of the adaptive capacity of people in the communities through training.
- Increase of the adaptive capacity of institutions through coordination and linkage.
- Access to safe drinking water and health improvement (Tabasco).
- Safeguards in case of flooding in stilt houses (Tabasco).
- Decrease of the vulnerability to extreme climatic events through mangrove reforestation (Veracruz and Tabasco), and rehabilitation of water fluxes in a mangrove ecosystem (Quintana Roo).
- Productive diversification and increase in purchasing power through the sustainable use of mangroves (Veracruz and Tabasco).

Good practice and lessons learned

- Processes and structures that are particularly conducive to stakeholder engagement (e.g. for engagement of local communities and the most vulnerable, and consideration of traditional, indigenous and local knowledge in adaptation planning and processes): diagnostic workshops and links with key stakeholders of all government institutions, non-governmental organizations, academics and communities.
- Active and coordinated response among federal, state and municipal government institutions. Meetings and field visits have been designed to involve them in the project.
- Involvement of communities in the project. Meetings, exhibitions and workshops have been designed so that communities take ownership of the project and identify adaptation measures.

- Implementing partners**
- World Bank. Implementing agency of the Global Environment Facility.
 - Nacional Financiera (National Development Banking Institution). Recipient's financial agent.
 - Instituto Nacional de Ecología y Cambio Climático (INECC) (National Institute of Ecology and Climate Change. Implementing agency.
 - Instituto Mexicano de Tecnología del Agua (IMTA) (Mexican Institute of Water Technology).
 - Comisión Nacional del Agua (CONAGUA) (National Water Commission). Collaborator.
 - Comisión Nacional de Áreas Naturales Protegidas (CONANP) (National Commission of Natural Protected Areas). Collaborator.

Date of submission April 21, 2016

Further information INECC website: <http://www.inecc.gob.mx/>

3. **MEXICO** | Implementation of adaptation measures in a coastal wetland in Tabasco
 Instituto Nacional de Ecología y Cambio Climático (INECC)

Sectors	Adaptation element	Climate hazard
Coastal areas/zones, ecosystem-based adaptation, ecosystems, health, human settlements, water	Adaptation planning and practices, communication and outreach/awareness, stakeholder involvement.	Floods, land and forest degradation, loss of biodiversity, sea level rise, storm surges, tropical cyclones/typhoons, vector and water-borne diseases

Description of the activities

Background

The Carmen-Pajonal-Machona lagoon system is located on the coast of the Gulf of Mexico in the state of Tabasco. It is separated from the sea by a narrow barrier with two mouths that are permanently connected with the gulf. The climate is hot and humid, with heavy rainfall in the summer (the average rainfall is 1,500 mm/year) that causes frequent floods in the area. The water bodies are strongly polluted by urban and industrial discharges; heavy deforestation is produced by the expansion of the agricultural frontier.

The communities in the wetlands area are poor and marginalized and suffer from a lack of clean water.

El Golpe, El Mingo and Las Coloradas are communities in the vicinity of the Carmen-Pajonal-Machona lagoon system, a large part of which are located in the wetlands.

Description of activities

Implementation of pilot adaptation measures consisting of:

1. Installation of a rainwater harvesting system; and construction of stilt houses as a safeguard in case of flooding.
2. Mangrove reforestation to contribute to the restoration of the wetlands and increase protection against extreme events.
3. Establishment of a Management Unit for the Conservation of Wildlife (UMA) for the sustainable use of mangroves.

Key stakeholders include officials of federal, state and municipal governments, local non-governmental organization (NGO) representatives, fishermen and schoolteachers.

The project includes a communication strategy to disseminate lessons learned and assess its replicability.

The project is developed under the ecosystem-based approach, which uses biodiversity and ecosystem services as part of an overall adaptation strategy to

help people and communities adapt to the negative effects of climate change.

Timeline and resources provided

- The project was carried out from 2011 to 2015, with an amount of USD 1,150,000 from the Global Environment Facility for Tabasco.
- The project uses the technical expertise of NGOs, academics, consultants and specialized groups in different adaptation measures, both in the environmental and social aspects.
- An interdisciplinary working group works on a daily basis to provide the technical follow-up to the project.

Outcomes

- Increase in the adaptive capacity of people in the communities through training.
- Increase in the adaptive capacity of institutions through coordination and linkages.
- Access to safe drinking water and health improvement.
- Safeguards in case of flooding in stilt houses.
- Decrease of vulnerability to extreme climatic events through mangrove reforestation.
- Productive diversification and increase in purchasing power through the sustainable use of mangroves.

Good practice and lessons learned

- Processes and structures that are particularly conducive for stakeholder engagement (e.g. for engagement of local communities and the most vulnerable, and consideration of traditional, indigenous and local knowledge in adaptation planning and processes): diagnostic workshops and links with key stakeholders, including government institutions, NGOs, academics and communities.
- Monitoring and evaluation (including how monitoring and evaluation methods and tools have been used to inform iterative adaptation planning processes). Periodic reports of the realized activities are undertaken, including through photos and videos. Informative meetings and a survey to collect baseline data will also be carried out so as to evaluate the effectiveness of the measurements at the end of the project.

Implementing partners

- World Bank. Implementing agency of the Global Environment Facility (GEF).
- Nacional Financiera (National Financial). Recipient's financial agent.
- Comisión Nacional del Agua (CONAGUA) (National Water Commission). Collaborator.
- Secretaría de Medio Ambiente y Recursos Naturales, Delegación en el Estado de Tabasco (Ministry of the Environment and Natural Resources in

the State of Tabasco). Local support.

- Desarrollo Integral de la Familia (DIF) del Gobierno del Estado de Tabasco (Integral Development of the Family of the Government of the State of Tabasco). Local support.
- Protección Civil del Gobierno del Estado de Tabasco (Civil Protection of the Government of the State of Tabasco). Local support.
- Secretaría de Energía, Recursos Naturales y Protección Ambiental del Gobierno del Estado de Tabasco (Ministry of Energy, Natural Resources and Environmental Protection of the Government of the State of Tabasco). Local support.
- Gobierno municipal de Cárdenas, Tabasco (Municipal government of Cárdenas). Local support.
- Centro Internacional de Investigación, Demostración, Captación y Servicio en Aprovechamiento de Agua de Lluvia (International Centre for Research, Demonstration and Catchment Service in Rainwater Harvesting). Installation of a rainwater harvesting system and training.
- Fundación Hijos de la Tierra (Children of the Earth Foundation). Construction of stilt houses and training.
- Adis Bacab Tenosique (Agencia social para el desarrollo integral sustentable) (Social agency for sustainable development). Mangrove reforestation and training.
- Independent consultant. Establishment of a Management Unit for the Conservation of Wildlife (UMA) and training.
- Communities of El Golpe, El Mingo and Las Coloradas, Tabasco. Beneficiaries of adaptation measures.

Date of submission

April 12, 2016

Further information

INECC website: <http://www.inecc.gob.mx/>

4. MEXICO | Coastal watershed conservation in the climate change context

Instituto Nacional de Ecología y Cambio Climático (INECC)

Sectors	Adaptation element	Climate hazard
Ecosystem-based adaptation, water	Adaptation planning and practices, capacity-building, institutional arrangements	Loss of biodiversity, shift of seasons, tropical cyclones/typhoons, wildfire
Description of the activities	<p>This project promotes integrated management of the 16 coastal watersheds (6 in the Gulf of Mexico and 10 in the Gulf of California) to conserve biodiversity, contribute to mitigation and strengthen the sustainable use of natural resources. The project is to take place between 2014 and 2018, and will contribute to the recovery of watersheds and the maintenance of the provision and regulation of ecosystem services. Three public institutions (Instituto Nacional de Ecología y Cambio Climático (INECC), Comisión Nacional de Áreas Naturales Protegidas (CONANP) and Comisión Nacional Forestal (CONAFOR)) participate in this project, as well as one private institution Fondo Mexicano para la Conservación de la Naturaleza (FMCN). The project aims at fostering synergies and collaboration among the working group.</p> <p>Some of the most important aspects of the project are the social participation and governance through regional committees which allow for improved planning processes and exchange of experiences. One of the most important strategies is the identification management practices that promote the hydrological ecosystem services through the incorporation of actions using local knowledge and capabilities.</p>	
Outcomes	<p>Through an open call, the project selected 35 subprojects that would benefit from three-year financing (semi-annual reviews). The projects are located in selected priority areas of the Gulf of Mexico and the Gulf of California coastal watersheds.</p> <p>The projects are focused on ecological restoration, ecosystem conservation, sustainable forest management and agro-ecology practices.</p>	
Good practice and lessons learned	<p>The two best practices that have been identified so far are:</p> <ul style="list-style-type: none"> ▪ The development of institutional coordination so as to focus efforts with a common vision in each of the watersheds and increase connectivity between high and low watershed areas through protected natural area consolidation. ▪ The development of targeted payment for ecosystem services and identification of local knowledge on sustainable land management practices, in keeping with the watershed approach, so as to concentrate positive 	

externalities in the territory.

- Implementing partners**
- Comisión Nacional de Areas Naturales Protegidas (National Commission of Natural Protected Areas): protected natural area consolidation.
 - Comisión Nacional Forestal (National Forestry Commission): payment for ecosystem services.
 - Fondo Mexicano para la Conservación de la Naturaleza (Mexican Fund for the Conservation of Nature): project management of sustainable land management.

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Further information INECC website: <http://www.inecc.gob.mx/>

E. South America

1. **BOLIVIA (PLURINATIONAL STATE OF)** | Use of bocachi fertilizer to adapt to the impacts of frost in Bolivia

Food and Agriculture Organization of the United Nations (FAO)

Sectors	Adaptation element	Climate hazard
Agriculture, ecosystem, food security	Adaptation planning and practices, knowledge management	Drought, extreme cold

Description of the activities The tropical Andes play a fundamental role for the food security of communities in the region. In the past, Andean agriculture could maintain a diversity of crops, even though agriculture in the high plateau area is exposed to severe climate conditions. In the Bolivian province of Omasuyos, located more than 3,800 m above sea level, climatic phenomena such as drought spells, cold spells and hail are frequent during winter, putting crop production at risk.

In response to the harsh climatic conditions, communities and farmers of the Union de Asociaciones Productivas del Altiplano (UNAPA) have developed an organic fertilization practice which enhances the resilience of crops to climate hazards. The bocachi fertilizer is based on natural ingredients widely available in the area. Its preparation is easy and relatively quick. It is effective to counteract impacts of cold spells or hail, and is considerably increasing the yields, even under extreme weather conditions.

The effects of climate change, in combination with the existing socioeconomic pressures, contribute to the severe degradation of these fragile ecosystems, with impacts not only on the communities located more than 3,000 m above sea level, but also in lower surrounding areas. These developments increase the importance of the broader use and further dissemination of techniques such as use of bocachi fertilizer.

Description of the sites

The pilot sites where the technique has been successfully tested are in the Omasuyos Province where the Achacachi community lives. This community is located near the Titicaca Lake, 3,850 m above sea level. The weather in the region is variable, with average temperatures ranging between 7° C and 18° C throughout the year; nonetheless, extreme temperatures decrease to as low as -13° C during winter.

Low precipitation rates cause soil to lack organic material due to the scarce

growth of vegetables, which affects their productivity.

Description of the good practice developed by the local farmers

The elaboration process for the production of bocachi fertilizer consists of two phases. The first phase is the fermentation of the components, and the temperature may rise up to 70–75° C due to the increase in the microbial activity; subsequently, the temperature will decrease due to exhaustion of the energy source. The second phase begins when the fertilizer initiates a stabilization process until it reaches a state that allows immediate utilization.

▪ Preparation of bocachi fertilizer:

Step 1: Solid components are arranged in layers. First, a layer of weeds, covered by a layer of dung, a layer of ash and a layer of bran. Between layers, a layer of sugared water and yeast.

Step 2: When the heap reaches approximately 1.5 m in height, everything is dampened homogeneously with sugared water, water and yeast. Humidity must reach 40 per cent; it is possible to determine the level by taking a handful of the mixture and compressing it (the mixture should not crumble or drip).

Step 3: The heap is then protected with a plastic cover secured to the ground with stones. This will allow humidity to be maintained during the fermentation process.

Step 4: The mixture must be turned over every 12 hours over a period of one week, approximately, to prevent the fertilizer from burning up. It is necessary to verify that the temperature range is between 35 and 50 °C. The temperature may be controlled by introducing a machete in the mixture for two minutes. When removed, the machete should be cold enough to be held in the hand. If this is not the case, the mixture should be turned over until it reaches the desired temperature.

The fertilizer is ready when the mixture starts producing a fermented odour and is covered with fungus colonies. If, on the contrary, the mixture gives off a rotten odour, it means that the fermentation process was not successful. The fermentation process should not exceed 30 days. It is recommended for use immediately after it is ready.

Finally, once the fertilizer has cooled down, it must dry up in the shade, extended on a cement surface to be then stored in bags.

▪ Application of bocachi fertilizer:

When applied, the fertilizer should not be in contact with the roots, since the fermentation process continues and there is a risk of burning the plant. The

fertilizer is usually applied before and after a cold spell/hail.

In order to build evidence of the benefits of bocachi fertilizer use on crops, a field trial was implemented on potato crops, whereby two plots were sown with the same potato breed. One plot remained as the control plot with no treatment and on the other plot the crops were treated with foliar application of bocachi fertilizer four times: once during an emergency phase and three times to recover from frost damage.

- Scientific background to the process of fertilization through the use of bocachi:
 - The use of organic fertilizers improves soil properties through the incorporation of nutrients and micro-organisms, and regulates the pH. The use of bocachi fertilizer reduces the dependence on other external inputs (often not available in isolated communities). It can be locally produced based on locally available resources, and thus in a sustainable way.
 - Bocachi fertilizer is produced through a fermentation process of organic material. It is done by piling up heaps of suitable materials. Under good humidity and temperature conditions, micro-organisms decompose and the simplest fraction of organic material, such as sugars, starch and proteins, release their nutrients. The elaboration of this fertilizer has advantages even when compared to other organic fertilizers, including:
 - It produces neither toxic gases nor bad odours.
 - Low cost of production.
 - There are neither storage nor transportation problems.
 - The product may be produced in a relatively short period of time (depending on the environment, between 12 and 24 days).
 - The product can be utilized immediately after its preparation.

Outcomes

The potato field trial yielded 10 t/ha for the control plot and 18 t/ha for the bocachi-treated plot.

The plot treated with bocachi fertilizer developed crops with higher leaf mass, greener leaves and more resistance. In addition, the treated crops were more resistant to climate stresses such as drought and frost incidents that occurred during the period 2008–2009.

Good practice and lessons learned

The development of organic foliar fertilizers is part of the practices included in organic agriculture. Through this practice, the community and other farmers have gained knowledge on how to adapt to and manage climatic variability in agriculture and minimize yield losses due to climate change. Further, the use of bocachi fertilizer has been taught to other farmers outside of the Achacachi community. The process of knowledge-sharing was mainly

done through farmer-to-farmer dissemination and, thereby, the good practice was more widely recognized and accepted by neighbours and community members. This knowledge-sharing also occurred through events where farmers could meet and share their experiences, such as at production fairs. Other success factors include the generation of low-cost and effective products for the users, in comparison with costly inorganic fertilizers. A cost–benefit analysis revealed the practice to be beneficial in terms of low-cost and easy access for the beneficiaries. The use of bocachi fertilizer has generated income for the users and has therefore improved livelihoods and food security.

Implementing partners

- Unión de Asociaciones Productivas del Altiplano (UNAPA): local coordination.
- Swiss Agency for Development and Cooperation: funding agency.

Date of submission

April 19, 2016

Further information

- Report on the use of bocachi fertilizer to adapt to the impacts of frosts in Bolivia. Available at <http://www.fao.org/climatechange/25215-0c721b24a5e73d4b2ce1fddbd1287b750.pdf>
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- “Preparando abono bocachi”. IDMA Perú (video in Spanish). Available at <http://www.youtube.com/watch?v=XounBoi5WYA>
- Colegio de Profesionales en Ciencias Agrícolas de Honduras y Cooperación Técnica Alemana. Available at <http://coopcoffees.com/for-producers/documentation/agriculture/produccion-de-abono-organico.pdf>
- FAO document repository. *Sistematización de Buenas Prácticas en el Marco de la Prevención y Mitigación de Siniestros Climáticos en el Sector Agropecuario Caso Territorio Indígena Jach’a Suyu Pakajaqi en el Altiplano Central y Yapuchiris en Omasuyos, Altiplano Norte*. Available at <http://www.fao.org/docrep/013/al930s/al930s00.htm>
- FAO website: <http://www.fao.org/>

2. **BOLIVIA (PLURINATIONAL STATE OF)** | Observation of bioindicators as early warning systems to mitigate the impacts of frosts and droughts in Bolivia
 Food and Agriculture Organization of the United Nations (FAO)

Sectors	Adaptation element	Climate hazard
Disaster-risk reduction, ecosystem-based adaptation, ecosystems, indigenous and traditional knowledge	Adaptation planning and practices, knowledge management	Drought, extreme cold, shift of seasons
Description of the activities	<p>Weather in the Andean high plateau is characterized by extreme climate events with serious impacts for agriculture, increasing the vulnerability of farmers. The lack of forecast weather stations in the region leads to a lack of data and thus weakens timely decision-making. Implementation of modern agro-meteorological services would imply high costs. However, local communities in the Omasuyo Province in Bolivia (Plurinational State of) traditionally rely on the observation of local bioindicators which provide a type of local agro-meteorological service that has produced reliable guidance over centuries for mitigating the impacts of extreme climate events on crops.</p> <p>The objective of the activities is to reduce vulnerability to climate events in the high plateau area through the observation of bioindicators.</p>	
Outcomes	<p>The validity of bioindicators is monitored by communities, by filling in cards every day describing the local weather.</p>	
Good practice and lessons learned	<p>The following examples include some of the lessons learned regarding bioindicators:</p> <p>Qariwao waycha (Senecio claviculus)</p> <p>This small bush grows in the Bolivian high plateau and is often located on river banks. The waycha bush blooms three times a year. The first flowering period occurs during June, the second in September and the third in November. Its three yearly blossoms are considered as bioindicators. Blossom periods are directly related to the three harvests: early harvests (nayra satas), middle harvests and late harvests (qhipa satas). If frosts do not affect the bush or its flowers during these periods, the harvest is expected to be successful. On the contrary, if the waycha is affected by a frost while blooming, the corresponding harvest will not be successful. Furthermore, places where this bush grows indicate good areas where potatoes should be cultivated.</p> <p>Chiilliwa (Festuca dolichophylla)</p> <p>This grass is widely present in the high plateau, in particular in humid places</p>	

near river banks. As a bioindicator, the colour of the stem is observed: if it is transparent and scaly, it is a sign of regular precipitation and favourable production. In addition, ripe and large seeds are a sign of good production of quinoa.

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Further information

- For additional information on bioindicators and their validity, see <http://teca.fao.org/technology/observation-bioindicators-early-warning-systems-mitigate-impacts-frosts-and-droughts>
- FAO website: <http://www.fao.org/>

3. **PERU | MARISCO** – Adaptive risk and vulnerability management and strategies for climate change adaptation in the El Sira Community Reserve. Project: Biodiversity and climate change in the El Sira Community Reserve

[Deutsche Gesellschaft für Internationale Zusammenarbeit \(GIZ\)](#)

Sectors	Adaptation element	Climate hazard
Biodiversity, ecosystems, indigenous and traditional knowledge	Adaptation planning and practices	All climate hazards

Description of the activities MARISCO ((Manejo Adaptativo de Riesgo y Vulnerabilidad en Sitios de Conservación – adaptive risk and vulnerability management at conservation sites) is a methodological approach used to facilitate the integration of the risk and vulnerability perspective into the management of conservation projects and sites. It is designed to take into account the impact of climate change in the strategic management of protected areas, although it is not confined solely to climate change. While other scientific approaches to vulnerability assessments focus on prediction models based on biophysical data, MARISCO integrates both scientific data and information on other stakeholders, such as indigenous groups. Key to this method is the input of multi-stakeholder groups which meet and discuss ecosystem services and the likely impacts of climate change, as well as other direct and underlying threats. This discussion is supported by further knowledge, such as scientific data that are collected beforehand and presented in a way that is easy to understand during the meetings of stakeholders.

The MARISCO method is based on theoretical considerations of climate change adaptation and risk management in conservation activities. It has been developed by the Centre for Economics and Ecosystem Management at the Eberswalde University for Sustainable Development. The method was tested and further developed at a number of conservation sites on different continents in countries such as China, Costa Rica, Ecuador and Peru in collaboration with the [Deutsche Gesellschaft für Internationale Zusammenarbeit \(GIZ\)](#) on behalf of the German Federal Ministry for Economic Cooperation and Development and the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety.

Application of the MARISCO method in the El Sira Community Reserve

The El Sira Community Reserve, located in the Peruvian Amazon, was established by the Peruvian State to conserve biological diversity for the benefit of the indigenous Ashaninka, Asheninka, Shipibo-Conibo and Yanesha ethnic groups living in the area. The main task of the project “Application of the MARISCO method in the El Sira Community Reserve” was to analyse

vulnerability, together with the organizations involved, as a step towards identifying climate change mitigation and adaptation strategies.

Representatives from indigenous communities, as well as a local organization, representing all the communities in the area around the reserve, participate with others in the workshops in the course of the project. The participants of the workshops worked through an iterative process, contributing their knowledge of the status of the reserve and its forests for the actualization of the management plan.

Following on from the work in the El Sira Community Reserve, a second project, “Biodiversity conservation through co-management in the Peruvian Amazon” (CoGAP), was organized to build on the achievements of the El Sira project and to share experiences and findings with other community reserves. The CoGAP project aimed to promote the protection of biodiversity through co-management and the sustainable use of natural resources in selected conservation areas and their buffer zones.

Outcomes

The workshops led to a good understanding of the vulnerability of the ecosystems of the region. Three local models were made and integrated into one large conceptual model covering the whole region.

The method facilitated the participation of local stakeholders and the contribution of indigenous knowledge.

In addition, recordings of indigenous knowledge were made in order to facilitate its transfer to the younger generation and ensure its maintenance.

Good practice and lessons learned

Lessons learned

The main findings of the El Sira project were the need to update continuously and adapt the initial formulated situation analysis to changes and developments over time in order to achieve efficient co-management. Furthermore, the legal requirements needed to be revised, partners strengthened and participation mechanisms improved.

Good practices

- Including all stakeholders:

The participatory method facilitated the active participation of local stakeholders and those with knowledge of the area, and also guided the discussion and analysis step by step through very complicated and complex issues. For these reasons, the method was appreciated by the participants.

- Raising awareness of climate change:

Furthermore, the iterative and participatory process helped to raise awareness of climate change among participants drawn from very different backgrounds and

with a range of divergent skills and levels of understanding of vulnerability, risk/threat dynamics and contributing factors. Climate change and adaptation were recognized as cross-cutting issues that can no longer be analysed or addressed in a piecemeal manner.

- Promoting and maintaining traditional and indigenous knowledge:

In order to reduce the area's vulnerability to climate change and other risks and factors, complementary strategies were designed to promote cultural activities and the recording of traditional knowledge for use in the future. It was felt that local knowledge was valued and needed to provide support to enable communities to adapt to climate change and prepare for extreme weather events (including assistance to improve agricultural production), as well as to promote fire control and prevention and support local governments in their development planning, including with regard to the climate change perspective.

The project developed an activity called "Biodiversity fair" (Ferias de biodiversidad) to contribute to the complementary strategy to promote cultural activities and the recording of traditional knowledge for future use, classified in the analysis as top priority. This will promote traditional knowledge among school children and re-evaluate the use of local biodiversity. The fairs were held very successfully with considerable interest shown by people from the villages and local communities, as well as by participants from ECOSIRA and Servicio Nacional de Áreas Naturales Protegidas por el Estado (SERNANP).

Date of submission 2013

F. Pacific/Oceania

1. AUSTRALIA | Community-based fire management in the Tanami Desert region of central Australia

Food and Agriculture Organization of the United Nations (FAO)

Sectors	Adaptation element	Climate hazard
Community-based adaptation, disaster risk reduction, indigenous and traditional knowledge, ecosystems	Adaptation planning and practices, knowledge management	Wildfire
Description of the activities	<p>For millennia, Aboriginal people have applied fire to their country to serve myriad purposes. Today, the indigenous people of the Tanami Desert in central Australia continue the practice of applying fire to their land systematically and, in so doing, maintain a central strand of their culture and connection with their traditional country. While fire is a part of daily life in desert communities, in mainstream Australia it is gaining recognition as a critical tool for the maintenance and protection of biological and cultural assets.</p> <p>Over the last 12 years, the Central Land Council (CLC)⁴ has actively encouraged and supported the involvement of Aboriginal people in community-based fire management (CBFiM) in the Tanami region. For the last five years, this programme has had at its core an evolving participatory process with traditional owners of the region that combines traditional and contemporary fire knowledge, practices and technologies in annual cycles of planning, implementation, monitoring and review.</p> <p>Aboriginal knowledge regarding fire management</p> <p>Aboriginal oral history recorded in songs and stories passed down from generation to generation over thousands of years suggests that fire was applied deliberately, systematically and broadly across much of the Australian continent prior to European colonization. This evidence is supported by the records of nineteenth-century European explorers who routinely recorded fires burning in the landscape (Jones, 1969; Griffin, 1992). It is thought that over tens of thousands of years the biota of the Australian arid interior was modified by its inhabitants, who effectively “farmed” the country with fire (Latz, 2007). This “firestick farming” (Jones, 1969) has created a patchwork mosaic of postfire ages</p>	

⁴ The Central Land Council was established under the Aboriginal Land Rights (Northern Territory) Act 1976 with, among other functions, statutory responsibilities for Aboriginal land acquisition and land management for an area of approximately 780,000 km² in the southern half of the Northern Territory. The Council comprises 90 Aboriginal people elected from across its vast region, representing some 24,000 Aboriginal people from 15 language groups.

in spinifex-dominated landscapes (Burrows and Christensen, 1991), which has induced a higher level of biodiversity and productivity than would otherwise have occurred. It has also protected the many areas of significant biological and cultural value from the harsh and destructive effects of intense summer wildfires, particularly along travel routes where burning activity was focused (Griffin, 1992).

Belatedly today, the mainstream scientific and land-management communities have recognized the wildfire prevention and biodiversity values of traditional burning practices. Current practices aim to emulate the pre-European state of widespread fire application both to maintain connection to the country and to protect the significant biological values of Central Australia. This case study describes how this goal is being achieved by Aboriginal people of the Tanami Desert, the many challenges involved in doing so successfully and the multiple benefits provided.

Project

In response to the above-mentioned issues, a programme of CBFiM has been developed by the Central Land Council together with Northern Tanami Indigenous Protected Area (IPA)⁵ management committees, traditional owners and Aboriginal ranger groups, with support from the Northern Territory government body responsible for fire control, Bushfires NT.

The objective of the programme in the Tanami region is to emulate previous periods of active fire management progressively over extensive areas, in a way that shifts the seasonality of fires back to a pre-European balance. It aims to make the best use of contemporary fire management tools and techniques, community governance structures and a depth of traditional knowledge, all to facilitate effective fire management by remote indigenous peoples across their lands.

The programme promotes local ownership of fire management activities and provides an important mechanism for maintaining connection to the country and culture, aspects of which are known to have tangible social and health benefits for Aboriginal people (Burgess et al., 2004).

Outcomes Improved fire management

- Well-resourced and informed ranger groups involved in all aspects of the programme.
- Improved relationships between traditional owners and government fire

⁵ An IPA is an area of indigenous-owned land or sea where traditional Aboriginal owners have entered into an agreement with the Australian Government to promote biodiversity and cultural resource conservation. In return, the Government agrees to give some support to the traditional owners to carry out the land-management work required to conserve the land's ecological and cultural value.

authorities.

- Improved access by Aboriginal people to technical expertise.

The results of burning activities are monitored through the acquisition and interpretation of satellite images as the burning season progresses, by the use of ‘hotspot’ fire-tracking websites, and through repeat visitations to burnt country. Satellite imagery is used to identify fire scars and areas of high fuel loads, and this information is then used to refine subsequent burning activities. Also, websites such as the North Australian Fire Information Service prove invaluable in monitoring the active spread of fires in remote areas.

Benefits to the Aboriginal people and their land

The evolving model of CBFiM in the Tanami Desert has seen tangible benefits for the country and its people. Key benefits seen so far include:

- Increasing levels of active participation and ownership by traditional owners.
- Improved relationships with neighbours of Aboriginal Land Trusts.
- Protection of cultural and environmental values, and the value of assets such as buildings.
- Reinvigorated connection of people with their remote country.
- Increased opportunities for intergenerational knowledge transfer.

Good practice and lessons learned

In order to support the many components of remote fire management by Aboriginal landholders in the Tanami Desert, a structured process of planning, implementation, monitoring and review has evolved over the last four years. This adaptive management model is integrated with IPA programmes and Aboriginal ranger group workplans to take advantage of existing governance structures, personnel and resources.

Five factors that have been critical to the programme’s success

1. The establishment and enhanced capacity of Aboriginal ranger groups in the region supported under the “Working on Country” programme of the former Department of the Environment, Water, Heritage and the Arts (DEWHA).
2. The development of two IPAs in the northern and southern portions of the Tanami Desert, with DEWHA funding support.
3. The establishment and resourcing of a dedicated fire management position within the Central Land Council (CLC).
4. The development of a peak Tanami Aboriginal regional fire management body, the Warlu Committee,⁶ through research supported by the Natural Resource Management (NRM) Board (NT).
5. The strong partnership approach taken by the CLC and Aboriginal traditional owners, together with the Northern Territory Government, and with Bushfires

⁶ “Warlu” means “fire” in Warlpiri, the largest language group of the Tanami.

NT, in particular.

The Warlu Committee consists of two elected representatives from seven key Aboriginal communities and one or more Aboriginal rangers from each. This group provides the strategic direction for fire management on Aboriginal land across the broader Tanami region. Members also sit on IPA management committees and regional fire-planning groups, thus forming a strong link between regional and local planning processes.

Process of regional fire planning

Regional fire planning occurs in five key communities, where groups of 30 to 40 people meet annually to plan and prioritize fire management activities for the coming fire season. The activities under consideration are in addition to traditional burning undertaken by family groups throughout the year on their more accessible country. In places where IPA committees operate, fire-planning workshops are held as part of the larger IPA pre-fire season planning meetings.

The ethos behind these planning meetings is to provide the best available contemporary knowledge, tools and technology to each group, so that they can combine these assets with their traditional knowledge and skills to enable them to make informed fire management decisions.

The annual planning workshops identify a selection of prescribed burning and wildfire mitigation activities that are required during the year. These activities, which may include both ground-based and aerial burning, are incorporated into the work programmes of Aboriginal ranger groups, members of which receive training by staff of the CLC and Bushfires NT. The operational costs are met primarily by the CLC, which accesses project-based grant funding from a variety of sources.

The use of Aboriginal knowledge on fire management fosters cultural maintenance

Prescribed burning and wildfire mitigation activities are undertaken as part of the larger body of work for that country, often in combined ‘country’ (cultural) fire trips. The benefits of pooling resources and combining burning activities with cultural maintenance have become very important for effective and strategic fire management practices, providing a familiar framework for traditional owners to re-engage with the broad-scale management of their country.

Similarly, land-management activities such as these are important opportunities to facilitate the intergenerational transfer of indigenous knowledge and skills regarding the country. The older generation of Aboriginal people in this area hold the most knowledge about the impacts of fire on the landscape, how to use it safely and the physical barriers used to stop its unwanted spread; many of them acquired this knowledge through walking through the country with their parents

and grandparents. They understand how best to use fire to keep their land and people healthy. They value the opportunities that land management presents them to be on the country with their young people, to teach them about fire and to impart other important cultural knowledge.

Monitoring and review of the burning activities

After the burning season has ended, the results of the year's activity are reviewed at an annual post-fire-season meeting of the Warlu Committee. At the annual meeting, Aboriginal rangers and members from across the Tanami Desert discuss the fire-related work they have done throughout the year, where they have had successes and where challenges need to be resolved. The committee provides these groups with feedback and guidance on the following year's strategies and on how the different groups can work together most strategically.

Success of the system: benefits for Aboriginal communities

The system of planning, implementation, monitoring and review enjoys a high level of participation because it provides Aboriginal people with the opportunity to make decisions about their lands and to work on their own country. More importantly, by using a participatory approach, Aboriginal people are able to influence the future of their culture and their children (Walsh and Mitchell, 2002).

In the past, fire management programmes have met with only limited success in Central Australia, in large part because of the area's vastness, the poor level of engagement with indigenous landholders by relevant authorities and the scarcity of resources available to implement management on this scale (Griffin, 1992). However, this new programme has a greater potential for success as a result of new partnerships based on:

- Mutual recognition of the role of fire in maintaining biodiversity and its cultural significance to Aboriginal people.
- The ability to leverage limited funding.
- The level of community ownership and participation.

Challenges and potential solutions

To ensure longevity, there remains an ongoing need to continue the development of capacity among local people to take more prominent roles in facilitating the fire management programme across the country in which they live.

- There are challenges at the policy level where the discord between indigenous and mainstream fire management practices continues to be evident (Vaarzon-Morel and Gabrys, 2008). Government policies that encourage traditional burning (Bird, Bird and Parker, 2003) and that recognize the nationally significant environmental service it provides would help to reconcile this

situation, as would formal recognition of the role of groups such as the Warlu Committee.

- There is a need to resource the operational aspects of the programme adequately, in particular, the costly activities of aerial burning and access track construction. These techniques are required both to meet the threshold needed to return fire regimes to a broad-scale traditional patchwork mosaic and to minimize risk. In the future, a greenhouse gases market, or a market based on other green and social services, may provide an economy that will fund fire jobs in the country and meet the operational costs of CBFiM in the Tanami Desert.
- There is also a need to fund and support research on the specific long-term biological impacts and benefits of changed fire regimes on different ecotypes in knowledge-poor bioregions. The first and most basic aspect is for fine-scale fire history and vegetation mapping across Central Australia.
- Programme participants are still learning how to apply fire on a broad scale to a highly flammable landscape that houses vulnerable ‘islands’ of ecological and cultural significance in contemporary Australia. The ability to manage the risks associated with applying fire at this scale will require increased collaboration with neighbours and will therefore provide more opportunities and benefits extending well beyond fire management.
- There are challenges involved in tailoring the format of review and planning workshops, as well as the language of fire, tools and techniques, to suit the several dominant indigenous language groups in the region.

Programme facilitators aim to understand better and further benefit from the wealth of traditional fire and country knowledge held by traditional owners. In return, contemporary burning activities will seek to better serve the aspirations of traditional owners for their country and their families, in particular by making a significant contribution to the transfer of traditional knowledge to future generations of indigenous managers of the Tanami landscape.

Date of submission

April 18, 2016

Further information

- The North Australian Fire Information Service is available at www.firenorth.org.au/nafi2/
- Information about the case study and good practice is sourced from: FAO. 2011. *Community-Based Fire Management: A Review*. Rome. Available at <http://www.fao.org/docrep/015/i2495e/i2495e.pdf>
- Authors of the case study for FAO: Gina Broun, Central Land, Alice Springs, Northern Territory, Australia; and Grant Allan, Bushfires NT, Alice Springs, Northern Territory, Australia
- For further information on fire management based on indigenous practices

in Australia, see *The Fire Book*, written for Indigenous communities in Central Australia and designed for use by indigenous community rangers, educators, land management agencies working with communities, etc. Available at

<http://www.schools.nt.edu.au/tlcland/publications/Fire%20Book.pdf>

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- GIZ website: <https://www.giz.de/de/html/index.html>

2. **PACIFIC ISLANDS** | Community relocation as an option for adaptation to the effects of climate change and climate variability in Pacific Island countries (PICs)
[Asia-Pacific Network for Global Change Research \(APN-GCR\)](#)

Sectors	Adaptation element	Climate hazard
Community-based adaptation, indigenous and traditional knowledge	Adaptation planning and practices, communication and outreach/awareness	Floods, sea level rise, storm surges, tropical cyclones/typhoons
Description of the activities	<p>There has been widespread conjecture that some, if not many, Pacific Island communities may have to be relocated in the event that climate change scenarios unfold as projected. The purpose of this project was to examine the implications of such an adaptive response.</p> <p>There were three main sets of activities. First, a literature and documentary search was conducted for examples of relocated communities in Pacific Island countries and for literature on the general issue of community relocation. Second, participatory research was conducted in the village of Biausevu, Fiji that had relocated in response to tropical cyclone related flooding. Third, a regional workshop was held in which participants shared experiences and/or expectations of relocation in their countries. In this workshop, information was also reported on the village-based research and training sessions were conducted using hypothetical scenarios where community relocation may be considered as an adaptation option.</p>	
Outcomes	<p>Community relocation is not uncommon in the Pacific region, although in many cases the distances moved are relatively short. Long-distance relocation is quite rare, especially in the post-colonial era. However, if climate change scenarios are borne out it, may well be that communities in countries entirely comprised of atolls may have to face the need for such relocation in the future.</p>	
Good practice and lessons learned	<p>Lessons learned:</p> <ol style="list-style-type: none"> 1. While it would appear that the current site is safe from flooding (the stability of its slopes notwithstanding) it took over a century (and three ‘failed’ relocations) before this was achieved. There were reasons for this. The technology for removing part of the hill at Koroinalagi was not really available until the post-war period and the means of piping water from a suitable head had become considerably cheaper as well. Nevertheless, it could be claimed that the three choices of relocation sites were inappropriate, although the choices were limited. 2. Leadership played a vital role in bringing about the community relocation. This included envisaging the scheme and achieving ‘buy in’. A key role was played by the late Ratu Filise Matabogi, a buli in the Fijian administration 	

- who developed the scheme and pushed it through [the approval process?].
3. Community cooperation was also important. Biausevu is the chiefly seat for the Vusu yavusa and assistance was given by people from other villages with Vusu people: Komave and Namatakula.
 4. Relocation can be very expensive, especially if significant groundwork and infrastructure development is needed. The costs include site preparation, house building (cost of materials and in some cases of hiring carpenters), provision of transport access, and other infrastructure development, including establishment of a reliable water supply.
 5. Water supply is very important as relocation sites are often away from lower land (where fresh water is found) in higher elevations that are safer from the threat of either flooding or storm surge. This raises the issue of how water can be delivered to the relocation site.
 6. Relocation is a relatively long-term process and may take several years. In the event that the original site has been badly damaged or destroyed by an extreme event, there is likely to be a need for temporary accommodation at or near the relocation site.

Date of submission

April 13, 2016

Further information

- This study focused on rural communities. There are two issues associated with urban areas that need to be considered in relation to relocation:
 - First, nearly all urban areas in Pacific Island countries are in coastal locations. Should sea level rise or flooding become a threat to these sites, the relocating of, at least parts of, urban areas will need to be considered. This has numerous implications relating to such considerations as land availability, infrastructure and informal urban settlements (many of which are located in at-risk sites, such as wetlands).
 - The second factor concerning urban areas is that many relocated communities may have little option other than to move to urban areas given the importance attached to land tenure. In the study, there are several references to urban communities of migrants (not relocatees). The problems of such communities and their adaptive strategies (to urban living) may provide important lessons for communities that may find themselves forced to relocate to urban areas. It is possible that a very large number of Pacific Island communities may have to relocate as a result of climate change. Such relocations will be of a variety of distances and cross a range of boundaries and borders. All are likely to have considerable costs involved and some will be long term. Research is needed to look at ways in which such costs can be reduced.
- *Community Relocation as an Option for Adaptation to the Effects of Climate Change and Climate Variability in Pacific Island Countries*

(PICs). Available at <http://www.apn-gcr.org/resources/items/show/1519>

- APN-GCR website: www.apn-gcr.org

3. **SOLOMON ISLANDS** | Increasing community resilience to natural disasters through the use of traditional coping strategies on the weather coast Guadalcanal communities in the Solomon Islands

[International Fund for Agricultural Development \(IFAD\)](#)

Sectors	Adaptation element	Climate hazard
<p>Agriculture, adaptation finance, biodiversity, coastal areas/zones, community-based adaptation, ecosystem-based adaptation, ecosystems, food security, food systems, farm systems, gender, indigenous and traditional knowledge, infrastructure, livestock, marine fisheries, service, tourism, water</p>	<p>Adaptation planning and practices, education and training, knowledge management, vulnerability assessment</p>	<p>Drought, storm surges, tropical cyclones/typhoons</p>
Description of the activities	<p>The project “Increasing community resilience to natural disasters through the use of traditional coping strategies on the weather coast Guadalcanal communities in the Solomon Islands” was financed through the International Fund for Agricultural Development (IFAD) Indigenous Peoples’ Assistance Facility (IPAF). The organization responsible for the project is the International Solomon Island Development Trust (SIDT).</p> <p>Total project cost: USD 48,000.</p> <p>Total IFAD financing (IPAF grant): USD 40,000.</p> <p>Implementation period: 2012–2014.</p> <p>IPAF was designed as an innovative financial approach that would enable direct partnerships to be built among indigenous peoples’ communities, grass-roots organizations and non-governmental organizations working with indigenous peoples in Africa, Asia and Latin America. IPAF also serves as a listening and learning instrument, which is useful in determining indigenous peoples’ needs, proposed solutions and innovations. As a community-driven fund, it is able to scout for innovations and pilot projects that could open the way for larger projects. It also has the potential to become a partner in strengthening indigenous peoples’ intercultural dialogue on national, regional and global policies that directly and indirectly affect them.</p> <p>The main objective of IPAF is to select and finance microprojects. Projects are referred to as ‘microprojects’, inasmuch as applicable grants cannot exceed USD 30,000 (most have budgets ranging from USD 10,000 to USD 30,000)</p>	

and the projects cannot run for more than one year.

One thing that differentiates all microprojects from other initiatives is the fact that they were conceived on the basis of a demand expressed directly or indirectly by the final beneficiaries and that the degree of ownership by the beneficiaries and the implementing organizations has been very effective. Some distinctive cross-sectoral issues in many of these microprojects set them apart from many other initiatives (i.e. livelihoods, land and territories, gender, local traditional knowledge and identity and culture).

In the Solomon Islands in Melanesia, a microproject was implemented with the Babanakira and Kolina communities. In the past, the Solomon Islands have suffered a large number of natural and human-induced disasters. The most recent of these was the April 2007 tsunami, which hit the western part of the country, causing the loss of many human lives and the destruction of livelihoods, and leaving a large number of people homeless. Moreover, between 1999 and 2003, these islands were the scene of violent conflict, which also had devastating effects on the population.

The project strategy and activities

Babanakira is the collective name for a series of villages located in the Guadalcanal Province, which are accessible only by sea and locally known as the “unpredictable weather coast area”. This is the area where the International Solomon Island Development Trust promoted the recording of traditional knowledge and practices concerning prevention measures and response mechanisms with the purpose of mitigating the effects of natural disasters. Consultations with elders and leaders served to document (i.e. transfer from oral to written) the indigenous peoples’ knowledge. The participatory rural appraisal method was applied in 11 communities to assess the situation of the villages, create maps of the communities (including hazard areas and risk maps), establish the seasonal calendar and historical timelines, and develop community disaster plans.

Outcomes Traditional indigenous peoples’ knowledge on response mechanisms was gathered and transmitted to the National Disaster Management Office. The International Solomon Island Development Trust then drafted a manual of response techniques, including both indigenous peoples’ knowledge and conventional knowledge.

Good practice and lessons learned The project was successful in recording and reviving indigenous peoples’ knowledge on coping mechanisms – “the knowledge you cannot uproot” – proving that such knowledge can enhance conventional techniques of disaster risk reduction and should be preserved and scaled up. From the hazard-ranking exercise, it emerged that the most frequent threat in Guadalcanal is flooding, followed by cyclones, drought, earthquakes, landslides and tsunamis. In

response to such hazards, the indigenous peoples of Guadalcanal have based their early warning system – key to their survival – on their ability to predict seasonal events by observing events in the surrounding natural world and establishing the link between the two.

The communities' traditional disaster preparedness mechanisms consist of revegetating coastal foreshores with native species, in order to cope with sea level rise, and careful household preparation prior to cyclones or flooding events, such as cutting trees around houses and reinforcing houses with reeds and branches. Preservation of the environment is also enforced by cultural rules, including restrictions in the form of taboos, bad luck or superstition around some communities' areas and fishing grounds in order to preserve them from landslides caused by excessive cutting of trees and exploitation of fisheries. Furthermore, careful and responsible management of resources enables the indigenous peoples' communities in the Solomon Islands to plan the necessary coping strategies. For example, they diversify their crops and rely on wild species to cope with food shortage. Matured crops or fruits from trees are collected and cooked in an underground oven pit for preservation and consumption in times of scarcity. Each year, before the dry season, farmers plant certain crops such as kumala (sweet potato), different varieties of yam, giant swamp taro and wild cassava, because these plants are known to survive seasons with low rainfall and provide a secure source of food. The project also documented that the indigenous peoples consume wild edible plants (e.g. napalanku, ialken-apen and karwatu) as a substitute for vegetables in times of scarcity and in the aftermath of a hazard, and that they manage marine resources as safety nets, occasionally closing the fishing grounds until a resource recovers. Lastly, the project reported that the differing knowledge of men and women plays an important and complementary role during disasters.

Implementing partners Federación de Club de Madres; Central de Comunidades Nativas de la Selva Central (Bolivia (Plurinational State of)); Ministry of Agriculture, Livestock and Fishery (Ecuador); Initiative for Living Community Action (Ethiopia); Society for the Protection of Animal Life and the Environment (Cameroon); Centre for Development Action (Orissa, India); Thenkhleg Khugjil (Mongolia); International Solomon Island; Aoke Langanga Constituency Apex Association (Solomon Islands); Bioversity International.

Date of submission April 11, 2016

**Further
information**

- For more information on the engagement of IFAD with indigenous peoples, see https://www.ifad.org/topic/overview/tags/indigenous_peoples
- Indigenous Peoples Assistance Facility website: https://www.ifad.org/topic/ipaf/overview/tags/indigenous_peoples
- IFAD website: <https://www.ifad.org/home>

II. Tools and methods

A. Global

1. **AFRICA, ASIA** | Vulnerability and risk assessment tool *Adaptation at Scale in Semi-Arid Regions (ASSAR)*

Sectors	Adaptation element
Adaptation finance, agriculture, coastal areas/zones, community-based adaptation, crops, disaster risk reduction, ecosystem-based adaptation, ecosystems, food security, food systems, farm systems, horticulture, indigenous and traditional knowledge, livestock, marine fisheries, service	Adaptation planning and practices, capacity-building, communication and outreach/awareness, education and training, impact assessment, institutional arrangements, science and research, vulnerability assessment, socioeconomic data and information, stakeholder involvement
Description of the tool/method	<p>The Adaptation at Scale in Semi-Arid Regions project utilizes Oxfam’s vulnerability and risk assessment (VRA) tool, which develops a holistic, landscape-wide understanding of vulnerability and links up actors across various levels of governance to jointly identify and analyse the root causes of vulnerabilities for distinct social groups and subsequently design programmes and risk reduction initiatives accordingly, ensuring that they are equitable, gender-sensitive and effective.</p> <p>The methodology promotes the inclusion of local and traditional knowledge in the process of understanding vulnerability and designing responses.</p> <p>Attention to historical and evolving power dynamics is fully embedded into the design of the VRA, primarily through the convening of a “knowledge group” to inspire and drive the analysis.</p>
Good practice and lessons learned	<p>VRA is designed to:</p> <ul style="list-style-type: none">▪ Develop a shared understanding of the links between local, regional, national and global drivers of vulnerability and risk in a given landscape.▪ Build understanding of the root causes and drivers of vulnerability for different people and social groups.▪ Support the joint identification and prioritization of hazards, issues, social groups and livelihood activities.▪ Inspire different stakeholders to discuss and explore governance-driven inequalities, climate change impacts, the capacity of people and the resulting vulnerabilities.▪ Enable participants to discuss future aspirations and visions of a resilient

future, including pathways to transformational change.

- Integrate different types of knowledge, including local and traditional knowledge, scientific knowledge and knowledge from policy and practice.
- Identify and explore how gender norms shape and constrain people's responses to hazards and issues, and address these with the aim of strengthening the rights of women.
- Promote inclusive decision-making, raise 'red flags' concerning specific groups at risk of being further marginalized or vulnerable.
- Enhance collaboration across sectors and levels of governance.
- Strengthen local-level or other existing technical vulnerability assessments.
- Support the joint identification of potential responses to reduce vulnerability and promote buy-in for sound adaptation planning.
- Promote innovation and new ways of working and thinking.
- Strengthen the accountability of decision makers to communities.
- Encourage long-term, flexible decision-making and planning.

Implementing partners Under the Adaptation at Scale in Semi-Arid Regions (ASSAR) project, Oxfam has trained participants from the University of Botswana, University of Cape Town and University of Namibia in the methodology.

Date of submission April 19, 2016

Further information

- *Finding Ways Together to Build Resilience: The Vulnerability and Risk Assessment methodology*. January 2016. This paper contains detailed information about the tools, case studies, lessons learned and recommendations. Available at <http://policy-practice.oxfam.org.uk/publications/finding-ways-together-to-build-resilience-the-vulnerability-and-risk-assessment-593491>
- *Reflections on a Multi stakeholder Workshop in Botswana*. February 2015. This article reports on the use of the VRA methodology at a workshop in Botswana. Available at <http://www.assar.uct.ac.za/news/reflections-multi-stakeholder-workshop-botswana#sthash.M1zCONiD.dpuf>
- VRA page on Oxfam's website: http://policy-practice.oxfam.org.uk/our-work/climate-change-drr/vulnerability-risk-assessment#contentprimary_0_ctl00_FirstTab
- Blogs on vulnerability and risk assessments:
 - <http://policy-practice.oxfam.org.uk/blog/2016/01/what-weve-learned-about-vulnerability-assessments>
 - <http://www.assar.uct.ac.za/VRA%20workshop>
 - <http://acdi.uct.ac.za/blog/can-community-institutions-enhance-behaviour-changes-towards-adaptation-climate-change>
- ASSAR website: <http://www.assaradapt.org/>

2. GLOBAL | The Sacred Groves and Green Corridors method (SGGC method)

Active Remedy Ltd.

Sectors	Adaptation element
Biodiversity, community-based adaptation, gender, horticulture, disaster-risk reduction, ecosystem-based adaptation, ecosystems, food security, human settlements, indigenous and traditional knowledge, water	Adaptation planning and practices, capacity building, education and training, financial support, impact assessment, institutional arrangements, vulnerability assessment, socio economic data and information, stakeholder involvement
Description of the tool/ method	<p>The Sacred Groves and Green Corridors (SGGC) method has been formulated in conjunction with traditional indigenous mountain people over many years. It offers a diversity of approaches that understand, respect and are adaptable to local ecosystems, values and spiritual customs throughout the mountain regions of the world. It is a horticultural method of working directly with mountain communities that integrates modern and traditional knowledge and conservation methods, along with long-term sustainability concepts. It does this through combining the conservation methods of sacred groves, green corridors/greenbelts, permaculture and companion planting.</p> <p>The SGGC method is based on two distinctive key features – safeguarding the ecological mechanisms which regulate global water and climate cycles, along with combining traditional, local indigenous knowledge and modern conservation practices that fit with the ecological and sociological opportunities and constraints of specific regions. It draws on lessons learned in particular case studies, assesses their strengths and weaknesses and offers compatible practices that can be used in combination to enhance effectiveness and long-term sustainability.</p>
Good practice and lessons learned	<p>The SGGC method provides a tool for spreading and linking biodiversity over large areas of land, while focusing on relatively small areas.</p> <p>The SGGC method offers an adaptation strategy which can be implemented regionally and globally to address the instability in both the climate systems and global water cycle, through the regeneration of mountain ecosystems.</p> <p>The SGGC method outlines the replication of successful activities that could be combined and utilized as a means of advancing climate adaptation. It is intended to expand the adaptive capacity of socioeconomic activities and to deal with current and future climate risks and variability within mountain regions worldwide.</p>

Date of submission

April 11, 2016

Further information

- More information on the method is available at http://www.activeremedy.org/wp-content/uploads/2016/04/A_Model_for_Utilising_Local_Indigenous_and_Traditional_Knowledge-and_Practices_to_Address_Global_Climate_cover.pdf
- Active Remedy Ltd. is hoping to establish a programme to implement the Sacred Groves and Green Corridors method with Mr. Jagat Singh in the Rudraprayag district of northern India. Mr. Singh is a renowned Indian ecologist. He has spent the last 30 years demonstrating environmental restoration techniques using traditional, local and indigenous knowledge for adaptive management in the Himalayan regions
- Since the severe flooding in the Rudraprayag district in 2013, there has been far greater interest in his work for its potential benefits in climate change related disaster mitigation Further information on Mr. Singh and his work is available at <https://www.youtube.com/watch?v=UuxUo9uHTAA>
- Active Remedy Ltd. website: <http://www.activeremedy.org>

3. GLOBAL | Climate vulnerability and capacity analysis CARE International

Sectors	Adaptation element
Community-based adaptation, indigenous and traditional knowledge	Capacity-building, impact assessment, knowledge management, science and research, stakeholder involvement, vulnerability assessment
Description of the tool/ method	<p>The climate vulnerability and capacity analysis (CVCA) method uses the traditional and indigenous knowledge of communities together with climate science and other quantitative data to identify adaptation interventions and build adaptive capacity at the community level. It is not tailored to any particular sector but helps to identify key underlying vulnerabilities and adaptation interventions to build capacity to respond to climate change. The tool has been implemented in Bangladesh, Ghana, Indonesia, Nepal, Peru and Viet Nam.</p> <p>The main objectives of the CVCA method are to:</p> <ul style="list-style-type: none">▪ Analyse vulnerability to climate change and adaptive capacity at the community level: CVCA is a methodology for gathering, organizing and analysing information on the vulnerability and adaptive capacity of communities, households and individuals. It provides guidance and tools for participatory research, analysis and learning. It also takes into account the role of local and national institutions and policies in facilitating adaptation.▪ Combine community knowledge and scientific data to yield greater understanding about local impacts of climate change: One of the challenges of working at the local level on climate change adaptation is the lack of scaled-down information on impacts. This is coupled with inadequate data and information on weather and climate predictions. The process of gathering from and analysing information in collaboration with communities serves to build local knowledge on climate issues and appropriate strategies to adapt. The participatory exercises and associated discussions provide opportunities to link community knowledge to available scientific information on climate change, which will help local stakeholders to understand the implications of climate change for their livelihoods, so that they are better able to analyse risks and plan for adaptation. <p>The CVCA methodology has a number of characteristics for assessing the vulnerability of communities to climate change, including:</p>

- A focus on climate change.
- Analysis of existing conditions, hazards and trends.
- An emphasis on multi-stakeholder analysis, collaboration and dialogue.
- A focus on communities, with an emphasis on enabling environments as well.

Good practice and lessons learned

The use of indigenous and traditional knowledge is facilitated by analytical teams that include community members and representatives of local organizations. In addition, CVCA entails participatory tools, such as discussions in focus groups involving 5 to 12 people selected to be representatives of different livelihood systems in the community.

Example: CVCA in Bolivia (Plurinational State of) (microbasins of Amachuma Grande and Tapacaya within the municipality of Palca, which is located 20 km south-east of the city of La Paz): focus groups with adults who possess traditional knowledge were used to survey climate changes with the use of bio-indicators. There is a noticeable loss of traditional knowledge among the younger generation, which was not able to contribute in the same way.

The CVCA process can act as a catalyst for dialogue in communities on issues of vulnerability. The approach is designed to help people articulate their experience and draw conclusions that may inform future decision-making.

Date of submission

2013

Further information

- CVCA handbook. Available at http://careclimatechange.org/wp-content/uploads/2014/12/CVCA_EN.pdf
- CARE International. 2011. *Understanding Vulnerability to Climate Change: Insights from the Application of CARE's CVCA Methodology*. Available at http://www.careclimatechange.org/files/adaptation/CARE_Understanding_Vulnerability.pdf
- CARE International. *Application of Climate Vulnerability and Capacity Assessment (CVCA) Methodology in Ecuador, Peru and Bolivia: Regional Project for Adaptation to the Impact of Rapid Glacier Retreat in the Tropical Andes – PRAA*. Available at http://www.careclimatechange.org/files/adaptation/PRAA_CVCA_CS_0611.pdf
- CARE International. 2013. *Climate Vulnerability and Capacity of Ethnic Minorities in the Northern Mountainous Region of Vietnam*. Available at http://www.careclimatechange.org/files/CARE_ClimChg_Vietnam_0413_web1.pdf

- CARE International. 2013. *Climate Vulnerability Capacity Analysis Report: South of Thailand*. Available at <http://www.careclimatechange.org/files/ThailandCVCA.pdf>
- CARE International website: <http://www.care-international.org/>

4. **GLOBAL** | Akwe: voluntary guidelines for the conduct of cultural, environmental and social impact assessments regarding development proposed to take place on, or which is likely to impact on, sacred sites and on lands and waters traditionally occupied or used by indigenous and local communities

[Convention on Biological Diversity \(CBD\)](#)

Sectors	Adaptation element
Coastal areas/zones, ecosystems, food security, human settlements, indigenous and traditional knowledge, marine fisheries, water	Impact assessment
Description of the tool/method	<p>The objective of the guidelines is to provide general advice on the incorporation of cultural, environmental, including biodiversity-related, and social considerations of indigenous and local communities into new or existing impact assessment procedures at the national level. They are intended to be applied in conjunction with the guidelines for incorporating biodiversity-related issues into environmental impact assessment legislation and/or processes and in strategic environmental assessment.</p> <p>The guidelines provide a framework to:</p> <ul style="list-style-type: none"> ▪ Support the full and effective participation and involvement of indigenous and local communities in screening, scoping and development planning exercises. ▪ Fully take into account the cultural, environmental and social concerns and interests of indigenous and local communities, especially of women who often bear a disproportionately large share of negative development impacts. ▪ Take into account the traditional knowledge, innovations and practices of indigenous and local communities as part of environmental, social and cultural impact assessment processes, with due regard to the ownership of and need for the protection and safeguarding of traditional knowledge, innovations and practices. ▪ Identify and implement appropriate measures to prevent or mitigate any negative impacts of proposed developments. <p>The means by which to achieve the use of traditional knowledge⁷ according to the guidelines include:</p>

⁷ “Traditional knowledge” refers to the traditional knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant to the conservation and sustainable use of biological diversity.

- Strengthening and building capacity:
 - The guidelines require the agencies responsible for impact assessment to have expertise in traditional knowledge, innovations and practices. In addition, indigenous and local community expertise is required in impact assessment methodologies, techniques and procedures. The assessment team should include indigenous experts in the traditional knowledge, innovations and practices related to the relevant ecosystems.
 - The guidelines promote training workshops on cultural, social and biodiversity-related aspects of environmental impact/strategic assessment and on the economic valuation of cultural, social and biodiversity resources for both assessment practitioners and representatives of indigenous and local communities, in order to facilitate the emergence of a cross-cultural understanding of the issues.
 - The guidelines stipulate that governments should encourage indigenous and local communities to formulate their own community-development plans, in order to encourage a culturally appropriate strategic, integrated and phased approach to the community's development needs and its goals and objectives. These plans should include a strategic environment assessment policy or aim to provide a systematic process for integrating social, environmental and cultural considerations in planning and decision-making, for the application of impact assessments to development proposals.
- According to the guidelines, the legislation should include cultural, environmental and social impact assessment processes relevant to indigenous communities as part of environmental impact assessment and strategic environmental assessment procedures.
- Exchange of information:
 - Web-based resources, means of exchanging experiences and information (including traditional means of communication) may help to raise awareness of the best available methods and of useful knowledge and experiences.
 - Communication between assessment practitioners and indigenous and local community members with experience in cultural, environmental and social impact assessment is in urgent need of improvement and should be enhanced through workshops, case-study assessments and the sharing of experiences through, for example, the focal point of Article 8(j) of the Convention on Biological Diversity and related provisions of the clearing-house mechanism.
- Resources:
 - Financial, technical and legal support should be made available to indigenous and local communities and relevant national organizations to enable them to participate fully in all aspects of national impact assessments. This support may be provided by national governments,

where possible, or, in developing countries and countries with economies in transition, by appropriate donor agencies.

Date of submission 2013

Further information

- The guidelines are available at <http://www.cbd.int/doc/publications/akwe-brochure-en.pdf>
- CBD website: <https://www.cbd.int/>

B. Africa

1. AFRICA | Participatory scenario planning (PSP) CARE International

Sectors	Adaptation element
Community-based adaptation, indigenous and traditional knowledge	Communication and outreach/awareness, knowledge management, climate scenarios
Description of the tool/method	<p data-bbox="407 625 1406 856">Participatory scenario planning (PSP) is a method used by CARE International under its Adaptation Learning Programme (ALP), implemented in Africa, for the collective sharing and interpretation of climate forecasts. ALP supports communities and local governments to use seasonal climate forecasts and information on climatic uncertainty for decision-making, as part of the community-based adaptation (CBA) approach.</p> <p data-bbox="407 884 1406 1270">The PSP method creates space for meteorologists, community members, local government departments and non-governmental organizations (NGOs) to share scientific and traditional local knowledge. It allows these stakeholders to find ways to combine and interpret these two sources of information into locally relevant and useful forms. Participants who use the PSP method consider the probabilities of changes in the climate, assess their likely hazards, risks, opportunities and impacts, and develop scenarios based on such an assessment. They discuss the potential implications of these scenarios on livelihoods, which leads to agreement on plans that respond adequately to the identified levels of risk and uncertainty.</p> <p data-bbox="407 1297 521 1329">Process:</p> <ol data-bbox="553 1356 1406 1900" style="list-style-type: none"><li data-bbox="553 1356 1406 1507">a. Identify the meteorological services and forecasts available for the location where adaptation is being planned and plan the PSP workshop with them and key local actors, following good practice principles (see below).<li data-bbox="553 1514 1406 1623">b. Invite participants from a relevant range of stakeholders, including meteorological services and local/traditional forecasting experts.<li data-bbox="553 1629 1406 1696">c. Exchange seasonal climate forecast from local and scientific sources.<li data-bbox="553 1703 1406 1745">d. Discuss and integrate the forecasts from the two sources.<li data-bbox="553 1751 1406 1900">e. Participants interpret the seasonal forecast into three probabilistic hazard scenarios, assessing risks posed by the hazards to develop impact scenarios. Opportunities in the coming season are also identified for each scenario.

- f. Participants discuss the local implications of the impact scenarios considering the status of food security, natural resources, livelihoods and sectors.
- g. Participants discuss and develop actions for each impact scenario, taking advantage of identified opportunities: What will communities, local government and local NGOs do? How will their actions be mutually supportive and respond to both the current situation and the expected forecast in relation to livelihood and sector priorities?
- h. Develop advisories from the actions discussed: locally relevant and actionable information, with agreed responsibilities among local actors.
- i. Communicate advisories to users, (e.g. through radio, local monitoring or other institutional systems, religious leaders, chiefs, government departments, local groups, NGOs, media).

Good practices and lessons learned

Implementing the principles guiding effective PSP for climate communication can be seen as a good practice. Those principles imply:

- Involve all relevant stakeholders, women and men of different ages, livelihoods, ethnic or other groups (including meteorological services and local/traditional forecasting experts), recognizing their roles and utilizing their specific knowledge and capacities to enable a participatory process and coordinated outcomes.
- Recognize, respect and build on both local and scientific climate knowledge.
- Encourage open discussion, dialogue and feedback among stakeholders. Use a range of participatory workshop methods to ensure discussion and reflection are open and useful to all. Pay attention to the language used, to ensure that everyone understands and can contribute.
- Communication should be inclusive, reaching all genders and groups (e.g. livelihood groups, land users, vulnerable groups) within the community.
- Conduct timely PSP, as soon as possible after the seasonal forecast is available, and timely communication of advisories to empower communities, local governments and other adaptation practitioners to take appropriate actions.
- Encourage participants to take their own decisions and actions as well as to support others and seek necessary support. Be ready with ideas on where this could be found.

Implementing partners Kenya Meteorological Department (KMD), Garissa County Climate Change Taskforce, the government ministries and communities in Garissa County and the ALP Kenya team, ALP Ghana team and the participants at the first PSP in Bolgatanga, Ghana.

Date of submission April 7, 2016

Further information

- *Decision-making for Climate Resilient Livelihoods and Risk Reduction: A Participatory Scenario Planning approach.* Available at http://www.careclimatechange.org/files/adaptation/ALP_PSP_Brief.pdf
- Culturally sensitive scenario planning for climate resilience. *Joto Afrika*. Issue 11, p.3. Available at http://www.careclimatechange.org/files/adaptation/JotoAfrika_SpecialIssue201212_03.pdf
- CARE International website: <http://www.care-international.org/>

2. **AFRICA** | Guidelines for sourcing local knowledge about adaptation to climate change in the process of municipality development planning

Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)

Sectors

Community-based adaptation, ecosystems, food security

Adaptation element

Adaptation planning and practices, vulnerability assessment, stakeholder involvement, impact assessment

Description of the tool/method

The guidelines provide municipal development planners with tools for sourcing local knowledge about the impacts of climate change, and vulnerabilities and adaptation options of rural communities. Key outputs of this local vulnerability and adaptation assessment are: (a) indicators for peoples' vulnerability (biophysical and socioeconomic); (b) values for the current state of these indicators at the community level; (c) prioritized adaptation options. The tool uses a bottom-up methodology of data collection mainly in the form of focus group discussions, putting target groups in a prominent position.

The local vulnerability and adaptation assessment consists of four steps:

- Step 1 prepares a community workshop. This comprises: the identification of local resource people; a village walk to familiarize municipal development planners with the community and the identification of participants for focus group discussions.
- Step 2 consists of a participatory mapping exercise to identify the major hazards, clarify the boundaries of the community area and identify the most important natural and physical features.
- Step 3 consists of a participatory analysis on how specific livelihood activities are impacted by climate change, and looks at the possible adaptation options. The aim is to gain information that will show whether livelihood activities need to be adapted. If there is a need, it proposes various options for making these changes. By the end of step 3, a list of vulnerability indicators and prioritized adaptation options have been identified.
- Step 4 makes the results accessible for development planners at the level of municipalities and regions.

The tools for sourcing local knowledge were implemented from March to June 2013 in the far north of Cameroon. The results were presented as climate impact chains for the key sectors. In addition, a study compiling scientific information on climate impacts and adaptation options in this region was conducted to complement the findings from the local level. The

results were brought together and shared with the involved partners and stakeholders during a workshop.

The presentations and discussions during the workshop led to a common understanding of climate change and its impacts among the participants, coming from local communities, science and sector ministries. Appropriate vulnerability indicators for monitoring the impacts, as well as adaptation options, were developed.

Implementing partners GIZ projects, commissioned by the German Federal Ministry for Economic Cooperation and Development (BMZ):

- Climate Protection Programme for Developing Countries
- Convention Project to Combat Desertification
- Decentralization and local development assistance programme, Cameroon.

Date of submission 2013

Further information

- GIZ. 2013. *Local Vulnerability and Adaptation Assessment in Rural Communities – Guidelines for Sourcing Local Knowledge About Adaptation to Climate Change in the Process of Municipality Development Planning (PCD) in the Far North of Cameroon*. Till Below, Eschborn, Germany
- GIZ website: <https://www.giz.de/de/html/index.html>

3. **AFRICA** | National adaptation platform of indigenous peoples, adaptation policymakers and national meteorological authorities

Indigenous Peoples of Africa Coordinating Committee (IPACC)

Sectors

Adaptation finance, agriculture, biodiversity, coastal areas/zones, farm system, freshwater fisheries, gender, health, community-based adaptation, crops, disaster-risk reduction, ecosystem-based adaptation, ecosystems, energy, food security, food systems, horticulture, human settlements, indigenous and traditional knowledge, infrastructure, livestock, marine fisheries, service, tourism, urban resilience, water

Adaptation element

Adaptation planning and practices, climate observations, communication and outreach/awareness, financial support, institutional arrangements, monitoring and evaluation, socio economic data and information, technology support, capacity-building, vulnerability assessment, stakeholder involvement, science and research, knowledge management, impact assessment, climate scenarios, education and training

Description of the tool/method

Indigenous Peoples of Africa Coordinating Committee (IPACC), in cooperation with its national host, agencies of the United Nations, technical partners and the Republic of Chad hosted a three-day seminar on synergizing knowledge systems of indigenous peoples, meteorologists for adaptation policymaking. The workshop generated a declaration which was also presented as a film and as text to the Conference of the Parties (COP) at its eighteenth session in Durban.

The main emphasis was that indigenous peoples and other rural communities in Africa have knowledge about biodiversity, ecosystems and changes in climatic patterns, impacts and vulnerability. Effective national adaptation platforms allow rural communities to interact with national and regional climate scientists about the types of information required for decision-making. Nomadic pastoralist systems of land and water use are not always understood by meteorologists and tend not to be included in information sharing. By creating an inclusive platform where there is the opportunity to put different types of knowledge together, clarify needs and decision-making at different scales, the national ministry responsible for adaptation policy and practices can be better informed and assist with improved meteorological service provision. The approach highlights the need to include conflict prevention as part of an overall national strategy on climate adaptation. Further, science and traditional or local knowledge can have complementary interactions and lead to decisions that are anchored in social, cultural, economic, ecosystems and scientific realities.

Implementing partners Association des Femmes Pastoralistes Autochtones du Tchad (AFPAT), Technical Centre for Agricultural and Rural Cooperation (CTA) and UNESCO Local and Indigenous Knowledge Systems division.

Date of submission April 7, 2016

Further information

- Film of the national adaptation platform: Select: *Climate Governance*
- IPACC. 2014. *Guidelines Towards Integrating African Indigenous & Traditional Knowledge in Adaptation Plans, Platforms and Policies*
Available at
http://www.ipacc.org.za/images/reports/climate_and_environment/climate/Lima_Report_2014.pdf
- N'Djamena declaration (2011) in French:
http://www.ipacc.org.za/images/reports/climate_and_environment/climate/NDjamena_Declaration_French.pdf
- IPACC website: <http://www.ipacc.org.za/en/>

4. **AFRICA** | Application of participatory three-dimensional modelling to create scaled models for dialogue between farmers and nomadic indigenous peoples on climate change, adaptation and resolution of tensions over natural resource uses
[Indigenous Peoples of Africa Coordinating Committee \(IPACC\)](#)

Sectors

Agriculture, biodiversity, coastal areas/zones, health, disaster-risk reduction, ecosystems, food security, food systems, horticulture, human settlements, indigenous and traditional knowledge, livestock, water

Adaptation element

Climate observations, socioeconomic data and information, vulnerability assessment, stakeholder involvement

Description of the tool/method

Participatory three-dimensional modelling (P3DM) is a geo-spatial information technology that assists indigenous peoples and other rural communities to represent their knowledge of their local landscape and ecosystem, including traditional land-use systems, governance and relevant patterns of natural resources, both wild and domesticated.

The participatory approach means that those who know the local natural/cultural system are the people representing the landscape to those who are responsible for evolving policies and practices. P3DM in the context of adaptation and climate change allows communities to speak to each other and look for ways to solve tensions, predict and avoid conflicts, and to improve disaster risk reduction.

P3DM was used in August 2012 for a mapping exercise in Baibokoum, Logone Orientale, southern Chad, as follows:

The mapping exercise was attended by over 60 M’bororo semi-nomadic and fully nomadic pastoralists from the territory concerned. Trainees included indigenous pastoralists from Uganda, Kenya, United Republic of Tanzania, Niger and Cameroon, as well as members of the Association des Femmes Pastoralistes Autochtones du Tchad (AFPAT) network in Chad. Resources were not available to bring pastoralists from southern Africa or north Africa.

Trainees were introduced to the basics of cartography. Training was done in French with interpreting into Fulfulde and English. The trainees then engaged in an exercise of building an ephemeral map of the compound where the training was located. Two groups took 45 minutes to study the compound, decide on codes and elements for representation, then worked collaboratively, one group in Fulfulde and one in a combination of English and French. There was a reflection on human cognition and 3D spatial representation.

The mapping was then translated into a model made with rubber and foam, which was built with the participation of local people: school-aged youths and adults. The team was led by a local tailor who was most helpful in the work.

The use of P3DM in this context led to favourable results to reduce stresses between sedentary farmers and transhumant herders competing for the same water and biodiversity resources. State officials found the exercise helpful in being able to visualize conflicts in resource uses and needs, and building a platform for cooperative solution making.

Good practice and lessons learned

Success factors for the use of P3DM in mapping in Baibokoum, August 2012:

- Participatory method: pastoralists from the region were engaged with the model and found it was a valuable platform for expressing their concerns about land-use changes and marginalization.
- Involvement of women in the mapping: it gave a voice to women and put together tradition and modernity by enabling women to talk with men and express their views on their traditional knowledge. Men became aware of the fact that women know their environment in detail.
- The inputs from the women were very valuable for conflict and natural resource management, as they prioritize the protection of water and resources for food and medicine.
- Transparent: pastoralists, AFPAT and government bodies all acknowledged how the mapping allowed issues of climate change and land-use competition (including administrative decisions) to become more transparent, with the opportunity to do conflict prevention work between farmers and herders.

Challenges and lessons learned

- The inapplicability of the P3DM to the Lake Chad area, and the problem of representing a vast mobile land-use system, still raises the question of whether IPACC should be supplementing the P3DM methodology with other methods to effectively engage in participatory modelling with nomadic pastoralists.
- The end of the mapping exercise had a few problems. For example, there was not a final systematic review of the legend with the knowledge holders. As a result, a few elements which are known to occur in the territory, such as *beellel* (a type of swamp), were not marked. More careful and systematic review before finalization should have been done.

- Implementing partners** The project was designed by IPACC in cooperation with:
- Association des Femmes Pastoralistes Autochtones du Tchad (AFPAT), N'Djamena Chad
 - Technical Centre for Agricultural and Rural Cooperation (CTA)
 - UNESCO Local and Indigenous Knowledge Systems division
 - African Centre of Meteorological Applications in Development (ACMAD)
 - World Meteorological Organization
 - Jade Film Productions, Ouagadougou, Burkina Faso.

Date of submission April 16, 2016

- Further information**
- Documentation on P3DM in Chad:
http://ipacc.org.za/images/reports/climate_and_environment/Chad_Report_2012_EN.pdf
 - Information on a previous P3DM workshop in Gabon:
http://ipacc.org.za/images/reports/climate_and_environment/GabonReport_EN_2010.pdf
 - IPACC website: <http://www.ipacc.org.za/en/>

5. **KENYA, UNITED REPUBLIC OF TANZANIA** | RADIMA – online participatory GIS (pGIS) tool

GeoData Institute, University of Southampton

Sectors	Adaptation element
Agriculture, coastal areas/zones, community-based adaptation, ecosystems, food security, indigenous and traditional knowledge, livestock, water	Adaptation planning and practices, capacity-building, knowledge management, monitoring and evaluation, science and research, stakeholder involvement
Description of the tool/method	<p>RADIMA is a participatory mapping platform to support resource advocacy, management and policy for communities.</p> <p>The RADIMA platform has been developed from a pilot phase (2009 to 2013) funded by the United Kingdom Department for International Development (DFID) as a component of a larger climate change adaptation programme operating in Kenya and the United Republic of Tanzania. It is a generic platform; although currently focused on arid and semi-arid lands (ASAL) and pastoralists, it can be applied in any mapping programme and is supporting the capture of adaptation actions. Its use has been focused on natural resource management (NRM) and the climate adaptation prioritization process – but equally can support any participatory global information system (pGIS) mapping process. The rationale for its development is to provide a platform that includes standards, data management and distribution of community-contributed information. RADIMA has used co-productive techniques to develop a digital mapping platform for community resources and the methodology used to capture and share the information, community training support and online community wikis (for the promotion of standards). The mapping technology is derived from the OpenStreetMap software stack and shares open-source software and open licensed data. It provides export to open-source GIS tools to enable the production of resource atlases. It is supported by a memorandum of understanding (MoU) with community stakeholders using the application, which provides the framework for accessible, open data (under an open database licence). The MoU enables the establishment of and collaboration between organizations engaged in participatory mapping of community resources and livelihoods, and provides and supports a mechanism for sharing information and encourages its wider adoption at policy levels.</p> <p>The platform is supported by training and trainers’ materials (facilitators) and further development will entail extending the platform and translating it into French.</p>

Good practice and lessons learned	Lessons learned include: (a) the need for a platform that captures the community information – to reduce the duplication of efforts in collating such information; (b) standardization of information on features and attributes to allow cross-community and trans-boundary feature representation; and (c) promotion of the platform with policymakers to ensure the information is usable in country and national spatial data infrastructures.
Implementing partners	International Institute for Environment and Development – programme implementers in Kenya and the United Republic of Tanzania. Developed in association with the United Republic of Tanzania/Kenya Climate Adaptation Finance programmes.
Date of submission	April 10, 2016
Further information	<ul style="list-style-type: none"> ▪ Hill C et al. 2015: Harnessing pastoral knowledge for climate change adaptation in the drylands. IIED Working Paper (in press). Presented at World Bank Land and Water ▪ GeoData Institute, University of Southampton website: http://www.geodata.soton.ac.uk/geodata/

6. **SUB-SAHARAN AFRICA** | Self-evaluation and holistic assessment of climate resilience of farmers and pastoralists (SHARP)

Food and Agriculture Organization of the United Nations (FAO)

Sectors

Agriculture, community-based adaptation

Adaptation element

Adaptation planning and practices, monitoring and evaluation, vulnerability assessment

Description of the tool/method

The self-evaluation and holistic assessment of climate change resilience of farmers and pastoralists (SHARP) tool was developed with the aim of filling the gap in current climate resilience assessment tools that work at a local (community) scale, while combining a scientifically rigorous foundation of resilience theory. The SHARP tool consists of a tablet computer-based survey with multiple components that allows trained facilitators to support communities to assess the climate resilience priorities of farmers and pastoralists at the individual (and household) and community levels through discussions and survey responses, serving local communities as well as feeding into national and regional policy discussions. SHARP is administered using tablet computers to ease the data collection process while immediately providing results for discussion with the farmers and pastoralists, such as the relative resilience ranking of components. SHARP comprises:

- A tool built on a comprehensive understanding of climate resilience encompassing social, economic and environmental aspects at multiple scales (individual, community and regional) for a range of smallholders;
- A participatory household-level assessment of climate resilience, performed over a field-school/cropping season that combines quantitative measurements of resilience indicators with participants' self-evaluation of the adequacy and importance of different farm/pastoral components to their overall livelihoods;
- An interactive learning and monitoring and assessment tool, using tablet computers that allow for immediate access to information resources, aiding with group discussions and identifying resilience priority actions;
- A baseline assessment of climate resilience for better forecasting and countering climate change impacts in specific areas based on community-specific vulnerabilities and strengths.

Good practice and lessons learned

SHARP aims to be a pragmatic tool for both farmers and pastoralists to help communities and projects to measure agro-ecosystem resilience. Geographical differences across communities limit the capacity of any single tool to perfectly measure resilience across all contexts while producing comparable results. The 13 indicators of resilience used as proxy properties of resilient systems, combined with a participatory approach with farmers and pastoralists, help to render SHARP adaptable to different contexts while keeping its results comparable among respondents across contexts. Participants (farmers and pastoralists) in early field tests of SHARP provided positive feedback, stating that the tool provided a forum for discussions of problems and helped to engage the community to find solutions to common problems. SHARP will continue to be developed, in formulation and implementation, to provide a valuable mechanism to measure, discuss and improve the climate resilience of farmers and pastoralists.

Challenges and coping strategies

The tool was developed and written in English and translated into Spanish, French and Portuguese. SHARP will be translated into other languages as appropriate. Facilitators translate the questions from the national level into local languages when conducting the survey. Translation is difficult, because often a direct translation of specific terms and concepts such as “resilience” does not exist. During the SHARP in-country training events and during Agro-Pastoral/Farmer Field Schools (AP/FFS) sessions, time must be dedicated to agreeing on common definitions and on ways to explain concepts and questions to the farmers and pastoralists in their local language. Jointly agreed explanations, synonyms and metaphors will help to ensure that the most complex concepts are reasonably consistent across languages. As part of the software application, there is also an option to translate the final resilience ranking resulting from the survey into different languages.

Many of the farmers and pastoralists who were involved in the testing and piloting of SHARP had low levels of literacy or had very low levels of formal education. Therefore “action learning”, such as that employed in the AP/FFS, is an adequate approach to transmit knowledge and results to farmers and pastoralists. A learning-by-doing approach, emphasizing social learning in an experimental approach, offers higher chances of successfully communicating with farmers and pastoralists not aware of the conventional vocabulary used. The fact that many farmers and pastoralists are illiterate means that facilitation is necessary when using SHARP, because many participants are unable to read the questions. Moreover, discussion of results obtained in terms of priorities for resilience-building will also require creative processes to ensure that there is understanding and ownership of results. Several participatory methods already exist and can be integrated into the third phase of SHARP – such as

scenario-building, which involves analysing future events based on a range of possible different scenarios (relating to farm systems and resilience in this example).

SHARP measures the resilience to climate change and climate variability of a farm system by asking one member of a farm/pastoralist household to make an assessment of their resilience. This approach can mask existing differences in the resilience of different members of the same household and can lead to adaptation strategies that mostly take into account the interests of the person participating in SHARP, but not necessarily the others in the household. This may significantly lower the impact of SHARP on household resilience.

The following measures have been taken during the design of SHARP to minimize issues linked to intra-household disparities: users were encouraged to have SHARP administered through AP/FSS facilitators who have built a relationship and trust with the community in order to elicit more honest and through responses; questions to assess the climate resilience at the level of the household have been formulated to obtain responses which cover all the members of the household; respondents are given the possibility to elaborate further on questions of interest and potentially sensitive questions should be asked at the individual level; it is possible to disaggregate results of the assessment by gender and other variables in a given community, thereby making it possible to detect differences in resilience priorities depending on the gender of respondents; a question on household decision-making patterns has been included in the survey, acting as an indicator of the level of intra-household inequalities – independent of the gender of the respondent. In addition, this topic will be elaborated in depth through training and the facilitators' training manual. Thus, when implementing the survey: survey questions will be asked in such a way as to uncover intra-household dynamics; following preliminary individual discussions, group discussion of results and actions at community level will be held in plenary sessions to allow for discussion.

SHARP is being developed with a key focus on smallholder farmers and pastoralists in sub-Saharan Africa, but is available to be tested and adapted to any context globally. The sheer diversity of agro-ecological and socioeconomic contexts will be a significant challenge to applying the same tool in all these contexts. SHARP is being adapted – in a limited form – to different localities, while allowing for enough data points to be comparable across regions. Although the individual questions may vary slightly and have different context-specific ratings the questions are linked to the 13 resilience indicators, so the results can be compared at the indicator level. To date, the changes focus only on different names for local species and exploring certain questions in greater depth, as warranted (e.g. further data on irrigation). One

such adaptation could include changing the weights and scoring systems given to questions at the country-level. This, however, would prevent inter-country comparisons. It is obvious that a trade-off exists between the level of specificity of the survey to local realities and the comparability of results across different localities. The more context-specific questions and scoring are, the less comparable they will be but the better they assess resilience in a given place. The ease with which scoring, weights, question formulation and implementation can be changed in SHARP allows user to determine their optimal solution.

The SHARP survey collects data that can be used both to prioritize actions at the household and community level, and to obtain an understanding of resilience levels and priorities at greater temporal and spatial scales. This means that, while the scope of questions needs to be precise and practical to be usable by farmers and pastoralists, the quality and range of information collected needs to allow for meaningful comparison of results at larger scales. Satisfying both needs with a single tool poses challenges in terms of number of questions, practicality, specificity and usability of questions, and scoring. This challenge was addressed by using different approaches to understand collected responses: the rapid assessment combines responses on the level of resilience of farm/pastoral system with their perceived adequacy and importance of resources to obtain resilience priorities, which can be used by farmers/pastoralists to set goals for improvement. This allows SHARP to be tailored to the specific resilience context of the respondent, while collecting resilience information that is scored using a broad enough calibration to be applicable to most contexts. A set of 26 key questions was determined and these need to be answered for the survey to be considered completed. These 26 questions cover the 13 indicators of resilience defined by Cabell and Oelofse (2012) and therefore allow for a set of questions that is comparable at a holistic level across time and space. As the questions still cover all the resilience indicators, they are a reasonable set for resilience assessment at a broader scale using the resilience indicators.

Date of submission

April 19, 2016

Further information

- SHARP website: www.fao.org/agriculture/crops/thematic-sitemap/theme/spi/sharp/en/
- SHARP: Integrating a traditional survey with participatory self-evaluation and learning for climate change resilience assessment
- Cabell, Oelofse, 2012, “An indicator framework for assessing agroecosystem resilience”, Ecology and Society, vol. 17, issue 1.
- FAO website: <http://www.fao.org/>

C. Asia

1. **REPUBLIC OF KOREA** | Effects of bibosoop plantation on wind speed, humidity and evaporation in a traditional agricultural landscape of Korea

Korea Adaptation Center for Climate Change (KACCC), Korea Environment Institute

Sectors	Adaptation element
Agriculture, ecosystems, indigenous and traditional knowledge, water	Adaptation planning and practices
Description of the tool/method	Bibosoops are a unique type of traditional Korean village grove. They grow at the mouths of watersheds, where villages are typically located and in the low mountain ridge areas surrounding villages. A bibosoop influences wind speed, humidity and evaporation in an agricultural landscape. The wind speed reduction by the bibosoop reduces evaporation and increases the absolute humidity of the leeward side in a traditional agricultural landscape. Consequently, a bibosoop contributes to water conservation in the leeward paddy fields during spring, which is a dry season in Korea.
Date of submission	2013
Further information	Koh I, Kim S, Lee D. 2010. Effects of bibosoop plantation on wind speed, humidity, and evaporation in a traditional agricultural landscape of Korea: Field measurements and modeling. <i>Agriculture, Ecosystems and Environment</i> 135 (2010) 294–303 KACCC website: http://ccas.kei.re.kr/english/eng_index.do

2. REPUBLIC OF KOREA | Ondol, Korean heating system

Korea Adaptation Center for Climate Change (KACCC), Korea Environment Institute

Sectors	Adaptation element
Human settlements, indigenous and traditional knowledge	Adaptation planning and practices
Description of the tool/method	<p>Ondol is an underfloor heating system which allows the heat from the furnace of a kitchen to pass under the room's floor to keep it warm. This is a traditional heating method of Korea. The principle of the Ondol is the use and transfer of heat. A fairly high chimney on the other side of the furnace facilitates the flow of the heat. The heat warms wide stone plates laid under the room's floor, and the heated stone plates raise the room temperature. At the same time, the heat passes through several parallel ducts that are divided in the beginning and combined at the end in order to be connected to the chimney. This facilitates uniform temperature distribution. And since the wide stone plates are usually pretty thick, the plates do not cool quickly and thus provide heat steadily and for a fairly long time.</p> <p>Ondol has several advantages in terms of climate change adaptation. In most cases, the fire furnace has a cooking caldron over it. This structure takes advantage of the heat generated for cooking. Hence, the heat is not wasted but is used to heat the room. It is a cost-efficient heating system in installation and maintenance. Other advantages of Ondol are: the efficient use of space; no cleaning is required; the system does not produce any noise.</p> <p>Although modern Korean apartment buildings use electrically heated water to run through the pipes under the room, traditional Korean houses still use the Ondol system.</p>
Date of submission	2013
Further information	<ul style="list-style-type: none">▪ Kim BA, Lee JL. 2003. A Study of the Ondol (Gudul, Floor Heating System) and Kitchen Space in the Traditional Houses on Jeju Island, Korea. <i>International Journal of Human Ecology</i>. 4(1): 15–23▪ Yeo MS, Yang IH, Kim KW. 2003. Historical changes and recent energy saving potential of residential heating in Korea. <i>Energy and Buildings</i>. 35(7): 715–727▪ KACCC website: http://ccas.kei.re.kr/english/eng_index.do

3. REPUBLIC OF KOREA | Onggi, Korean traditional jars

Korea Adaptation Center for Climate Change (KACCC), Korea Environment Institute

Sectors	Adaptation element
Human settlements, indigenous and traditional knowledge	Adaptation planning and practices
Description of the tool/ method	<p>Climate change has created various issues in our society. Food security is one of the most significant issues among the negative impacts of climate change. A way to adapt to climate change is to preserve food in fresh conditions with good level of nutrients. Koreans have maintained their unique way of preserving food without using any electricity. Onggi, a type of traditional Korean earthenware pottery, is used to keep fresh and store food and condiments such as soy sauce, kimchi, soybean paste, spices and dried foods. Throughout the four seasons, with the temperature and humidity fluctuating, Onggi retains a moderate temperature and humidity inside. The flavour of the seasonings, sauces and pickles, which have been fermented inside the jars, can last for several years.</p> <p>In addition, Onggi absorbs harmful toxins. When water seeps into Onggi jars, the jars automatically filter harmful toxins and substances. Similarly, Onggi help because the food ferments slowly, retaining the fresh quality of the food for a very long time. Onggi jars allow air and moisture to slowly seep through their walls, which enhances the flavour of the food. Temperature change and humidity usually decay foods rapidly. Onggi is able to reduce vulnerability to climate change for maintaining freshness of the food. It is widely used in Korea.</p>
Date of submission	2013
Further information	<ul style="list-style-type: none">▪ Jeong JK, Kim YW, Choi HS, Lee DS, Kang SA, Park KY. 2011. Increased quality and functionality of kimchi when fermented in Korean earthenware (onggi). <i>International Journal of Food Science & Technology</i>. 46(10): 2015–2021▪ Seo GH, Chung SK, An DS, Lee DS. 2005. Permeabilities of Korean earthenware containers and their potential for packaging fresh produce. <i>Food Science and Biotechnology</i>. 14(1): 82–88▪ Seo GH, Yun JH, Chung SK, Park WP, Lee DS. 2006. Physical properties of Korean earthenware containers affected by soy sauce fermentation use. <i>Food Science and Biotechnology</i>. 15(2): 168–172▪ KACCC website: http://ccas.kei.re.kr/english/eng_index.do

4. **NEPAL** | Integrated climate change adaptation: a community forestry-based approach
 The Center for People and Forests (RECOFTC)

Sectors	Adaptation element
Adaptation finance, agriculture, biodiversity, community-based adaptation, crops, ecosystem-based adaptation, ecosystems, food security, human settlements, indigenous and traditional knowledge, livestock, water	Adaptation planning and practices, capacity-building, education and training, financial support, impact assessment, institutional arrangements, vulnerability assessment, socio economic data and information, stakeholder involvement
Description of the tool/method	<p>There is growing recognition that the people who have contributed the least to global carbon emissions, such as natural resource dependent communities in the global South, will be the hardest hit by the impacts of climate change. These communities must adapt, with large-scale financial transfers from those nations responsible for the bulk of global emissions, and institutional and policy support from their national governments. Further, because climate change impacts do not respect socially constructed boundaries between forestry, agriculture, livestock, water and sociopolitical dynamics, adaptation efforts must consider how these sectors intersect and the best ways to implement interventions for positive cross-sectoral impacts.</p> <p>Therefore, an integrated community forestry-based climate change adaptation (CF-CCA) framework has been developed for practitioners – including natural resource management user groups and non-governmental and civil society organizations – working in rural contexts. The framework draws on a landscape approach to resource management in order to reconcile trade-offs and identify priorities across different land-use sectors. Furthermore, the framework aims at improving existing landscape management strategies for climate change adaptation by utilizing the institutional and material aspects of community forestry (CF) and community forestry user groups as an entry point for participatory adaptation assessment and intervention. It focuses on enabling community forestry user group members to lead adaptation initiatives, and access local level financing, in order to address both climate and non-climate vulnerabilities. It places the poor, disadvantaged ethnic groups and castes, and women at the centre of all activities.</p> <p>The CF-CCA framework comprises three major phases. The first phase includes reviewing all aspects of the broadly defined ‘CF landscape’ and how different land-use sectors interact, assessing current and future climate trends based on local knowledge and meteorological data, and evaluating political, social and economic factors and their effect on community-level</p>

adaptive capacities and livelihood assets (human, social, financial, physical and natural assets). The second phase is the feasibility assessment phase, which includes the prioritization of adaptation interventions from the previous phase and the identification of local financing opportunities. It also provides tools that will guide project proposal development, and the identification and assessment of potential partner institutions. The final stage comprises intervention implementation, and community level monitoring and evaluation.

The framework should rely on the institutional support of the local community forestry user group for its activities, and should target marginalized populations within the user group, as determined by the intervention facilitators. Who the facilitators work with in the community during the framework's implementation and how they reach consensus on decisions will be complicated, contentious and political, and should be determined based on the local context; as mentioned, the framework seeks to enable pro-poor adaptation that targets socially marginalized groups – including women and ethnic minorities – and draws on the resources (both institutional and physical) of the community forest.

Example: The Center for People and Forests, with funding from USAID Adapt Asia-Pacific, has piloted the CF-CCA framework in the Bishnupur community of Nepal's Terai. The framework has enabled a women-led community forestry user group to identify promising adaptation interventions, and attain local adaptation financing.

RECOFTC's adaptation facilitators and local user group members used the framework to conduct an integrated analysis of the forestry, agriculture, livestock and water sectors. This allowed for the evaluation of vulnerabilities within the community forestry landscape and the identification of adaptation interventions that will cut across sectors.

In using the CF-CCA framework, a number of community-level vulnerabilities emerged that are the result of both climate and non-climate threats. The identified landscape level vulnerabilities in Bishnupur with community forestry linkages included:

- Declining productivity of crops owing to poor soil quality, changing rainfall patterns, and an increasing number of pests and weeds.
- Decreasing incomes from sugarcane (a major income generator), owing to declining productivity.
- Decreasing availability of multipurpose tree species in the community forest.
- Increasing workloads and decreasing incomes for women, in general, because of water scarcity.

- Flood vulnerability.

Following the vulnerability assessment, RECOFTC and forest user group members conducted feasibility assessments on three intervention topics that would address the vulnerabilities that had been identified above: riverbank stabilization, agroforestry and water management. Based on this assessment, which also helped to identify local financing sources, several specific interventions emerged. These adaptation interventions were pursued in tandem in order to provide an integrated adaptation intervention package.

Good practice and lessons learned

In order to facilitate the successful uptake of the CF-CCA framework by future practitioners, a number of lessons learned should be emphasized:

- The flexible implementation of the CF-CCA framework is imperative. This is ensured by striving to achieve a genuinely participatory and community-led process that targets marginalized populations.
- In order to ensure the long-term sustainability of project outcomes, practitioners must engage with governmental units and line agencies via technical and financial assistance.
- Practitioners must work to triangulate all available information on climate change (including community knowledge) during the vulnerability assessment phase.
- Practitioners must determine whether they are seeking to address current or future climate threats and impacts, and they must be aware that addressing current impacts may exacerbate future climate threats.
- The application of the CF-CCA framework should aim to address equity in all of its processes. Women-led community forests may serve as a useful entry point for the implementation of the framework.
- Finally, in using the CF-CCA framework it is important to resist seeing forest-dependent communities, and the various marginalized populations within them, as uniformly vulnerable and passive subjects. Understanding these groups in such a way fails to recognize the work that they have probably already undertaken to enhance their adaptive capacity, and their potential to adapt in the future. These groups must lead the CF-CCA process.

Implementing partners

- Bishnupur Community Forestry User Group: local implementation, technical support
- District Forest Office (DFO), Sarlahi: local implementation, technical support
- HIMAWANTI (Himalayan Grassroots Women's Natural Resource Management Association): local implementation
- USAID Adapt Asia-Pacific: financial support, technical support

Date of submission

April 4, 2016

Further information

- RECOFDTC – USAID Adapt Asia-Pacific project brochure: <http://www.recoftc.org/reports/recoftc-usaid-adapt-asia-pacific-project-brochure>
- CARE. 2009. *Climate Vulnerability and Capacity Analysis: Handbook*. CARE International
- DFID. 2001. Sustainable livelihoods guidance sheets. Department for International Development (DFID), London, UK
- ICEM. 2011. *Climate Change Adaptation and Mitigation (CAM) Methodology Brief*. ICEM – International Centre for Environmental Management, Hanoi, Viet Nam
- ICIMOD. 2011. *Framework for Community Based Climate Vulnerability and Capacity Assessment in Mountain Areas*.
- ICIMOD, Kathmandu, Nepal
- OECD. 2009. *Integrating Climate Change Adaptation into Development Co-operation: Policy Guidance*. OECD, Paris, France.
- RECOFTC website: <http://www.recoftc.org/>

D. Caribbean and Central America

1. SAINT LUCIA, TRINIDAD, TOBAGO | Participatory research to enhance climate change policy and institutions in the Caribbean: Caribbean adaptation rapid institutional analysis (ARIA) toolkit pilot

Caribbean Natural Resources Institute (CANARI)

Sectors

Agriculture, coastal areas/zones, community-based adaptation, ecosystems, ecosystem-based adaptation, food security, health, human settlements, infrastructure, marine fisheries, tourism, water

Adaptation element

Capacity-building, climate observations, institutional arrangements, knowledge management, monitoring and evaluation, socioeconomic data and information, science and research, stakeholder involvement

Description of the tool/method

The study, which was conducted in Saint Lucia and Trinidad and Tobago, was implemented by CANARI, in collaboration with the World Resources Institute (WRI) and the Saint Lucia National Trust (SLNT). It was aimed at improving the capacity of Caribbean islands to develop and implement effective climate change adaptation policy and action. The specific objectives were to:

- Analyse the state of institutional capacity and readiness to implement climate change adaptation policies to identify strengths and weaknesses using the Rapid Institutional Analysis for Adaptation (ARIA) toolkit.
- Develop high-priority and low-cost next steps within national and regional policy contexts.
- Assess the level of transparency in adaptation policy-making and planning and the opportunities for public involvement.
- Conduct ‘deep dive’ assessments into three priority areas selected by project participants for each country to better understand institutional capacity at the sectoral level.
- Build civil society capacity to more meaningfully engage in these processes through use of the toolkit and interaction with relevant government agencies.

The study was conducted in two phases. In phase I, the lead organizations, SLNT and CANARI, examined the capacity of national institutions to effectively adapt to climate change in their respective countries. In phase II, they examined the capacity of the institutional arrangements to effectively adapt to climate change within three priority sectors. The priority sectors were selected in a participatory manner based on the findings of the phase I research. Information to complete the ARIA toolkit workbooks in phases I

and II was gathered through desk-based reviews and interviews with participants from key agencies knowledgeable about climate change and climate change adaptation initiatives. An advisory panel (comprising representatives from academia, government, regional and international climate and related institutions, and civil society) was established to carry out multiple functions, including quality control of research, networking for greater impact and engagement, and awareness-raising of results.

Good practice and lessons learned

- Vulnerability assessments should be directed by national priorities, informed through public consultations.
- A public inventory to monitor the implementation of adaptation options should be created and maintained.
- Coordination bodies for climate change adaptation should be formalized/institutionalized.
- Information collection and management systems need to be consolidated and maintained.
- Mechanisms for greater public participation in the development of priorities and monitoring of policy implementation should be established.
- Innovate financing mechanisms should be developed.

The research process for this project and the subsequent results provided lessons learned, such as:

- Knowledge on climate change adaptation processes is not adequately shared among public sector agency personnel.
- Mandates and responsibilities for climate change adaptation procedures among ministries and agencies may be in a state of flux or unclear, even to those within the agencies.
- Significant knowledge gaps persist at the civil society level regarding national climate change adaptation priorities and activities.

Implementing partners

- Saint Lucia National Trust – conducted the study in Saint Lucia and prepared technical and workshop reports
- World Resources Institute – provided the ARIA toolkit and participated in technical reviews and report writing

Date of submission

April 11, 2016

**Further
information**

- Information on the use of the tool in Saint Lucia and Trinidad and Tobago: <http://www.canari.org/participatory-research-to-enhance-climate-change-policy-and-institutions-in-the-caribbean-aria-caribbean-toolkit-pilot/>
- Information on the WRI ARIA toolkit: <http://www.wri.org/our-work/project/access-initiative-tai/tools>
- CANARI website: www.canari.org

2. **DOMINICA** | Participatory three-dimensional modelling (P3DM) Caribbean Natural Resources Institute (CANARI)

Sectors	Agriculture, farm systems, coastal areas/zones, community-based adaptation, crops, disaster-risk reduction, ecosystems, ecosystem-based adaptation, food security, health, human settlements, infrastructure, marine fisheries, tourism, water	Adaptation element	Capacity-building, climate observations, institutional arrangements, stakeholder involvement, vulnerability assessment
Description of the tool/method	The activity used participatory three-dimensional modelling (P3DM) to facilitate the inclusion of local knowledge in spatial adaptation planning. Contour maps were produced by global information system (GIS) experts and each contour was traced onto cardboard and cut out. The cardboard layers were glued together on a table to give a three-dimensional (3D) rendering of the area. It was then covered with crêpe paper and painted white. Stakeholders from the communities and decision-makers were invited to add their local knowledge to the model using paint, pins and other craft material. The 3D model gave stakeholders opportunities to amend the model and discuss the climate change impacts observed and possible adaptation actions with each other. The information on the model was put into GIS and shared with decision-makers. The physical model remained with the local communities so that they could update the information as needed.		
Good practice and lessons learned	<ul style="list-style-type: none"> ▪ Community local knowledge is important in vulnerability assessments and adaptation planning. ▪ Visual tools can help both community stakeholders and decision-makers to better understand the impacts of climate change, assess vulnerabilities and plan for adaptation. ▪ National adaptation priorities should be communicated in clear language and shared with local communities for buy-in and action. ▪ Providing space for local communities and national decision-makers to meet improves the likelihood that vulnerabilities can be assessed and adaptation actions taken with the support of stakeholders. ▪ Climate change awareness-building should occur often to ensure that stakeholders fully understand the ramifications of the impacts. It also helps to clear up misconceptions periodically. 		
Implementing partners	The Caribbean Public Health Agency (CARPHA) and the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH provided the		

funding for this activity as part of the Caribbean Aqua-Terrestrial Solutions Programme (CATS), through its component “Adaptation of Rural Economies and Natural Resources to Climate Change (focus Agriculture, Forestry, Water Management)”.

Date of submission

April 11, 2016

Further information

- Rambaldi G and Callosa-Tarr J. 2002. *Participatory 3-Dimensional Modelling: Guiding Principles and Applications*. Los Baños, Laguna, Philippines: ASEAN Regional Centre for Biodiversity Conservation (ARBC)
- CANARI website: www.canari.org

E. Pacific/ Oceania

1. COOK ISLANDS, FIJI, SAMOA, VANUATU | Community-based vulnerability and adaptation assessment guidelines

Secretariat of the Pacific Regional Environment Programme (SPREP)

Sectors	Adaptation element
Agriculture, coastal areas/zones, ecosystems, food security, human settlements, indigenous and traditional knowledge, water	Climate observations, impact assessment, vulnerability assessment
Description of the tool/ method	<p>This guide to community vulnerability and adaptation assessment and action (CV&A) was developed by the Secretariat of the Pacific Regional Environment Programme (SPREP). It aims to assist community vulnerability and adaptation assessment work to be carried out by the four pilot Pacific Island Countries that are implementing the Capacity Building for the Development of Adaptation Measures (CBDAMPIC) project. These countries are: Cook Islands, Fiji, Samoa and Vanuatu.</p> <p>The guidelines outline six main phases for executing an assessment at local community level:</p> <ol style="list-style-type: none">1. Adaptation context.2. Diagnostic.3. Assessment and evaluation.4. Development.5. Implementation.6. Monitoring phases. <p>The guide is a tool to understanding the vulnerability of Pacific Island communities to climate change, variability and sea-level change; and to determining what action needs to be carried out in order to adapt to these changes. In the CV&A process, the focus of data collection is the community, which includes elders, men, women, youths and children. Their experience in relation to climate variability, change over time and extreme events becomes very important, and provides the basis for the inclusion of traditional and indigenous knowledge in the implementation plan. The assessment focuses on current vulnerability to both climate-related factors and factors that are not climate related, and on examining current adaptive capacity. It then includes evaluation of vulnerability to future climate-related risks, involving key</p>

stakeholders in the evaluation process. This eventually leads to the formulation of adaptation policies that would strengthen adaptive capacity. It also allows for traditional knowledge to be brought into the discussions, through the interactivity and inclusiveness of the approach taken.

Climate modelling, scenario generation and social science have roles to play in the process but are not the starting point. This community-focused approach to vulnerability and adaptation assessment is innovative and different from the model-based impact assessments commonly used worldwide.

The guide builds on the various participatory methodologies that have already been introduced into the Pacific Island Countries. These include; rapid rural appraisal (RRA), participatory learning and action (PLA), and comprehensive hazard and risk management (CHARM).

Although developed specifically for the CBDAMPIC project, the guide to CV&A can be used for similar purposes by all Pacific Island Countries as well as other regions of the globe. It was later updated and modified to be utilized in the Pacific Adaptation to Climate Change project in 14 Pacific Island Countries and Territories.

Good practice and lessons learned

- Indigenous and traditional knowledge and practices (ITKP) should be considered as a starting point on the matter of adaptation. This contributes to recognition of the value of ITKP.
- Ensuring that the process is interactive and inclusive makes it possible to take into account indigenous knowledge in each stage of the vulnerability and adaptation assessment. Participatory methodologies include: RRA, PLA and CHARM.

Date of submission

April 7, 2016

Further information

- Pacific Climate Change Portal: www.pacificclimatechange.net
- SPREP website: www.sprep.org

III. DATA COLLECTION INITIATIVES

A. Global

1. CANADA, PERU, UGANDA | The Indigenous Health Adaptation to Climate Change (IHACC) project

Department of Geography, McGill University, Canada

Sectors	Adaptation element	Climate hazard
Food security, food systems, health, indigenous and traditional knowledge, water	Adaptation planning and practices, climate observations, capacity-building, education and training, science and research, monitoring and evaluation, stakeholder involvement, vulnerability assessment	Drought, floods, glacier retreat and related impacts, loss of biodiversity, shift of seasons, vector and water-borne diseases

Type of initiative Scientific peer reviewed publications

Description of the data collection initiative IHACC is a multi-year, trans-disciplinary community-based initiative working with remote indigenous populations in the Peruvian Amazon, Canadian Arctic and Uganda to examine vulnerabilities to the health effects of climate change and to develop an evidence base for adaptation. Funded by the International Development Research Centre (IDRC) and Canadian Tri-council Agencies (the Canadian Institutes of Health Research (CIHR), the Natural Sciences and Engineering Research Council of Canada (NSERC) and the Social Sciences and Humanities Research Council (SSHRC)) the project is led by McGill University and the University of Guelph in Canada, Cayetano University in Peru and Makerere University in Uganda, and is working closely with communities, indigenous organizations, and government partners in the three regions.

The overall aim of the research programme is to apply scientific and indigenous knowledge to empower remote indigenous communities to adapt to the effects of climate change on health. The specific objectives of the project are:

- To characterize and compare the vulnerability of remote indigenous health systems and the pathways through which climate affects the incidence and prevalence of food and water insecurity and vector-borne diseases.

- To estimate future vulnerability by analysing how climate change might alter identified health risks and the adaptive capacity of health systems.
- To implement and monitor pilot interventions using indigenous and scientific knowledge on health vulnerability and adaptation, working closely with communities, stakeholders and policy-makers.
- To develop adaptation plans based on vulnerability assessment and on experience from pilot interventions and comparative analysis that will identify actions to reduce vulnerability and increase adaptability. Local and national adaptation plans will be developed, and this will involve close collaboration with relevant community and policy stakeholders at each level.
- To create adaptation leaders in the scientific community, partner organizations and communities through training, so that they have the tools, experience and knowledge to develop and promote adaptation.
- To develop an indigenous knowledge bank to document indigenous knowledge on health, and the implications for adapting health systems.

The pilot project took place during 2010.

The full project ran from 2011 to 2016 and is currently in its final stages.

Implementing partners

Makerere University, Department of Geography (Kampala, Uganda)

Universidad Peruana Cayetano Heredia, Department of Epidemiology (Lima, Peru)

University of Guelph, Population Medicine (Guelph, Ontario, Canada)

University of Capetown, Department of Geography (Capetown, South Africa)

Dr. James Ford (McGill University, Lead Primary Investigator)

Dr. Lea Berrang-Ford (McGill University, Co-Primary Investigator)

Dr. Alejandro Llanos (UPCH, Co-Primary Investigator)

Dr. Cesar Carcamo (UPCH, Co-Investigator)

Dr. Shuaib Lwasa (Makerere University, Co-Primary Investigator)

Mr. Didacus Namanya (Uganda Ministry of Health, Co-Investigator)

Dr. Sherilee Harper (University of Guelph, Co-Investigator)

For the full list of community and other partnering organizations, please refer to our project organizational structure available at: <http://ihacc.ca/partners>

Year of publication

To be published in 2016

Further information

1. Peer-reviewed journal articles from the project

Arctic team

Ford JD et al. 2016. Community-based adaptation research in the Canadian Arctic. *WIREs Clim Change*. 7(2), 175–191

Ford JD, Petrusek Macdonald J, Huet C, Statham S and MacRury A. 2016. Food policy in the Canadian North: Is there a role for country food markets? *Social Science & Medicine*. 152, 35–40

Ford JD, McDowell G and Pearce T. 2015. The adaptation challenge in the Arctic. *Nature Climate Change*. 5, 1046–1053

Ford JD, Stephenson E, Cunsolo-Wilcox A, Edge VL, Farahbakhsh K, Furgal C, Harper S, Chatwood S, Mauro I, Pearce T, Austin S, Bunce A, Bussalleu A, Diaz J, Finner K, Gordon A, Huet C, Kitching K, Lardeau MP, McDowell G, McDonald H, Nakoneczny L and Sherman M. 2015. Community-based adaptation research in the Canadian Arctic. *WIREs Climate Change*

Bunce A and Ford JD. 2015. How is adaptation, resilience, and vulnerability research engaging with gender? *Environmental Research Letters*. 10: 123003

Petrusek MacDonald J, Ford JD, Cunsolo-Wilcox A, Mitchell C, Konek Productions, My Word Storytelling and Digital Media Lab, and the Rigolet Inuit Community Government. 2015. Youth-Led Participatory Video as a Strategy to Enhance Inuit Youth Adaptive Capacities for Dealing with Climate Change. *Arctic*. 68(4), 486–499

Harper SL, Edge VL, Ford J, Thomas MK, IHACC Research Group, Rigolet Inuit Community Government, and McEwen SA. 2015. Lived experience of acute gastrointestinal illness in Rigolet, Nunatsiavut: “Just suffer through it”. *Social Science & Medicine*. 126: 86–98

Ford J, Cunsolo-Wilcox A, Chatwood S, Furgal C, Harper S, Mauro I and Pearce T. 2014. Adapting to the effects of climate change on Inuit health. *American Journal of Public Health*. 104(S3): e9–e17

Petrusek MacDonald J, Ford J, Cunsolo-Wilcox A and Ross N. 2013. A review of protective factors and causal mechanisms that enhance the mental health of Indigenous Circumpolar youth. *International Journal of Circumpolar Health*. 72

- Ford J. 2012. Ford responds: Letter in response to Macpherson and Akpinar-Elci comment on Ford's "Indigenous Health and Climate Change". *American Journal of Public Health*. 103(1)
- Ford J. 2012. Indigenous health and climate change. *American Journal of Public Health*. 102(7): 1260–1266
- Ford J and Pearce T. 2012. Climate change vulnerability and adaptation research focusing on the Inuit subsistence sector in Canada: Directions for future research. *The Canadian Geographer*. 56(2): 275–287
- Ford J, Bolton KC, Shirley J, Pearce T, Tremblay M and Westlake M. 2012. Research on the Human Dimensions of Climate Change in Nunavut, Nunavik, and Nunatsiavut: A Literature Review and Gap Analysis. *Arctic*. 65(3): 289–304
- Ford J, Bolton KC, Shirley J, Pearce T, Tremblay M and Westlake M. 2012. Mapping human dimensions of climate change research in the Canadian Arctic. *Ambio*. 41(8): 808–822

Peruvian team

- Sherman M, Ford J, Llanos-Cuentas A, Valdivia MJ, Bussalleu A, IHACC Research Group. 2015. Vulnerability and adaptive capacity of community food systems in the Peruvian Amazon: a case study from Panaillo. *Natural Hazards*
- Sherman M and Ford J. 2013. Market engagement and food insecurity after a climatic hazard. *Global Food Security*. 2(3): 144–155
- Sherman M, Berrang-Ford L, Ford J, et al. 2012. Balancing Indigenous Principles and Institutional Research Guidelines for Informed Consent: A case study from the Peruvian Amazon. *American Journal of Bioethics: Primary Research*. 3(4): 1–16
- Hofmeijer I, Ford JD, Berrang-Ford L, Zavaleta C, Carcamo C, Llanos E, Carhuaz C, Edge V, Lwasa S, and Namanya D. 2012. Community vulnerability to the health effects of climate change among Indigenous populations in the Peruvian Amazon: A case study of from Panaillo and Nuevo Progreso. *Mitigation and Adaptation Strategies for Global Change*

Ugandan team

- Labbé J, Ford JD, Berrang-Ford L, Donnelly B, Lwasa S, Namanya DB, Twesigomwe S, IHACC Research Team, Harper, SL. In Press. Vulnerability to the health effects of climate variability in rural southwestern Uganda. *Mitigation and Adaptation Strategies for*

Global Change

Clark S, Berrang-Ford L, Lwasa S, Namanya DB, Edge VL, IHACC Research Team and Harper S. 2014. The burden and determinants of self-reported acute gastrointestinal illness in an Indigenous Batwa Pygmy population in southwestern Uganda. *Epidemiology and Infection*, [Epub ahead of print]

Lewnard J, Berrang-Ford L, Lwasa S, Namanya D, Patterson, K Donnelly B, Kulkarni-Woodstock M, Harper S, Ogden N, Carcamo C, Indigenous Health Adaptation to Climate Change Research Group. 2014. Relative undernourishment and food insecurity associations with *Plasmodium falciparum* among Batwa pygmies in Uganda: evidence from a cross-sectional survey. *American Journal of Tropical Medicine & Hygiene*. 91(1): 39–49

Berrang-Ford L, Dingle K, Ford J, et al. 2012. Vulnerability of Indigenous Health to Climate Change: A Case Study of Uganda's Batwa Pygmies. *Social Science & Medicine*. 75: 1067–1077

2. Results dissemination booklets:

- *Floods, Markets, and Institutions: What's changing food security in the Peruvian Amazon?*
- *Diarrheal disease among the Batwa of Kanungu, Uganda*
- *IHACC Uganda- Summary of Emerging Research Results*
- *Iqaluit's Food System Under Climatic Stress*
- *Responses to Food Insecurity*

3. Videos:

- SIACC – Salud Indígena y Adaptación al Cambio Climático
- IHACC – Indigenous Health Adaptation to Climate Change

4. Other relevant websites:

- IHACC project website: www.ihacc.ca
- Photovoice methods: <http://ihacc.ca/photovoice>
- Ethics protocol (including links to the peer-reviewed literature that fed in to the creation of this protocol): <http://ihacc.ca/ethics>
- McGill University, Department of Geography website: www.mcgill.ca/geography/
- Climate Change Adaptation Research Group: www.jamesford.ca
- Geographic and Environmental Epidemiology Lab: www.leaberrangford.ca

2. **GLOBAL** | Forests and trees for social adaptation to climate variability and change

Center for International Forestry Research (CIFOR)

Sectors	Adaptation element	Climate hazard
Biodiversity, agriculture, coastal areas /zones, community-based adaptation, crops, disaster-risk reduction, ecosystem-based adaptation, ecosystems, food security, farm systems, human settlements, indigenous and traditional knowledge, livestock, urban resilience, water	Adaptation planning and practices, institutional arrangements, vulnerability assessment	Drought, extreme heat, floods, land and forest degradation, storm surges, tropical cyclones/typhoons
Type of initiative	Scientific peer reviewed publication	
Description of the data collection initiative	<p>The objective of this initiative was to review the scientific literature related to ecosystem-based adaptation (EBA) with forests and trees. Ecosystems provide important services that can help people adapt to climate variability and change. This role is central to many local, indigenous and traditional knowledge systems and practices. The review highlights cases in which forests and trees support adaptation; for example, forests and trees providing goods to local communities facing climatic threats and trees in agricultural fields regulating water, soil and microclimate for more resilient production. The review provides evidence, sometimes derived from analyses of local perceptions and knowledge, that EBA with forests and trees can reduce social vulnerability to climate hazards. For example, the review shows that forest ecosystem services are part of the short-term coping strategies of local communities and longer-term diversification of livelihoods under climate variability and change. Farmers have long been managing local tree species to reduce their sensitivity to climate variability through a continuous harvest of products. Some traditional agroforestry practices can reduce the impacts of droughts on crop yield and their benefits are sometimes enhanced through traditional soil and water conservation techniques.</p>	
Authors	Emilia Pramova, Bruno Locatelli, Houria Djoudi and Olufunso A. Somorin	
Year of publication	2012	

**Further
information**

- Pramova E, Locatelli B, Djoudi H, Somorin O. 2012. Forests and trees for social adaptation to climate variability and change. *WIREs Climate Change*. 3: 581–596. doi:10.1002/wcc.195 <http://onlinelibrary.wiley.com/doi/10.1002/wcc.195/pdf> [OPEN ACCESS]
- CIFOR website: <http://www.cifor.org/>

3. **GLOBAL** | Including indigenous knowledge and experience in IPCC assessment reports

McGill University, Canada

Sectors	Adaptation element	Climate hazard
Indigenous and traditional knowledge	Science and research	Desertification, drought, extreme cold, extreme heat, floods, glacier retreat and related impacts, increasing temperatures, land and forest degradation, tropical cyclones/typhoons, vector and water-borne diseases, wildfire
Type of initiative	Scientific peer reviewed publication	
Description of the data collection initiative	<p>The Intergovernmental Panel on Climate Change (IPCC) is the leading international body for the assessment of climate change, forming the interface between science, policy and global politics. Indigenous issues have been under-represented in previous IPCC assessments. This review analysed how indigenous content is covered and framed in the contribution of Working Group II (WGII) to the IPCC Fifth Assessment Report (AR5). The review count that, although there is reference to indigenous content in the Working Group II contribution, and that this had increased when compared with the Fourth Assessment Report, the coverage is general in scope and limited in length, there is little critical engagement with indigenous knowledge systems, and the historical and contextual complexities of indigenous experiences are largely overlooked. The development of culturally relevant and appropriate adaptation policies requires more robust, nuanced and appropriate inclusion and framing of indigenous issues in future assessment reports, and the review outputs outlined how this can be achieved.</p>	
Authors	James D. Ford, Laura Cameron, Jennifer Rubis, Michelle Maillet, Douglas Nakashima, Ashlee Cunsolo-Wilcox and Tristan Pearce	
Year of publication	2016	

**Further
information**

- Ford JD, et al. 2016. Including indigenous knowledge and experience in IPCC assessment reports. *Nature climate change*. Vol. 6, pp. 349–353. Available at:
<http://www.nature.com/nclimate/journal/v6/n4/full/nclimate2954.html>
- McGill University website: <https://www.mcgill.ca/>

4. **GLOBAL** | The use of indigenous plant species for drinking water treatment in developing countries: a review

Department of Environmental Health Science and Technology, Jimma University, Ethiopia

Sectors	Adaptation element	Climate hazard
Indigenous and traditional knowledge, water	Adaptation planning and practices, science and research	Vector and water-borne diseases

Type of initiative Scientific peer reviewed publication

Description of the data collection initiative The data collection initiative is a review of the scientific literature about the use of indigenous plant species for water treatment. Many plants that have cleaning properties were used at first by indigenous communities and are part of traditional knowledge. The review gives an overview of the scientific research that has been done, including on the use of traditional and indigenous plant knowledge for the purposes of water treatment.

Abstract

“Although universal access to safe and piped water is an important long-term solution, it is very expensive and challenging to implement in developing countries in the short term. Hence, improving both physicochemical and microbiological quality of drinking water at a household level is believed to be effective in preventing infectious diarrhea. There are a number of household water treatment technologies proven to be effective in coagulation and disinfection. At present, a number of effective coagulants and disinfectants have been identified of plant origin. Of the large number of plant materials that have been used over the years, the seeds from *Moringa oleifera* have been shown to be one of the most effective primary coagulants for water treatment, especially in rural communities. In addition, indigenous knowledge indicates that there are several plant species that can be used as a coagulant and disinfectant. Out of which seeds of *Prosopis juliflora*, *Dolichos lablab* and leaves of *Opuntia ficus indica* showed effectiveness in coagulation. Although, plant species have enormous advantage in water treatment, they also have limitation. The major limitation is the release of organic matter and nutrients to apply at large scale. From these review, it can be concluded that plant species have the potential to serve as a complementary water treatment agent especially in rural areas.”

Authors Moa Megersa, Abebe Beyene, Argaw Ambelu, Bizuneh Woldeab

Year of publication 2014

Further information

- Megersa M, et al. 2014. The use of indigenous plant species for drinking water treatment in developing countries: a review. *Journal of Biodiversity and Environmental Sciences (JBES)*. Vol. 5, No. 3, pp. 269–281. The publication is available at:
<http://www.innspub.net/wp-content/uploads/2014/09/JBES-Vol5No3-p269-281.pdf>
- Further information on the topic: Megersa M, et al. 2015. Ethnomedicinal knowledge on water purification in selected rural areas of Ethiopia. *Ethnobotany Research and Applications*. Vol. 14, pp. 393–404. The publication is available at:
<http://journals.sfu.ca/era/index.php/era/article/view/1186>
- Jimma University website: <https://www.ju.edu.et/>

5. **GLOBAL** | Community-based fire management – A review
 Food and Agriculture Organization of the United Nations (FAO)

Sectors	Adaptation element	Climate hazard
Community-based adaptation, disaster-risk reduction, ecosystems, indigenous and traditional knowledge	Adaptation planning and practices, knowledge management, stakeholder involvement	Wildfire

Type of initiative Technical document/report

Description of the data collection initiative **Context**
 In many countries around the world communities continue to use fire in a safe and effective manner to improve livelihoods and protect resources. These communities are quite familiar with fire and its uses for traditional livelihood activities such as clearing vegetation for agriculture, improving pastures for grazing, hunting and managing non-timber forest products (NTFPs).

Examples of community-based fire management (CBFiM) can be found globally in developing, transitioning and industrialized nations. The success of these efforts varies depending upon a number of factors, including the existence of: supporting policy and legislation; land tenure; and institutional and community capacity. What remains consistent, however, is that fire, people and the ecosystems that they inhabit are inextricably linked. There always has been fire and, as a natural disturbance event, there always will be fire. For these reasons it is essential that contemporary fire management approaches, if they are to be effective, consider not only the technical aspects of fire management, but also the communities and the environments in which they live.

Definition of CBFiM

CBFiM can be considered to be a subset of community-based natural resource management (CBNRM), which is not a new idea or approach to natural resource management. In practice, CBNRM is mostly about ways in which the state or government can share rights and responsibilities regarding natural resources with local communities. A continuum for CBFiM has been identified, suggesting that in general terms it can be considered as having three nodes:

- Local-scale fire management in which traditional or indigenous knowledge plays the major role in informing and undertaking fire management, and

which is also planned, conducted and controlled by local people. Livelihoods and maintaining the landscape are key to this node of CBFiM. A community may have complete ownership and legally recognized tenure rights, including management of land and natural resources, completely community-based. The practices of Australian aborigines are an example of this node of CBFiM. [This node is relevant regarding the use of indigenous and traditional knowledge and practices (ITKP).]

- Community involvement in fire management, which involves a range of local actors, including agencies and non-governmental organizations (NGOs), that work on fire management. Livelihood dependence, some traditional practice and community institutions may be characteristics. Elements needing support may include: analysis of the fire problem, technical capacity, regulatory framework or logistical assistance.
- Volunteers from the community, perhaps with agency involvement, conduct fire management on behalf of the community across private and public lands. The development of Community Wildfire Protection Plans (CWPPs) in the United States of America and the Volunteer Bushfire Brigades in Australia are examples of this node of local management. There may be very little direct involvement of local people in the rural landscape, and livelihood dependence on lands or forests is low. Hence, community involvement may be limited to a role in which the community is informed of management decisions and designated roles and responsibilities by the government, with very limited consultation. This node is, therefore, not really considered community-based.

The data collection initiative gathers five case studies of CBFiM in Namibia, the United States of America, Mexico, Australia and Mozambique.

The case studies illustrate a variety of CBFiM strategies being used to achieve specific objectives for the communities in question. The examples highlight, among others: hazardous fuel reduction in the wildland–urban interface (WUI) in the United States of America; fire and traditional livelihood activities such as agriculture in Namibia; the use of fire in Mexico for such objectives of sustainable forest management as conservation of biodiversity; and the combination of traditional and contemporary fire knowledge to facilitate effective fire management by indigenous groups in Australia. The case studies represent developing and developed countries.

The case studies in Australia, Mexico and Namibia include the use of ITKP for fire management.

**Year of
publication**

2011

**Further
information**

- Reference for the publication:
FAO. 2011. *Community Based Fire Management: A Review*. FAO, Rome. Available at:
<http://www.fao.org/docrep/015/i2495e/i2495e.pdf>
- Other relevant publication:
International Forest Fire News (IFFN). 2003. Strategic Paper. Community-based fire management. Outcomes of the international wildland fire summit. Sydney, Australia, 8 October 2003. *International Forest Fire News*. No. 29, pp. 20–35
- FAO website: <http://www.fao.org/>

6. **GLOBAL** | The traditional knowledge advantage: indigenous peoples' knowledge in climate change adaptation and mitigation strategies

International Fund for Agricultural Development (IFAD)

Sectors	Adaptation element	Climate hazard
Agriculture, biodiversity, adaptation finance, coastal areas/zones, community-based adaptation, crops, ecosystem-based adaptation, ecosystems, food security, food systems, farm systems, gender, indigenous and traditional knowledge, infrastructure, livestock, marine fisheries, service, tourism, water	Adaptation planning and practices, capacity-building, communication and outreach/awareness, education and training, knowledge management, monitoring and evaluation, vulnerability assessment	All climate hazards
Type of initiative	Technical document/report	
Description of the data collection initiative	<p>Indigenous peoples have millennia of experience in collecting and applying local environmental information to help their communities plan for and better manage the risks and impacts of the natural variability and extremes of climate. What is new is the threat of human-induced climate change and the need to adapt to its adverse effects. In this context, communities of indigenous peoples are proving to be an important source of climate history and baseline data, and are already playing a valuable role by providing local-scale expertise, monitoring impacts and implementing adaptive responses at the local level. The traditional knowledge of indigenous people offers information and insight that complement conventional science and environmental observations, as well as provide a holistic understanding of the environment, natural resources and culture, and the human interrelation with them.</p> <p>Today, 30 per cent of the ongoing projects funded by International Fund for Agricultural Development (IFAD) loans support indigenous communities in 38 countries, representing a total investment of about USD 800 million. In addition to regular loan and grant-financed activities, IFAD has access to a dedicated financial instrument, the Indigenous Peoples Assistance Facility (IPAF), which aims to strengthen indigenous communities and their organizations by financing small projects that foster their self-driven development. IPAF builds direct partnerships with indigenous peoples in order to enable them and their communities to design, approve and implement grass-roots development projects. Since 2007, IPAF has financed</p>	

130 projects for a total amount of about USD 4 million.

The *Traditional Knowledge Advantage* catalogues a range of approaches put forward by indigenous communities around the world, supported by IFAD, to contend with the effects of environmental degradation and climate change. The publication provides an overview of IFAD engagement with indigenous peoples and presents case studies that highlight effective partnerships with indigenous institutions to improve well-being, income and food security through self-driven development that builds on their identity and culture.

Case studies:

- Climate change adaptation in Bolivia
- Disaster-risk reduction in the Solomon islands
- Biodiversity conservation in India
- Food security and agrobiodiversity in different countries (Bolivia, Ecuador, Peru, India, Nepal, Egypt and Yemen)
- Natural resources management in the Philippines
- Pastoralism in Chad

Implementing partners Federación de Club de Madres, Central de Comunidades Nativas de la Selva Central (Bolivia); Ministry of Agriculture, Livestock and Fishery (Ecuador); Initiative for Living Community Action (Ethiopia); Society for the Protection of Animal Life and the Environment (Cameroon); Centre for Development Action (Orissa, India); Thenkhleg Khugjil (Mongolia); International Solomon Island, Aoke Langanga Constituency Apex Association (Solomon Islands); Bioersity International

Year of publication To be published in 2016

Further information

- For more information on IFAD engagement with indigenous peoples, see: https://www.ifad.org/topic/overview/tags/indigenous_peoples
- Indigenous Peoples Assistance Facility website: https://www.ifad.org/topic/ipaf/overview/tags/indigenous_peoples
- IFAD website: <http://www.ifad.org/>

7. **GLOBAL** | WWF Climate Crowd
[World Wildlife Fund \(WWF\)](#)

Sectors	Adaptation element	Climate hazard
Agriculture, biodiversity, coastal areas/zones, community-based adaptation, crops, ecosystem-based adaptation, ecosystems, food security, food systems, farm systems, freshwater fisheries, health, horticulture, gender, indigenous and traditional knowledge, infrastructure, livestock, marine fisheries, water	Adaptation planning and practices, capacity building, climate observations, communication and outreach/awareness, education and training, knowledge management, monitoring and evaluation, science and research, socio economic data and information, stakeholder involvement impact assessment, vulnerability assessment	All climate hazards

Type of initiative Online portal

Description of the data collection initiative **What is WWF Climate Crowd?**

Far removed from decision-making bodies and financial resources, rural communities are often left to their own devices to cope and adapt to changes in weather and climate. WWF Climate Crowd is a new initiative to crowdsource information on how these communities are responding and how their responses are impacting biodiversity. WWF Climate Crowd collaborates with organizations such as the Peace Corps, School for Field Studies and Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), to collect this data, find and implement ways to better help communities adapt, and alter conservation strategies in light of the information gathered.

Why?

Indigenous, local and traditional knowledge systems could be a very useful tool for adapting to climate change, but these have not been used consistently in existing efforts. Additionally, most research has focused on the direct impacts of climate change on biodiversity, but largely neglected how human responses to climate change are impacting biodiversity.

Goals

- To fill critical knowledge gaps that will increase understanding of how communities are responding to climate change and the effects of their responses on biodiversity.
- To implement projects that increase the resilience of both wildlife and communities.
- To raise awareness of this issue through compelling stories from the front lines of climate change.

Implementing partners Peace Corps, School for Field Studies, USAID, GIZ, University of Belize, Emerging Wildlife Conservation Leaders, International Gorilla Conservation programme, and others.

Year of publication 2016

Further information

- The WWF Climate Crowd portal is available at <https://www.wwfclimatecrowd.org/>
- WWF website: <http://www.worldwildlife.org/>

8. **GLOBAL** | Weathering uncertainty: traditional knowledge for climate change assessment and adaptation

Local and Indigenous Knowledge Systems programme, United Nations Educational, Scientific and Cultural Organization (UNESCO) and United Nations University – Traditional Knowledge Initiative

Sectors	Adaptation element	Climate hazard
Community-based adaptation, ecosystem-based adaptation, food security, gender, indigenous and traditional knowledge, livestock	Adaptation planning and practices, climate observations, impact assessment	Desertification, drought, land and forest degradation, sea level rise, shift of seasons
Type of initiative	Scientific/peer-reviewed publication	
Description of the data collection initiative	This 120-page volume, co-published by UNESCO and UNU, is the product of an inter-agency partnership that also includes the Intergovernmental Panel on Climate Change (IPCC), Secretariat of the Convention on Biological Diversity and the United Nations Development Programme (UNDP) Global Environment Facility (GEF) Small Grants programme and an international expert meeting on traditional knowledge and climate change adaptation (for details, see www.ipmpcc.org). It references 280 publications from the scientific literature (peer-reviewed and grey literature) and covers themes at the core of the IPCC Fifth Assessment Report such as foundations for decision-making on indigenous knowledge, traditional livelihoods, vulnerability, resilience, and adaptation policy and planning.	
Year of publication	2012	
Further information	<ul style="list-style-type: none"> ▪ Nakashima DJ, Galloway McLean K, Thulstrup HD, Ramos Castillo A and Rubis JT. 2012. <i>Weathering Uncertainty: Traditional Knowledge for Climate Change Assessment and Adaptation</i>. Paris, UNESCO, and Darwin, UNU ▪ <i>Weathering Uncertainty</i> (full publication): http://unesdoc.unesco.org/images/0021/002166/216613E.pdf ▪ <i>Weathering Uncertainty</i> (executive summary): http://unesdoc.unesco.org/images/0021/002175/217502m.pdf ▪ Press release on the launch of the publication: 	

http://www.unesco.org/new/en/natural-sciences/about-us/single-view/news/turning_tables_on_climate_change_indigenous_assessments_of_impacts_and_adapt/#.VxebuHrqXrw

- UNESCO website: <http://en.unesco.org/>
- UNU website: <http://unu.edu/>

9. **GLOBAL** | Technologies and practices for small agricultural producers
 Food and Agriculture Organization of the United Nations (FAO)

Sectors	Adaptation element	Climate hazard
Agriculture, crops, disaster-risk reduction, energy, livestock	Adaptation planning and practices, capacity building, education and training, technology support	Drought, extreme heat, extreme cold
Type of initiative	Online portal	
Description of the data collection initiative	TECA is a platform that provides practical information – agricultural technologies and practices – to help small producers in the field. In addition, it enables users to interact with people with similar interests and discuss sustainable solutions through online forums.	
Year of publication	2015	
Further information	TECA is available at: http://teca.fao.org/home FAO website: www.fao.org	

10. **GLOBAL** | Community-based fire management
 Global Fire Monitoring Center (GFMC)

Sectors	Adaptation element	Climate hazard
Community-based adaptation, disaster-risk reduction, ecosystem-based adaptation, ecosystems, indigenous and traditional knowledge	Adaptation planning and practices, education and training, stakeholder involvement	Land and forest degradation

Type of initiative Technical document/report

Description of the data collection initiative The data collection initiative gathers information on community-based fire management (CBFiM), including case studies from different regions.

Examples of CBFiM can be found globally in developing, transitioning and industrialized nations (e.g. use of fire in natural and anthropogenically influenced natural landscapes) or land-use systems (agriculture, pastoralism). Its use is usually reviewed when devising a local system of fire management. The review of indigenous or traditional use of fire is necessary because such practices may not necessarily be in line with the latest scientific insights and/or with advanced compatibility of principles of environmental protection. For instance, traditional burning practices may be beneficial for enhancing productivity of land-use systems, but may generate gas and particle emissions that cause more problems than benefit. However, certain burning practices may result in less total greenhouse gas emissions than uncontrolled fires, which may burn under different regimes and cause higher emission rates or more damage. In all cultural systems around the world traditional practices have some similarities but are different in the detail (e.g. techniques and objectives of fire use). Traditional and sometimes indigenous practices are tested or applied in many continents and countries, as follows:

- Africa and the Arab States: Yes – traditional practices of using fire in the management of savannah landscapes for wildlife and biodiversity conservation, hunting and domestic livestock.
- Asia-Pacific: Yes – assisting indigenous communities to use fire as a small and sustainable land-use tool for maintaining livelihoods of shifting cultivators (e.g. in tropical rainforest areas); early burning of tropical Australian biota to avoid late-fire season fires that are more destructive and emit more greenhouse gases than early season fires.

- Caribbean and Central America: Yes – use of prescribed fire in managing native pine forests, based on indigenous expertise and advanced science.
- Europe: Yes – revival of traditional burning practices in regeneration and biodiversity management of open cultural landscapes.
- North America: Yes – revival of indigenous burning practices in forest and prairie landscapes, to maintain or to restore open forest and prairies habitats for wildlife and flora.
- South America: Yes – moving from the principles of fire exclusion to integrated fire management’ (i.e. allowing traditional burning methods to be applied under ‘controlled’ conditions and supervision in order to avoid excessive burning and fires getting out of control).
- Not region-specific: As stated above – many common principles to be applied globally.
- Global: As stated above – many common principles to be applied globally.

Year of publication

The dedicated web-based portal of CBFiM was established by the Global Fire Monitoring Center (GFMC) in 2005 and has been updated continuously since then.

Further information

- The data collection initiative website: <http://www.fire.uni-freiburg.de/Manag/CBFiM.htm>
- GFMC website: <http://www.fire.uni-freiburg.de/>

11. **GLOBAL** | Advance guard: Climate change impacts, adaptation, mitigation and indigenous peoples

United Nations University (UNU) – Traditional Knowledge Initiative

Sectors	Adaptation element	Climate hazard
Agriculture, biodiversity, coastal areas/zones, community-based adaptation, crops, disaster-risk reduction, ecosystem-based adaptation, ecosystems, energy, food security, food systems, farm systems, freshwater fisheries, gender, health, horticulture, human settlements, indigenous and traditional knowledge, livestock, marine fisheries, water	Adaptation planning and practices, climate observations, capacity-building, climate scenarios, communication and outreach/awareness, education and training, financial support, impact assessment, institutional arrangements, knowledge management, monitoring and evaluation, science and research, socio economic data and information, stakeholder involvement, technology support, vulnerability assessment	Desertification, drought, extreme cold, extreme heat, floods, glacier retreat and related impacts, increasing temperatures, land and forest degradation, loss of biodiversity, ocean acidification, salinization, sea level rise, shift of seasons, storm surges, tropical cyclones/typhoons, vector and water-borne diseases, wildfire

Type of initiative Technical paper/report

Description of the data collection initiative **Executive summary**
Advance Guard – Climate Change Compendium is a 125-page report that presents a wide-ranging overview of more than 400 projects, case studies and research activities specifically related to climate change and indigenous peoples. The compendium provides a sketch of the climate and environmental changes, local observations and impacts being felt by communities in different regions, and outlines various adaptation and mitigation strategies that are currently being implemented by indigenous peoples – the world’s “advance guard” of climate change – as they use their traditional knowledge and survival skills to test adaptive responses to change.

Effective adaptation planning relies on the best available knowledge base, and the urgent need to respond to the pressures of climate change has put a premium on the generation, interpretation and use of information in this regard. In recent years, there has been an increasing realization that the observations and assessments of indigenous groups provide valuable local-level information, offer local verification of global models, and are currently providing the basis for local community-driven adaptation strategies that are way past the planning stage and are already being implemented and tested.

Local observations of direct effects of climate change by indigenous peoples corroborate scientific predictions, and include: temperature and precipitation changes; coastal erosion; permafrost degradation; changes in wildlife, pest and vector-borne disease distribution; sea-level rise; increasing soil erosion, avalanches and landslides; more frequent extreme weather events, such as intense storms; changing weather patterns, including increasing aridity and drought, fire and flood patterns; and increased melting of sea-ice and mountain ice.

Specific vulnerabilities and early effects being reported by indigenous peoples include: cultural and spiritual impacts; demographic changes, including displacement from traditional lands and territories; economic impacts and loss of livelihoods; land and natural resource degradation; impacts on food security and food sovereignty; health issues; water shortages; and loss of traditional knowledge. Impacts are felt across all sectors, including: agriculture and food security; biodiversity and natural ecosystems; animal husbandry (particularly pastoralist lifestyles); housing, infrastructure and human settlements; forests and natural resource management; transport; energy consumption and production; and human rights.

In spite of these impacts, indigenous peoples have a variety of successful adaptive and mitigation strategies to share. The majority of these are planned adaptive responses that are based in some way on traditional ecological knowledge, whether the responses involve modifying existing practices or restructuring relationships with the environment. Indigenous strategies include: the application and modification of traditional knowledge; shifting resource bases; altering land use and settlement patterns; blending of traditional knowledge and modern technologies; fire management practices; changes in hunting and gathering periods and crop diversification; management of ecosystem services; awareness-raising and education, including an increasing use of multimedia and social networks; and policy, planning and strategy development.

The compendium incorporates material from different disciplines and covers a diversity of approaches to data collection and project reporting drawn from the literature. Although the compendium of projects and case studies does not claim to provide an exhaustive list of ongoing activities related to climate change and indigenous peoples, it does contain a representative and illustrative survey of current effects and adaptive responses. It aims to provide an insight into the ecological and cultural complexity of sustainable development issues surrounding climate change and indigenous peoples, and to highlight instances that may be useful in providing guidance for future policy development.

Author Kirsty Galloway McLean

Year of publication 2010

Further information

- Galloway McLean K. 2010. *Advance Guard – Climate Change Compendium*. United Nations University. The publication is available at: <http://tfm.unu.edu/publications/books/2010-advance-guard-climate-change-compendium.html#overview>
- UNU website: <http://unu.edu/>

12. GLOBAL | World Overview of Conservation Approaches and Technologies (WOCAT)

WOCAT

Sectors	Adaptation element	Climate hazard
Agriculture, biodiversity, coastal areas/zones, community-based adaptation, crops, disaster-risk reduction, ecosystem-based adaptation, ecosystems, food security, food systems, farm systems, indigenous and traditional knowledge, water	Adaptation planning and practices, knowledge management, science and research	Desertification, drought, extreme heat, floods, glacier retreat and related impacts, increasing temperatures, land and forest degradation, loss of biodiversity, ocean acidification, salinization, sea level rise, shift of seasons, storm surges, tropical cyclones/typhoons, vector and water-borne diseases, wildfire
Type of initiative	Technical paper/report	
Description of the data collection initiative	<p>World Overview of Conservation Approaches and Technologies (WOCAT) is an established global network which supports innovation and decision-making processes in sustainable land management (SLM).</p> <p>The overall goal of the WOCAT network is to unite the efforts in knowledge management and decision support for upscaling SLM among all stakeholders including national governmental and non-governmental institutions and international and regional organizations and programmes. The network provides tools that allow SLM specialists to identify necessary actions and share their valuable knowledge about land management. It also assists them in their search for appropriate SLM technologies and approaches and supports them in making decisions in the field and at the planning level and in upscaling identified best practices.</p> <p>The most important WOCAT knowledge products are:</p> <ol style="list-style-type: none"> 1. A global online database system: Three databases on SLM Technologies, SLM Approaches and SLM Mapping including case studies and maps from over 50 countries. 2. Global, regional and national books, factsheets and brochures: Over 20 publications have been generated by WOCAT and its partners, including overview books, inventories of practices and guidelines. 	
Implementing partners	The WOCAT network is coordinated by the Steering Committee of WOCAT International consisting of eight partners:	

- University of Bern, Centre for Development and Environment (CDE), Bern, Switzerland
- Food and Agriculture Organization of the United Nations (FAO), Rome, Italy
- ISRIC – World Soil Information (Stichting International Soil Reference and Information Centre), Wageningen, Netherlands
- Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH
- A Swiss confederation, represented by the Federal Department of Foreign Affairs acting through the Swiss Agency for Development and Cooperation (SDC), Bern, Switzerland
- International Center for Agricultural Research in the Dry Areas (ICARDA), Beirut, Lebanon
- International Centre for Integrated Mountain Development (ICIMOD), Kathmandu, Nepal
- International Centre for Tropical Agriculture (CIAT), Consultative Group on International Agricultural Research (CGIAR), based in Latin America, sub-Saharan Africa, South-East Asia

Year of publication 1992

Further information WOCAT website: <https://www.wocat.net/>

B. Africa

1. AFRICA | An Introduction to Integrating African Indigenous and Traditional Knowledge in National Adaptation Plans, Programmes of Action, Platforms and Policies Indigenous Peoples of Africa Coordinating Committee (IPACC)

Sectors	Adaptation element	Climate hazard
Community-based adaptation, ecosystem-based adaptation, indigenous and traditional knowledge	Knowledge management	Desertification, drought, extreme cold, extreme heat, floods, glacier retreat and related impacts, increasing temperatures, land and forest degradation, storm surges, tropical cyclones/typhoons, vector and water-borne diseases, wildfire
Type of initiative	Technical document/report	
Description of the data collection initiative	<p>The document provides an introduction and a framework for indigenous peoples, rural communities and governments in Africa to work cooperatively in harnessing indigenous and traditional knowledge and practices (ITKP) to meet the challenges of climate change impacts. The materials have been developed by the Indigenous Peoples of Africa Coordinating Committee (IPACC) to assist African governments and civil society organizations, including indigenous peoples organizations and traditional leadership, to consider how to mobilize the rich and detailed systems of Africa knowledge to contribute to surviving climate instability and enhancing national adaptation initiatives.</p> <p>The materials are intended to help policymakers understand how diversity of knowledge contributes to problem solving with regards to climate impacts, vulnerability, social coherence and ecological resilience in our unstable future. The ability to draw on diverse knowledge holders and systems of thought and culture all contribute to maintaining peace and security, while conserving the environmental components that support human and other life forms. In addition, knowledge management embeds active engagement by communities in the climate change agenda and promotes a national consciousness about sustainability. Such approaches are meshed with cultural diversity, intangible heritage and systems of decision-making.</p>	

Implementing partners	The report was primarily funded by Siemenpuu Säätiö (Finland) with additional support from Bread for the World (Germany) and Norwegian Church Aid.
Year of publication	2016
Further information	<ul style="list-style-type: none"> ▪ Crawhall N. (ed.). 2016. <i>An Introduction to Integrating African Indigenous and Traditional Knowledge in National Adaptation Plans, Programmes of Action, Platforms and Policies</i>. IPACC, Cape Town ▪ IPACC website: http://www.ipacc.org.za/en/

2. **AFRICAN SAHEL** | The value of indigenous knowledge in climate change mitigation and adaptation strategies in the African Sahel

Authors: A. Nyong, F. Adesina, B. Osman Elasha

Sectors	Adaptation element	Climate hazard
Agriculture, crops, disaster-risk reduction, ecosystems, food security, food systems, farm systems, human settlements, indigenous and traditional knowledge, livestock	Adaptation planning and practices, climate observations, vulnerability assessment	Desertification, drought

Type of initiative Technical document/report

Description of the data collection initiative Past global efforts to deal with the problem of global warming concentrated on mitigation, with the aim of reducing and possibly stabilizing greenhouse gas concentrations in the atmosphere. With the slow progress in achieving this, adaptation was viewed as a viable option to reduce the vulnerability to the anticipated negative impacts of global warming. There has been a growing realization that mitigation and adaptation should not be pursued independent of each other but as complements. This has resulted in recent calls for the integration of adaptation into mitigation strategies. However, integrating mitigation and adaptation into climate change concerns is not a completely new idea in the African Sahel. The region is characterized by severe and frequent droughts with records dating back centuries. The local populations in this region, through their indigenous knowledge systems, have developed and implemented extensive mitigation and adaptation strategies that have enabled them to reduce their vulnerability to past climate variability and change, which exceed those predicted by models of future climate change. However, this knowledge is rarely taken into consideration in the design and implementation of modern mitigation and adaptation strategies.

This paper highlights some indigenous mitigation and adaptation strategies that have been practiced in the Sahel, and the benefits of integrating indigenous knowledge into formal climate change mitigation and adaptation strategies. Incorporating indigenous knowledge can add value to the development of sustainable climate change mitigation and adaptation strategies that are rich in local content, and planned in conjunction with local people.

Year of publication 2007

Further information Nyong et al. 2007. The value of indigenous knowledge in climate change mitigation and adaptation strategies in the African Sahel. *Mitigation and Adaptation Strategies for Global Change*. Vol. 12, Issue 5, pp. 787–797

<http://link.springer.com/article/10.1007%2Fs11027-007-9099-0>

3. **SWAZILAND** | Analysis of indigenous knowledge in Swaziland

Author: Paiki Muswazi

Sectors	Adaptation element
Agriculture, farm systems, indigenous and traditional knowledge	Knowledge management
Type of initiative	Technical document/report
Description of the data collection initiative	<p>Data collection included three phases. During the first phase, data were gathered through searches in archived literature, visits to the national museum, and correspondence with indigenous knowledge centres worldwide. Correspondence with these centres generated a global view of indigenous knowledge.</p> <p>The purpose of the study was to assess the status of indigenous knowledge management in Swaziland and explore various perspectives, specifically focusing on: codification programmes; indigenous knowledge management processes, systems and tools; and preliminary suggestions for deepening indigenous knowledge management concepts and practices in Swaziland's library and information services.</p> <p>The sources of data for this study include: a review of information resources and services available in Swaziland; analysis of a select sample of eight studies, surveys and initiatives, most of which involve indigenous communities; analysis of initiatives at the University of Swaziland (UNISWA), the national knowledge centre; and an examination of services, systems, facilities and processes for creating, accessing, sharing and linking knowledge to and between users inside and outside Swaziland.</p> <p>One limitation was the difficulty of quantifying the volume of structured and unstructured indigenous knowledge because of either its transient nature or scarcity on the one hand, and amorphousness on the other. To the extent that Swaziland communities have a strong oral inclination, an indeterminate volume of knowledge invariably exists in difficult to access, unstructured formats.</p>
Author	Paiki Muswazi

**Year of
publication** 2002

**Further
information** Paiki Muswazi. 2001. Analysis of Indigenous Knowledge in Swaziland.
Information Development. Vol. 17, No.4, pp. 250–256. Available at
<http://idv.sagepub.com/content/17/4/250.full.pdf+html>

4. **UGANDA** | Indigenous climate knowledge in southern Uganda: the multiple component of a dynamic regional system
 Makerere University

Sectors	Adaptation element	Climatic hazard
Indigenous and traditional knowledge	Climate observations, communication and outreach/awareness	Drought, shift of seasons
Type of initiative	Scientific/peer-reviewed publication	
Description of the data collection initiative	<p>A study of indigenous knowledge in southern Uganda.</p> <p>Objectives: to analyse a system of indigenous knowledge on climate; to document the system’s complexity, spatial, temporal and social scales, and dynamic nature; to discuss the complementarity between this system and modern science; and to contribute to the body of work on indigenous knowledge in the area of climate change.</p> <p>Methods: field visits over a period of 18 months at the onset of rains during the years 2005 and 2006, with research designed in the form of a combination of semi-structured individual and group interviews, as well as open-ended interviews.</p> <p>Outcomes: the communities are enabled to communicate with modern science through indigenous knowledge, in terms of climate variability and change.</p>	
Authors	Orlove B, Roncoli C, Kabugo M and Majugu A	
Year of publication	2010	
Further information	<ul style="list-style-type: none"> ▪ Orlove B, Roncoli C, Kabugo M and Majugu A. 2010. Indigenous climate knowledge in southern Uganda: the multiple components of a dynamic regional system. <i>Climate Change</i>. Vol. 100, Issue 2, pp. 243–264. Available at http://link.springer.com/article/10.1007%2Fs10584-009-9586-2 ▪ Makerere University website: http://mak.ac.ug/ 	

5. **UGANDA** | Role of indigenous knowledge in climate change adaptation: a case study of the Teso sub-region, Eastern Uganda
 Makerere University

Sectors	Adaptation element	Climatic hazard
Indigenous and traditional knowledge	Climate observations, communication and outreach/awareness	Drought, shift of seasons
Type of initiative	Scientific/peer-reviewed publication	
Description of the data collection initiative	<p>A study of indigenous knowledge in climate change adaptation in the Teso sub-region.</p> <p>Objectives: to identify indigenous knowledge practices used in climate change adaptation; to document indigenous knowledge in climate observations; to identify constraints to the use of indigenous knowledge for climate change adaptation.</p> <p>Methods: semi-structured questionnaires, individual interviews, focused group discussions and observations of local traditional rites.</p> <p>Outcome: the information collected highlighted that indigenous knowledge in Uganda is applied for crop production, charcoal production, livestock treatment, monitoring rainfall and preparing for dry season.</p>	
Implementing partners	Uganda National Meteorological Authority (UNMA)	
Author	Egeru A	
Year of publication	2010	
Further information	<ul style="list-style-type: none"> ▪ Egeru A. 2012. Role of indigenous knowledge in climate change adaptation: a case study of the Teso Sub-Region, Eastern Uganda. <i>Indian Journal of Traditional Knowledge</i>. 11(2), pp. 217–224. Available at http://repository.ruforum.org/documents/role-indigenous-knowledge-climate-change-adaptation-case-study-teso-sub-region-eastern ▪ Makerere University website: http://mak.ac.ug/ 	

C. Asia

1. ASIA | Climate Asia BBC Media Action

Sectors	Adaptation element	Climate Hazard
Agriculture, coastal areas/zones, community-based adaptation, crops, disaster-risk reduction, energy, food security, gender, health, human settlements, infrastructure, livestock, urban resilience, water	Adaptation planning and practices, climate observations, communication and outreach/awareness, socioeconomic data and information	Desertification, drought, floods, increasing temperatures, land and forest degradation, shift of seasons, tropical cyclones/typhoons

Type of initiative Multimedia material

Description of the data collection initiative **Overall research methodology**

The research undertaken for the Climate Asia project used a mix of quantitative and qualitative techniques to provide a comprehensive picture of how people are feeling the changes in climate across the region and how stakeholders (e.g. non-governmental organizations, governments and media) are tackling this issue now and what they are planning for the future.

Qualitative research included in-depth interviews with experts and opinion-formers, audience focus groups and community assessments. Initial insights from this research and the communications development process (which included workshops and an evaluation of existing initiatives) shaped the approach to quantitative research. These insights will inform analysis of the data it generates and the development of communication strategies.

Methods used

Researchers conducted 150 in-depth interviews across seven countries with key experts and opinion formers from government, media, business, civil society, science and academia. These interviews aimed to understand how people framed the issue, the priority they placed on it and their aims for communicating to the general public.

Focus groups

Ninety-six focus group discussions (FGDs) with the members of the public were completed across six countries (not China). These explored people's views of their lives, how they talk about their environment and relate to changes in climate. They also explored people's media habits, their trust in sources of information and their views of specific actions that they could take to deal with changes in the environment.

Community assessments

Forty-two community assessments were conducted across six countries (not Viet Nam). These assessments aimed to generate a more detailed understanding of how communities experience the impacts associated with climate change, including how the community is already responding to climate variability. The assessments used a range of research techniques (more details can be found in the downloadable guide, linked below).

Communications development workshops

Communications development workshops were held in Bangladesh, India, Indonesia, Nepal, Pakistan and Viet Nam in early 2012 with climate change experts, officials and practitioners along with media and communications professionals. These workshops discussed priority issues related to climate change, pinpointed affected communities and considered which communications solutions were most appropriate.

Communications evaluations

One hundred existing initiatives and programmes on climate change were evaluated. This process identified where resources are currently being placed, the types of communication approaches being implemented and where best practice lies.

Survey

Over 33,000 interviews were conducted across seven countries with adult population aged over 15 years. Nationally representative surveys were conducted in each country, but owing to their size, in India and China specific regions were chosen to cover a geographical representation of the country.

Implementing partners	Funded by United Kingdom Department for International Development (DFID)
Year of publication	2013

**Further
information**

- Further information, reports, infographics and links are available at <http://www.bbc.co.uk/climateasia> and all downloads available at <http://www.bbc.co.uk/climateasia/resources>
- A policy overview is available at: http://downloads.bbc.co.uk/mediaaction/policybriefing/bbc_media_action_from_the_ground_up_climate_change.pdf
- BBC Media Action website: www.bbc.co.uk/mediaaction

2. ASIA | On-farm composting methods

Food and Agriculture Organization of the United Nations (FAO)

Sectors	Adaptation element	Climate hazard
Agriculture, crops, food security	Communication and outreach/awareness, education and training, technology support	Land and forest degradation

Type of initiative Technical document/report

Description of the data collection initiative Growing concerns relating to land degradation, threat to ecosystems from over and inappropriate use of inorganic fertilizers, atmospheric pollution, soil health, soil biodiversity and sanitation have rekindled the global interest in organic recycling practices such as composting. The potential of composting to turn on-farm waste materials into a farm resource makes it an attractive proposition. Composting offers several benefits, such as enhanced soil fertility and soil health, thereby increasing agricultural productivity, improving soil biodiversity, reducing ecological risks and improving the environment. The following technologies are described in *On-Farm Composting Methods*, published by the Food and Agriculture Organization of the United Nations (FAO).

Even though the practice of on-farm composting is well known, farmers in many parts of the world, especially in developing countries, find themselves at a disadvantage by not making the best use of organic recycling opportunities available to them, owing to various constraints which, among others, include the absence of efficient expeditious technology, long time span, intense labour, land and investment requirements and economic aspects.

There is extensive literature on composting methodology. However, the FAO paper presents only a selective and brief account of the salient approaches.

By and large, ‘traditional methods’ adopt an approach of anaerobic decomposition, or aerobic decomposition based on passive aeration through measures such as little and infrequent turning or static aeration provisions (e.g. perforated poles/pipes), and are time-consuming processes involving several months. On the other hand, ‘rapid methods’ make use of the treatments introduced recently such as those mentioned above to expedite the aerobic decomposition process and bring down the composting period to around four to five weeks. Other recently introduced approaches, such as ‘vermi-composting’, bring down the process duration to a considerable extent when compared with the conventional methods in addition to producing a far-

superior quality product, but have a lower turn-over and longer time required taken compared with other rapid methods.

Traditional methods based on passive composting approaches involve simply stacking the material in piles or pits to decompose over a long period with little agitation and management. The 'Indian Bangalore method', which relies on this approach and permits anaerobic decomposition for a larger part of operations, requires six to eight months for the operations to complete. The method is still in use in urban areas of the developing world, mostly for the treatment of urban wastes. A method similar in approach involving anaerobic decomposition and followed in the global west by large farms, is 'passive composting of manure piles'. The active composting period in this process may range from one to two years.

The 'Indian Indore method', which slightly enhances passive aeration through a number of turnings (thereby permitting aerobic decomposition) reduces the time requirement, and enables production within a time-span of around four months. Chinese rural composting methods, based on the passive aeration approach using turnings/aeration holes, provide output in two to three months. These methods are extensively used in the developing world. Though the labour requirements for these methods are high, they are not capital intensive and do not require sophisticated infrastructure and machinery. Small farmers find them easy to practise, especially in those situations where manual labour is not a constraint. However, the low turnover and longer time span are the major bottlenecks.

The 'turned windrows' method has been used by large farms, especially in the developed parts of the world. The windrows are periodically turned using a bucket loader or special turning machine, commonly available on these farms. The turning operation mixes the composting materials, enhances passive aeration and provides conditions congenial for aerobic decomposition. Composting operations may take up to eight weeks. The 'passively aerated windrows' method eliminates the need for turning by providing air to the materials via pipes which serve as air ducts. The active composting period could range from ten to twelve weeks.

Rapid methods such as 'Berkley rapid composting' and 'North Dakota State University hot composting' involve accelerated aerobic decomposition through measures such as: chopping raw materials into small pieces; use of mineral compounds such as ammonium sulphate, chicken manure, urine; and turning of the material on daily basis. While chopping without much use of machinery may be possible at smaller scales, mechanization may be necessary for large scale applications. Whereas the 'Berkley rapid composting' method claims an active composting period of only two to three weeks, 'North Dakota

State University hot composting' may take four to six weeks.

The effective microorganism-based (EM-based) 'quick compost process' involves aerobic decomposition of rice husk/bran and cow dung as raw materials in pits, activated through turning; and uses EMs as an activator for expediting the decomposition process, which brings down the composting period requirement from twelve weeks to four weeks.

An example of the cellulolytic culture-based method is 'IBS rapid composting', which is a development of windrow composting. Salient process features include: the chopping of vegetative organic materials; passive aeration provided through air ducts; and the use of a cellulose decomposer fungus (*Trichoderma harzianum*). The process requires about four weeks.

Mechanical forced aeration-based methods such as 'aerated static pile' reduce the composting time period further, allow for higher, broader piles and have lower land requirements as well in comparison with the windrow or passively aerated windrow methods.

However, there is little experience of using aerated static piles with agricultural wastes: the technology is commonly used for the treatment of municipal sewage sludge. The active composting period may range from three to five weeks.

Mechanical forced aeration and accelerated mechanical turning methods such as 'in-vessel composting' are specially designed commercial systems, with potential advantages including reduced labour, weather proofing, effective process control, faster composting, reduced land requirement and quality output. However, high investment and recurring costs related to operation and maintenance could be a bottleneck for adoption, especially in economically disadvantaged areas. Among the in-vessel composting systems, 'bins' and 'rectangular agitated beds' in particular have found favour on several large farms in the developed world. Bin composting requires: the provision of forced aeration in the bin floor; little turning of the composting material; and movement of material from one bin to another.

Agitated bed systems appear to have promise for on-farm rapid composting. However, the cost for the system is expensive. Commercially manufactured large systems (150 tonnes/day or larger) are reportedly available, but small systems (20 tonnes/day or less), which are likely to be of interest the majority of farmers, are lacking.

Vermi-composting, based on the use of worms, results in high-quality compost. The process does not require physical turning of the material. To maintain aerobic conditions and limit the temperature rise, the bed or pile of materials needs to be of limited size. Temperatures should be regulated so as

to favour the growth and activity of worms. The composting period is longer when compared with other rapid methods and varies between six weeks and twelve weeks.

**Year of
publication**

2006

**Further
information**

- FAO. 2006. *On-Farm Composting Methods*. Available at:
[http://teca.fao.org/sites/default/files/technology_files/8 On farm comp methods_0.pdf](http://teca.fao.org/sites/default/files/technology_files/8_On_farm_comp_methods_0.pdf)
- FAO website: www.fao.org

3. **SRI LANKA** | Documenting good practices on climate change adaptation in agriculture
 Sri Lankan Youth Climate Action Program (SLYCAN)

Sectors	Adaptation element	Climate Hazard
Agriculture, community-based adaptation, crops, disaster-risk reduction, ecosystem-based adaptation, food security, indigenous and traditional knowledge, water	Adaptation planning and practices, capacity building, education and training, knowledge management	Drought, floods, salinization
Type of initiative	Online portal	
Description of the data collection initiative	<p>This data collection initiative is multi-faceted in that it is intended to have several outcomes. The project aims to document, at the technical level, good practices which would contribute to the national policy on food security and climate adaptation through an analysis of methods that will be used by farmers in agriculture which maximize water resources, minimize salinization and reuse land or agriculture through use of good practices, and climate-resilient varieties of seeds.</p> <p>The outcomes of the data collection are case studies, online articles and two papers which are being developed on: biodiversity-based adaptation in agriculture; and good practices for climate adaptive agriculture.</p> <p>The data collection focuses on traditional practices that enhance resilience and reduce the impacts of salinization and soil degradation. One of the key methods that has been implemented is the use of toxin-free fertilizer as an adaptation as well as a co-benefit based effort. In addition, data collection also focuses on ways of using the hay cover as a means of fertilizer, as well as the introduction of traditional seed varieties which are proven to be capable of growing on salinated land, and are flood resilient. Some of these varieties include: the very good rice varieties Pachaperumal, Periavellai, At 303, Adakari, Bg 406 and CO-10; and the good rice varieties Bg 250, At 353, At 362,Modaikarupan, H4, Bg 304 and Morungan.</p>	
Implementing partners	Nagenahiru Development Society (local community-based group): provided research assistance, primary data collection from farmers for case studies	
Year of publication	The articles and online information dissemination began in March 2016, while the papers are to be released in July 2016	

**Further
information**

Case studies and articles, and background information is available on the SLYCAN website: www.climatesrilanka.wordpress.com

D. North America

1. CANADA | Building Climate Resilience and Adaptation in the Kainai First Nation The Rockies Institute

Sectors	Adaptation element	Climate hazard
Agriculture, crops, food security, gender, health, indigenous and traditional knowledge, water	Capacity-building, education and training, stakeholder involvement	Drought, extreme heat, glacier retreat and related impacts, increasing temperatures, land and forest degradation, shift of seasons, wildfire
Type of initiative	Multimedia material	
Description of the data collection initiative	<p>The Building Climate Resilience and Adaptation in the Kainai First Nation project is engaging youth in a ‘learning journey’. The learning journey will result in photos, narratives and short films produced by young people who follow the project.</p> <p>The learning journey will create opportunities for Kainai young people to learn about climate change and be directly involved in the collection of data about good practices. This project will also inspire other young people in the Kainai First Nation to take positive actions towards building a climate resilient future.</p> <p>Through the project, the young people will learn what aspects of their lives stand to be most impacted by immediate localized and changing regional and international conditions. Resources and guidance will be provided that will allow them to document these same aspects during the discovery process as well as be in a position to document suggested solutions and offer their own thoughts and solutions to their community.</p>	
Implementing partners	<p>The Kainai First Nation – co-authoring the community approach and helping with the sourcing of funding.</p> <p>All One Sky Foundation – co-developing a community approach to climate risk assessment.</p>	
Year of publication	To be released in 2018	

**Further
information**

The Rockies Institute website: www.rockiesinstitute.com

E. South America

1. BRAZIL | SOMAI – System of Observation and Monitoring of the Indigenous Amazon Amazon Environmental Research Institute (IPAM)

Sectors	Adaptation element	Climate hazard
Ecosystems, indigenous and traditional knowledge	Climate scenarios, impact assessment, vulnerability assessment	Drought, extreme heat, shift of seasons

Type of initiative Online portal

Description of the data collection initiative System of Observation and Monitoring of the Indigenous Amazon (SOMAI) is a web-based platform that contains scientific data which reinforce the role of the indigenous people of the Brazilian Amazon and their territories in the maintenance of regional and global climate balance.

By using historical data on climate anomalies and deforestation in the region, the platform provides a geographic database that will be able to generate indicators about the indigenous lands which are most exposed to extreme climate events such as drought, heat and precipitation, to support a consultation and monitoring system.

SOMAI has been in development since 2013 and it is under constant improvement. It has been improved through public consultation with the indigenous organizations (Articulation of Indigenous Peoples of Brazil (APIB), Coordination of Indigenous Organizations of Brazilian Amazon (COIAB)) and partner institutions (Instituto Socioambiental (ISA)) and government organizations (the Brazilian Environmental Ministry and the Indigenous National Foundation (FUNAI)). The platform was created to support the efforts of climate change mitigation and adaptation, to empower the indigenous leaders and decision makers on the impacts of climate change on their lands and to help build action plans for the climate change adaptation of indigenous peoples.

Outcomes

Although the public consultation is still in progress and the platform is currently being improved, its climate analysis will provide some diagnosis data for the Adaptation National Plan (under development by the Environmental Ministry of Brazil), for the chapter on vulnerable populations, especially for the indigenous people of the Brazilian Amazon. Moreover, the platform is able to provide climate data for each indigenous territory of the

Brazilian Amazon, and is very useful for the planning of adaptation activities to mitigate the climate change impacts in these lands.

Good practices and lessons learned

The main challenge is to be overcome in the next step in the development of the platform. As a future activity it is aimed to integrate field data about the impacts already felt by the indigenous peoples in their lands with the scientific data analysis of SOMAI. For this activity, the development of applications for smartphones is being evaluated. The applications would give indigenous peoples the opportunity to monitor how some indicators of climate change are having an effect on their traditional way of life.

Technical expertise

The platform is being developed by high-level researchers, who are very experienced in climate projections and vulnerabilities. All of them are part of IPAM team. A report containing all the analysis compiled in the SOMAI is being developed. This report will be reviewed and validated by experts, including some IPCC report reviewers.

Implementing partners

- The Norwegian Embassy: financial support through its Indigenous Program Support
- USAID: financial support through the Accelerating Inclusion and Mitigating Emission (AIME) consortium
- COIAB (Coordination of Indigenous Organizations of Brazilian Amazon): support for capacity-building among indigenous groups on climate change and SOMAI
- APIB (Articulation of Indigenous People of Brazil): support for capacity-building among indigenous groups on climate change and SOMAI
- FUNAI (National Indigenous Foundation): data exchange about indigenous lands in Brazilian Amazon, and feedback for the improvement of SOMAI

Year of publication

2013

Further information

The platform provides a compilation of a large amount of publicly available data, including information on the following websites:

- Climate projections from global climate models: www.worldclim.org/CMIP5
- Surface temperature: MODIS (MOD09Q1)
- Rainfall: Tropical Rainfall Measuring Mission (TRMM)
- Mining: <http://sigmine.dnpm.gov.br/webmap/>
- Historical drought frequency: SPEI Global Drought Monitor

- <http://sac.csic.es/spei/map/maps.html>
- Carbon stock: Baccini et al., 2012, “Estimated carbon dioxide emissions from tropical deforestation improved by carbon-density maps”, Nature Climate Change, vol. 2, pp. 182-185.
 - Deforestation: PRODES project www.obt.inpe.br/prodes/index.php
 - Biodiversity: species distribution modeling of endangered birds and mammals
 - Fire: INPE Fire Monitoring www.inpe.br/queimadas/
 - Roads: DNIT (Departamento Nacional de Infraestrutura de Transportes)
 - Energy: ANEEL (Agência Nacional de Energia Elétrica)

More information on IPAM projects is available at:

- <http://ipam.org.br/nova-ferramenta-ajuda-a-planejar-e-gerir-projetos-de-adaptacao-as-mudancas-climaticas/> and
- <https://www.youtube.com/watch?v=vy03Dc6696U>
- The platform is available at: www.somai.org.

IPAM website: <http://www.ipam.org.br>

F. Pacific/Oceania

1. AUSTRALIA | Traditional fire management in Australia

United Nations University (UNU) – Institute of Advanced Studies Traditional Knowledge Initiative

Sectors	Adaptation element	Climate hazard
Agriculture, biodiversity, community-based adaptation, crops, disaster-risk reduction, ecosystem-based adaptation, ecosystems, food security, food systems, farm systems, freshwater fisheries, gender, health, horticulture, indigenous and traditional knowledge, livestock, water	Adaptation planning and practices, climate observations, communication and outreach/awareness, education and training, institutional arrangements, knowledge management, monitoring and evaluation, science and research, socioeconomic data and information, stakeholder involvement, vulnerability assessment	Extreme heat, land and forest degradation, loss of biodiversity, wildfire

Type of initiative Online portal

Description of the data collection initiative The United Nations University (UNU) is working with the Government of Australia to explore the transferability to developing countries of Australia’s savannah fire management abatement methodology and project experience.

Indigenous peoples have historically employed customary burning practices to manage the savannah regions of tropical northern Australia. In many cases these practices have ceased, resulting in hot and uncontrolled wild fires late in the annual dry season. Experience in northern Australia shows that the strategic reintroduction of traditional patchwork burning early in the dry season can limit the scale and intensity of late dry season fires, reducing emissions of the greenhouse gases that contribute to climate change.

Innovative methodology and valuable co-benefits

Savannah fire management in tropical north Australia is an approved offset methodology under Australia’s Carbon Farming Initiative. It allows indigenous communities and farmers to generate carbon credits, which can then be sold to Australian companies to offset their emissions. Through this methodology, indigenous communities are reducing emissions and generating sustainable incomes through the Australian carbon market.

Australia's savannah fire management projects have also demonstrated valuable co-benefits: improving biodiversity, community health, food and water security; reinvigorating cultural and social traditions; enhancing human capital; and strengthening capacity to adapt to climate change.

International Savanna Fire Management Initiative

Preliminary studies have shown that the conditions necessary to establish projects of this kind, when adapted to local conditions, are available in regions with similar savannah landscapes and traditional management practices, including in Asia, Southern Africa and Latin America.

The initial stages of this initiative are exploring the potential for approaches similar to Australia's methodology and project experience in interested developing countries. The initiative is also identifying potential pilot sites, in-country partners and implementation pathways.

Year of publication 2016

Further information

- See <http://tfm.unu.edu>
- UNU website: <http://unu.edu/>

2. **PACIFIC REGION** | Role of traditional knowledge to address climate change impacts
 Secretariat of the Pacific Regional Environment Programme (SPREP)

Sectors	Adaptation element	Climate hazard
Biodiversity, community-based adaptation, disaster-risk reduction, food security, human settlements, indigenous and traditional knowledge	Adaptation planning and practices, climate observations, knowledge management	Drought, floods, loss of biodiversity, shift of seasons, storm surges, land and forest degradation, tropical cyclones/typhoons, vector and water-borne diseases

Type of initiative Technical document/report

Description of the data collection initiative This data collection initiative is a compilation of responses from 24 member organizations with experience and expertise from the Pacific region to a survey about the role of traditional knowledge to address climate change impacts.

The survey called for traditional knowledge (TK) to be incorporated into all national planning, and sought feedback based on case studies or personal stories of how TK has been, or is being, used to address climate change impacts and disaster risk reduction. Members shared information and stories about how TK should be used more for prediction, preparation and recovery from disasters, especially in relation to food security, and how best to find ways to balance modern technology and science with such traditional practices.

Respondents related stories of how their Pacific Island ancestors lived at one with nature and had a deep spiritual affiliation with the land and sea. Participants discussed how the need to better merge TK with western science was just two parts of the triumvirate puzzle, with the third and possibly most important piece being the balance of “kinship” (whereby traditional skills and knowledge may be “owned by a family or clan” so is not easily passed on to others as it is considered “sacred”).

Members also discussed the challenges of documenting TK. Many agencies including the United Nations Educational, Scientific and Cultural Organization (UNESCO) are doing this, but they are often faced with protestations from community members, given a lack of clarity around issues such as kinship and TK intellectual property rights and regulations.

Participants reflected on how the recent Cyclone Evan, which tore through parts of the Pacific, was a timely reminder of how TK and taking signals from nature can be used to help predict, prepare for and recover from natural disasters. However, many of these traditional approaches are no longer practised.

Further, members emphasized the “very important” need to renew agricultural and farming TK practices, coupled with the need to reduce harmful farming practices that are compounding the negative impacts of climate change, such as burning vegetation to clear the land for planting thus making it prone to landslide, flood and drought. They agreed that uniting traditional and new methods would be ideal, such as an “integrated farming system approach” which incorporates the planting of fruit trees with root crops.

Unfortunately, already much TK has been lost owing to migration, urbanization, the passing away of elders, and a disinterest in TK by many young people who do not have the same connection or kinship with the environment as older generations.

On the other hand, there is also much good news, with members sharing information about how TK is still being used in the Pacific Islands such as in Kiribati and Cook Islands. It seems that elders are also becoming increasingly proactive to encourage conservation approaches, especially those that include TK, such as in Mauke Island. Other TK inroads being made include the Secretariat of the Pacific Community (SPC) list of crops from the SPC climate-ready collection, and glossaries of traditional climate change terms in some Pacific countries, including the iTaukei Glossary in Fiji. Interestingly, quite a few respondents asked for TK to be included in school curriculums, especially in remote places with no access to computers or the Internet, to better educate and prepare children.

In conclusion, members overwhelmingly spoke of the need to better embrace TK as a primary tool to combat climate change and disaster risk management. The challenge is to better “marry” TK with modern scientific knowledge, to ensure environmental, economic and social sustainability by working with “local communities who will need to be the implementers, monitors and main beneficiaries of such a marriage”. This union needs to address the innate difficulties of blending the old with the new, plus the additional need to balance traditional value systems. Furthermore, time is eroding the region’s TK capacity because of a combination of migration, urbanization and the passing away of elders. If TK and cultural values are not used and preserved the ability of the Pacific Islanders to build resilience to natural disasters may be seriously diminished over time.

Implementing partners United Nations Development Programme (UNDP) in partnership with Pacific Islands Forum Secretariat (PIFS), University of South Pacific (USP), Asian Development Bank (ADB).

Year of publication 2013

Further information

- The report is available at http://www.solutionexchange-un.net/repository/pc/ccd/cr16-en-TK_25032013.pdf
- SPREP website: <https://www.sprep.org>

3. PACIFIC REGION | The challenges and opportunities of traditional knowledge: examples and experiences

Secretariat of the Pacific Regional Environment Programme (SPREP)

Sectors	Adaptation element	Climate hazard
Biodiversity, disaster-risk reduction, food security, human settlements, indigenous and traditional knowledge	Adaptation planning and practices, climate observations, knowledge management	Drought, floods, shift of seasons, storm surges, land and forest degradation, tropical cyclones/typhoons, vector and water-borne diseases

Type of initiative Technical document/report

Description of the data collection initiative This data collection initiative is a compilation of responses from relevant organizations to a survey on the challenges and opportunities of traditional knowledge. The survey engaged member organizations to comment on the difference between traditional knowledge and local knowledge, how best to maintain and share traditional knowledge and to what extent it can be shared.

Members shared their definition of ‘traditional knowledge’ stating that it is knowledge accumulated and built over many generations and passed down from one generation to the next. ‘Local knowledge’ does not necessarily have any grounding in long-term historical understandings. It consists of personal observations of a place over time. Unlike traditional knowledge, local knowledge is linked to a location.

However, both traditional and local knowledge can provide very valuable information in times of disaster as members discussed. Over time, people build up on a bank of observations and experiences that will inform how people respond and make decisions in times of disaster. Members believe that, while local knowledge is important, communities that have maintained traditional knowledge would have greater resilience to natural disasters. Members also highlighted that, while conceptually traditional knowledge and local knowledge can be differentiated, in practice the two get blurred and the terms often get used interchangeably. People themselves can become uncertain of what is knowledge learned from ancestors and what is knowledge recently learned.

The discussion focused on the need to maintain and share traditional knowledge. It not only needs to be captured, it needs to be protected as well under the rules of the World Intellectual Property Organization (WIPO) which the national governments have adopted. However, WIPO rules require the naming of an inventor at a specific time and place, which traditional knowledge cannot do, so it is deemed valueless based on that criteria.

Members strongly agreed, stating that although traditional knowledge in the Pacific Islands environment is old, it is usually new knowledge to the rest of the world and should be rewarded as such. They believe the best ways to maintain and share traditional knowledge, and the extent it can be shared is to reward it – specifically, to change WIPO rules to recognize that traditional knowledge has a role: it may not be out there in the world but it can be invaluable in addressing modern problems.

According to members, traditional knowledge has addressed the world's issues regarding viral infections and has been the most used resource for traditional healers around the world for many years, but because small island developing States do not have the resources to develop their traditional knowledge, it has languished into obscurity. There needs to be a mechanism to protect the intellectual property of these countries and to ensure they are rewarded when sharing it. Traditional knowledge needs to be recorded before it is completely lost in the hands of a generation who do not believe in its value to the modern world.

A number of people, including teachers, have suggested that there should be traditional knowledge components in the national curriculum to encourage young people to learn about their cultural heritage. Also a way to engage young people might be to use different media such as film and radio.

Members highlighted that it is also important to note the need to follow an informed consent process when documenting and sharing traditional knowledge. People must be properly informed about how their knowledge will be stored, used and shared and have the option as to whether or not to participate. Although documenting and archiving traditional knowledge is important, without it being utilized, discussed and lived, it becomes a relic.

Members discussed the challenges and opportunities of using traditional knowledge. A member from the Solomon Islands Meteorological Services (SIMS) shared details of one of its projects that is currently monitoring, verifying and integrating traditional methods into SIMS forecasting, and promoting traditional knowledge as an important tool for disaster early warning and building community resilience. One of the challenges SIMS faces is how to apply scientific rigor to traditional knowledge. Western science can be characterized as lineal precise and reductionist, while traditional knowledge is cyclical, fluid and part of a dynamic system of knowledge. Isolating a piece of traditional knowledge from a whole system of knowledge can be difficult and science struggles with testing systems of knowledge. While there have been challenges, SIMS sees a lot of potential in linking traditional knowledge with science in a meaningful way. There is always a margin of error in any forecasting method so traditional knowledge is not expected to be one hundred per cent accurate. SIMS sees it as a great

opportunity to improve communication with the public by reflecting people's own knowledge system, and an opportunity to reinforce and revive traditional knowledge before it is lost and help communities remain resilient to natural disaster.

Members concluded the discussion by sharing the specific projects and organizations that have succeeded in using traditional knowledge.

They agree on the value of traditional knowledge and its need to be recognized and documented as such by the world. They hope that the discussion highlights this and that the members carefully consider it in their area of work.

Implementing partners Griffith University, Secretariat of the Pacific Regional Environmental Programme (SPREP) and three pilot countries (Fiji, Tonga, Vanuatu).

Year of publication 2016

Further information

- The report is available at:

<http://www.solutionexchange-un.net/repository/pc/ccd/cr51-eng-19042016.pdf>

- SPREP website: <https://www.sprep.org/>

G. Polar region

1. CANADA | Qapirangajuq: Inuit Knowledge and Climate Change Isuma Distribution International Ltd. (IsumaTV)

Sectors	Adaptation element	Climate hazard
Biodiversity, community-based adaptation, ecosystems, indigenous and traditional knowledge	Adaptation planning and practices, climate observations, impact assessment	Increasing temperatures, land and forest degradation, sea level rise, shift of seasons
Type of initiative	Multimedia material	
Description of the data collection initiative	<p>The film director Zacharias Kunuk (<i>Atanarjuat: The Fast Runner</i>) and researcher and filmmaker Dr. Ian Mauro (<i>Seeds of Change</i>) have teamed up with Inuit communities to document their knowledge and experience regarding climate change. This new documentary, <i>Qapirangajuq: Inuit Knowledge and Climate Change</i>, is the world's first Inuktitut language film on the topic, takes the viewer "on the land" with elders and hunters to explore the social and ecological impacts of a warming Arctic. This film aims to foster an appreciation of Inuit culture and expertise regarding environmental change and indigenous ways of adapting to it.</p> <p>Exploring centuries of Inuit knowledge, allowing the viewer to learn about climate change first-hand from Arctic residents themselves, the film portrays Inuit as experts regarding their land and wildlife and makes it clear that climate change is a human rights issue affecting this ingenious indigenous culture, including stories about Arctic melting and how Inuit believe that human and animal intelligence are key to adaptability and survival in a warming world.</p> <p>Qapirangajuq is the first Inuktitut-language film to deal with the human effects of climate change and draws on interviews with elders, hunters, and leaders from Inuit communities.</p> <p>These indigenous perspective are important, in their own right, and should be considered by scientists, industry, policymakers and the general public, especially in the north, as Inuit are the original inhabitants of these lands and waters.</p>	

Directors Zacharias Kunuk and Dr. Ian J. Mauro

Year of publication 2010

Further information

- The film is available at <http://www.isuma.tv/inuit-knowledge-and-climate-change>
- Isuma TV website: <http://www.isuma.tv/>