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The Indirect Effects of Adaptation: Pathways for Vulnerability Redistribution in the Colombian Coffee Sector

Aaron Atteridge and Elise Remling

Stockholm Environment Institute
Linnégatan 87D, Box 24218
104 51 Stockholm
Sweden

Tel: +46 8 674 7070
Fax: +46 8 674 7020
Web: www.sei-international.org

Author contact:
Aaron Atteridge
aaron.atteridge@sei-international.org

Director of Communications: Ylva Rylander
Editor: Marion Davis

Cover photo: A coffee farmer near La Celia, in Colombia's Eje Cafetero, rakes coffee beans laid out to dry. © Aaron Atteridge

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ABSTRACT

This paper examines the possibility that measures taken to bolster livelihoods and adapt to climate change in one place could increase vulnerability elsewhere. In a world characterized by increasingly complex economic, social and biophysical interconnections, vulnerability redistribution may in fact represent the norm rather than an exception. We examine the literature on globalization, development and adaptation to understand how adaptation interventions might create indirect effects that undermine the livelihoods of other people, and how we might predict and/or measure such indirect effects. We then propose a framework that practitioners could use to analyse planned adaptation interventions – specifically, those focused on strengthening livelihoods – in order to identify potential indirect impacts. We apply the framework to a case study of Colombia's coffee sector, and find several examples of how, because of the connections between farmers in Colombia, and the global nature of the coffee market, adaptation actions within Colombia and abroad could redistribute vulnerability. Finally, we discuss how these insights might inform decisions by adaptation and development practitioners, and suggest areas for further research.

CONTENTS

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A coffee farm in Colombia. Photo by David Bonilla Abreo. © FNC-Ministerio de Cultura, 2011.

EXECUTIVE SUMMARY

This paper is concerned with the possibility that interventions intended to bolster livelihoods as a means of adaptation to climate change might, instead of reducing vulnerability, simply *redistribute* vulnerability between people and places. In a world characterized by increasingly complex economic, social and biophysical interconnections, vulnerability redistribution may in fact represent the norm rather than an exception. However, very little has been written about this possibility, aside from a very thin literature on the concept of maladaptation. It has garnered even less attention in adaptation practice or monitoring and evaluation frameworks.

Our analysis focuses specifically on the possibility of adaptation creating indirect effects. We use this term to refer to the creation of geographically and/or socially distinct outcomes (i.e. impacts on people and/or ecosystems other than the intended beneficiaries of an adaptation action). We address the following questions:

1. How might adaptation interventions create indirect effects that undermine the livelihoods of other people?
2. How might we predict and/or measure such indirect effects?
3. What are the implications of those effects for adaptation decision-makers?

We depart from an observation about the way globalization processes create economic, social and biophysical links between people and places in distant locations, seeing these as mechanisms by which adaptation interventions in one place could trigger indirect effects on groups or ecosystems beyond its intended beneficiaries.

We sketch an analytical framework that might be useful for trying to predict indirect effects. Attempting to measure and attribute indirect livelihood (or vulnerability) *outcomes* is virtually impossible in the complex systems in which ecosystems and particularly people are embedded, so we propose an alternative. Indirect effects on livelihoods might manifest through disturbance to any of the various "assets" that people rely on to make a living, so the

"sustainable livelihoods" approach can be used to identify the range of different factors that might create or influence vulnerability in a particular group of people, as well as how these factors are influenced by happenings further afield. Such an analysis could provide an understanding of the *pathways* by which specific adaptation actions might redistribute risk and vulnerability. Thus, the potential for creation of indirect effects becomes at least more transparent, even if it is not crystal-clear.

The paper then shifts to a detailed empirical analysis, applying this framework to the Colombian coffee sector to highlight some concrete examples of how connections between communities might act to redistribute vulnerability as a result of adaptation actions. We identify a number of ways in which undesirable indirect effects might be, or in several cases already have been, created. First, as a result of economic competition in the global coffee market, adaptation actions that change the production volume and/or cost-competitiveness of particular growers could undermine livelihoods for other growers. How, and to whom, these changes might be transmitted elsewhere depends to a degree on the type of coffee exported (Arabica or Robusta, particular certification, if any, and quality rating). Second, we find that activity by international donors in the coffee sector has sometimes diverted some of the resources of the national coffee federation, and in doing so reduced the crucial support that Colombian growers otherwise receive from the federation's extension services. Third, we find that private initiatives to improve local infrastructure and thus reduce the time farmers must spend processing their coffee may indirectly reduce demand for coffee pickers, particularly women. These concrete examples provide some empirical evidence of the potential for indirect effects to result from adaptation.

Finally, we discuss how these insights might inform decisions by adaptation and development practitioners, while also making plain some of the challenges with trying to empirically measure indirect effects. Further work, including more empirical analysis, is needed to translate our conceptual awareness of indirect effects into tools and methods that can be useful in the design of adaptation interventions.

1. INTRODUCTION

1.1 The indirect effects of adaptation

Scientific consensus around some degree of unavoidable climate change creates an imperative for individuals, communities, governments and the private sector to take action to adapt. Adaptation is essentially about responding to new opportunities or vulnerabilities with the goal of protecting and enhancing livelihoods and ecosystems. Livelihoods depend on the interaction of many factors combined, meaning climate change is just one among many potential stressors that affect the ability of people or ecosystems to cope with changing circumstances. Adaptation, in its broadest sense, thus includes potential actions ranging from those designed to respond to a direct climate risk, to those which tackle the underlying drivers of social and/or ecosystem vulnerability.[1]

Although adaptation may often target outcomes at the local scale, for instance in the form of agricultural irrigation measures or livelihood diversification strategies, the "beneficiaries" are usually part of larger, interconnected biophysical, economic and/or social systems. Literature from a range of disciplines describing globalisation point to the fact that individuals, households, communities and ecosystems are complexly – and increasingly – interconnected on a global scale.

Livelihood outcomes for people in any part of the world are increasingly influenced by a deepening *economic* integration of communities into a global market economy. At the same time, the emergence of new forms of market institution and engagement – increasing "financialization", for instance (Bellamy Foster 2007; Lapavitsas 2011) – is changing the character of global markets and widening the range of factors that influence market behaviour and thus "reworking" livelihood outcomes (Bebbington and Batterbury 2001).[2]

Livelihoods are also shaped by *social* connections across scales and between places, connections that are being forged and re-worked continuously in response to, for instance, the physical movement of people (migration), or the constant creation, transformation and/or degradation of social institutions, from the local to the global level. Rules of international trade adopted under the World Trade Organization, for instance, or the economic liberalization agenda of international institutions such as the International Monetary Fund, can erode national sectoral institutions and, in doing so, may either undermine local livelihoods, open up new opportunities, or both.

Biophysical linkages across different scales are increasingly prominent within the globalization discourse. A proliferation of international agreements designed to manage shared environmental services, for instance regimes for managing transboundary waters,[3] highlights the way these resources create interconnections and interdependencies between

[1] A *contextual* approach views the vulnerability of peoples, places and systems as being influenced by a wide range of potential stresses, including access to livelihood options and resources and health, and is often linked with variables such as gender. By contrast, an *outcome*-based approach frames climate change as the root cause of vulnerability, and thus focuses adaptation responses on reducing or removing specific climate risks. See O'Brien et al. (2007) for an overview of the separate epistemological positions on "outcome" versus "contextual" approaches to vulnerability.

[2] For example, as described in the case study later, the global price of crops such as coffee is no longer determined solely – or perhaps even primarily – by the balance between supply and demand of the crop itself, but perhaps more strongly by the general global financial condition and opportunity costs related to other sectors, since these influence trading behaviour by financial speculators on world stock exchanges.

[3] For example, establishment of the UN-Water Task Force on Trans-boundary Waters and the more than 3,600 transboundary water agreements and treaties signed internationally to date.

different communities. Environmental disturbances at the local level aggregate to produce regional changes such as urban air pollution, as well as global changes such as rising atmospheric concentrations of greenhouse gases, while global changes then cascade back down to the local level, perhaps in the form of altered rainfall patterns, more intense storms, or in the deposition of chemical contamination.

Interconnectedness is not new to the modern era (see Hopkins 2002 for perspectives on globalization throughout world history). However, even among those scholars with a longer historical view on world development, certain features of contemporary globalization tend to be singled out as novel. One is an *increasing number of connections* between livelihood outcomes in different places and even between producers of different commodities. Another is the *increasing speed* with which a change in one part of the market is transferred to other places as an impact of some kind (Young et al. 2006; Held et al. 1999). *Increasing diversity* in the way connections are formed (i.e. increasing connectedness between actors at different geographic scales) has also been highlighted, which it is argued produces less hierarchical global systems (Young et al. 2006). These descriptions relate to the notions of "time-space compression" (Harvey 1989; Massey 1991), and to what Reynolds (2002) calls the "multiplier effect" created by modern technology.

In sum, these features of contemporary globalization – increasing interconnectedness and the formation of new kinds of connections between people and places – prompt the question of whether and how interventions of the kind that might be considered *adaptation to climate change* might trigger indirect effects. In other words, **do adaptation actions generate net benefits or instead simply redistribute vulnerability from one group to others**? In this paper we consider indirect effects as outcomes that are geographically and/or socially distinct from the intended beneficiaries. Indirect effects may be less obvious or immediate than unintended consequences that occur in the direct proximity of an adaptation action, but are no less important.

This is a particularly important question for external providers of support for adaptation interventions. Actors making adaptation decisions on their own behalf (whether individuals, companies or governments) might be expected to have little or no concern for "losers", especially if those suffering increased vulnerability are in distant locations (as implied by Markowitz and Shariff 2012). However, this question should weigh more heavily on international development partners who are supporting adaptation interventions in developing countries – not least since their own institutional objectives in reducing vulnerability extend far beyond the local scale.

The unintended creation of indirect effects has already become an important topic in the design of responses to mitigate greenhouse gas emissions. The issue of "carbon leakage", for instance, has been contentious in relation to carbon pricing policies, while concerns about indirect land use change have been raised in response to policies such as the EU Renewable Energy Directive, which stimulates crop production for biofuels.

By contrast, relatively little attention has been given to indirect effects within adaptation literature or practice. The concept of "maladaptation", as it is used in both adaptation literature and policy documents, recognizes the possibility of actions producing unintended and undesirable consequences that might actually increase vulnerability in certain groups or systems. However, there has been little articulation of what these consequences could be or how to assess for them. In particular, attention has rarely been given to perverse effects that may occur in spaces far from the original action, although a few papers (further discussed in

Section 2) do begin to trace the conceptual linkages that might lead to so-called "spatial spillovers" (Adger et al. 2009; Eakin et al. 2009; Klein et al. 2001).

1.2 Objectives and outline of the paper

This paper focuses on actions designed to support adaptation to climate change, but the analysis may be equally pertinent for more broadly focused development interventions that have livelihood improvement as their goal. The paper has two main aims. The first is to propose an analytical framework by which the potential for indirect effects might be assessed *ex-ante* by adaptation and development practitioners,[4] in order to help improve the design of interventions. The second is to make an empirical contribution to the field, by presenting a case study highlighting the ways in which livelihoods of coffee farmers in Colombia are linked to actions initiated in other places and by other groups, and evaluating the ways in which adaptation interventions might actually redistribute risks and vulnerabilities.

Coffee from Colombia being packaged for export. Photo by Elise Remling.

We begin by identifying the problem of indirect consequences arising from adaptation interventions, contending that in a world characterized by increasing interconnections between social, biophysical and economic systems at all scales between the local and the global levels, adaptation (and livelihood) outcomes are linked. Second, we look at how we might empirically analyse the ways these linkages could act to redistribute vulnerability, suggesting a practical analytical framework that might be useful as a tool for predicting indirect effects. By applying this framework in a case study of coffee growers in Colombia, we highlight some concrete examples of how connections between communities might act to redistribute vulnerability. We end by discussing how these insights might inform decisions by adaptation and development practitioners, while also making plain some of the challenges with trying to empirically measure indirect effects.

The framework we present, though incomplete and in need of further critique and development, is an attempt to move beyond simply pointing at complexity, and towards some useful guidance that might help communities, governments, development practitioners and the private sector reduce the likelihood of adaptation creating perverse indirect effects.

[4] We use the term "practitioners" in reference to people and organizations – whether in the public or private sector – who have the task of designing, planning and/or implementing specific actions or policies that are intended to reduce vulnerability. We use the terms "interventions" and "adaptation actions" interchangeably, to refer to activities, projects, programmes and policies that include the goal of reducing vulnerability.

2. DOES ADAPTATION REDUCE VULNERABILITY OR SIMPLY REDISTRIBUTE IT?

Within the field of adaptation, literature on the concept of "maladaptation" already points at the possibility for adaptation to create unexpected impacts, recognizing that some actions designed to reduce one group's vulnerability may inadvertently increase vulnerability for others.[5] Various kinds of maladaptive outcomes are described, including geographic "downstream" effects (Adger et al. 2005); effects on other sectors and groups, including minority groups or low-income households (Barnett and O'Neill 2010); and long-term effects for communities and societies when adaptations are undertaken by individuals with regard to their own interest only (Fazey et al. 2011).

As a concept, maladaptation is a useful prompt to practitioners to consider not only the outcome they hope to produce (i.e. reduced vulnerability for specific people/ecosystem in a specific place), but also unintended effects, either in the same place or elsewhere. However, far less has been written on how a practitioner might actually assess for perverse outcomes, or how one might analytically approach the complexity of natural and especially social systems in order to identify the possibility for risk and vulnerability to be transferred between different places and groups. Barnett and O'Neill (2010) list five "pathways to maladaptation",[6] but none relates to the risk of indirect effects in geographically distinct locations, and the authors themselves lament that few descriptions of *how maladaptive practices actually arise* are to be found in the literature.

This gap is also visible in practice. Our own review of some of the more advanced frameworks which have emerged for monitoring and evaluation (M&E) of adaptation[7] reveals that, in current practice, the potential for indirect effects to arise is often overlooked. The more advanced of these frameworks, such as Villanueva (2011) and Pringle (2011) mention the need to consider unintended consequences on other groups or sectors, but do not articulate how wide to set the lens when looking for these consequences or provide any insights into how to do this in practice. Most M&E frameworks acknowledge the difficulty of dealing with uncertainty in a temporal sense (e.g. shifting baselines in terms of both climate impacts and adaptive capacities) and thus the possibility of unintended impacts emerging beyond the life of the project, but none actively looks beyond the project's geographic scale at the possibility for wider economic and societal effects.

Perhaps part of the difficulty in advancing practical use of the maladaptation concept is, as Fazey et al. (2011) argue, that the term itself is somewhat problematic: "whether an adaptive response is considered desirable is subjective, with any response likely to have both winners and losers" (p.1275).

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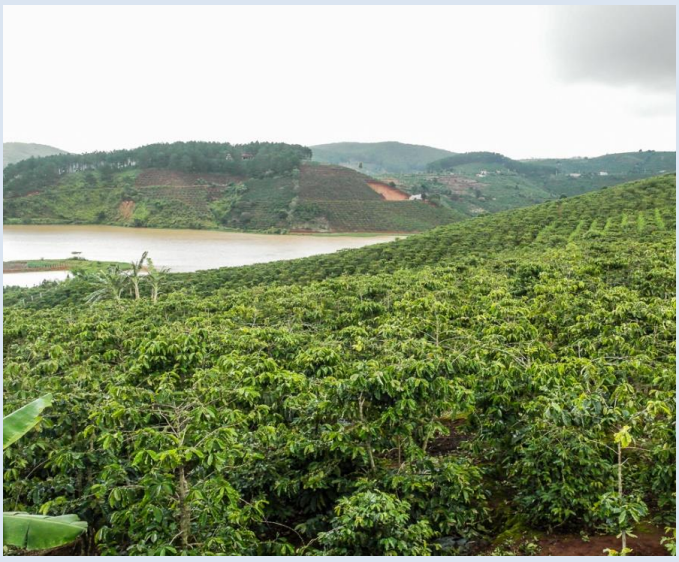
[5] Barnett and O'Neill (2010) define maladaptation as "action taken ostensibly to avoid or reduce vulnerability to climate change that impacts adversely on, or increases the vulnerability of other systems, sectors or social groups" (p.211). The IPCC's *Fourth Assessment Report* (IPCC 2007) does not define the term, though the *Third Assessment Report* did, as "any changes in natural or human systems that inadvertently increase vulnerability to climatic stimuli" or as "an adaptation that does not succeed in reducing vulnerability but increases it instead" (IPCC 2001, p.378). Note that maladaptation can also involve actions that increase one's own vulnerability. In the context of our study, however, we focus on maladaptive actions that increase others' vulnerability.

[6] According to Barnett and O'Neill, the five distinct types or pathways through which maladaptation arises are actions i) that increase GHG emissions; ii) disproportionally burden the most vulnerable; iii) have high opportunity costs; iv) reduce incentives to adapt; and/or v) set paths that limit choices available to future generations. With regard to impacts on the most vulnerable, the authors refer to minority groups or low-income households (Barnett and O'Neill 2010). There is no connection made to non-place-based actors.

[7] Eight main frameworks are identified based on Bours et al. (2013).

There is a small amount of adaptation-oriented literature focused on more concretely conceptualizing the concern we raise here about indirect effects. The notion that actions taken in one place could trigger changes in risk and vulnerability elsewhere is pointed at by Adger et al. (2005), who refer to such outcomes as "spatial spillovers". In this case, the authors offer the example of a new flood embankment that protects one community yet potentially increases the hazard for other communities downstream. Continuing this theme, Adger (2006) argues that measures of vulnerability should be sensitive to possible changes in the *distribution* of risk, such that as some people/places reduce their overall vulnerability to stressors, the vulnerability of other people/places is inadvertently increased, so overall vulnerability is not reduced. Using an example of coastal adaptation measures, Klein et al. (2001) also point at this possibility.

A number of subsequent papers attempt to show this transfer of vulnerability in practice, and provide useful conceptualizations of the phenomenon. Both Eakin et al. (2009) and Adger et al. (2009) offer examples from within the coffee sector, asserting that the actions of one group of coffee growers triggers new vulnerabilities in another group. Eakin et al. (2009, p.399, citing Young et al. 2006; Leichenko and O'Brien 2008) argue that environmental, political and economic connections between distant households mean that changes in one place are transmitted to – and influence – others. In a similar vein, Adger et al. (2009, p.151) argue that "increased interdependence creates novel and difficult to foresee vulnerabilities in social-ecological systems, which often appear unrelated and which may have considerable geographical distance between them". Continuing the theme, Eriksen et al. (2011) argue that adaptation is not exclusively positive or neutral, and will inevitably imply trade-offs, feedbacks and negative consequences. Interactions between local and global processes can create both positive and negative feedbacks, and thus individual adaptation actions need to be designed with sensitivity to their spatial and temporal consequences. They argue that adaptation strategies and policies must take account of these wider effects on other groups and places, if they are to avoid undermining the goals of sustainable development.



A coffee farm near in Dalat, Vietnam, near the Elephant Falls. Photo © by Mr. & Mrs. Backpacker, http://goo.gl/vtim57.

Highlighting the fact that complex social, economic and biophysical linkages can bind livelihood outcomes between different and geographically distinct populations, as these authors do, is important. A gap remains, however, in how we might actually *identify and evaluate* potential indirect effects that may result from a discrete adaptation project.

Rueda and Lambin (2013) suggest that although we recognize globalization has created many direct and also indirect interactions between markets and land uses, our understanding of *by which* channels global market signals are received by farmers is still very poor. The limitations of the case study analyses presented in both Eakin et al. (2009) and Adger et al. (2009) reveal how difficult it is to analytically define the consequences of interconnectedness

in specific cases, particularly when looking at outcomes transmitted through social and market connections. Though both papers, particularly the former, piece together elements of a framework for identifying and evaluating the way livelihoods are linked, their analyses fall short in the task of demonstrating the links in the real world. Instead, they settle for describing coinciding events in two different countries and assuming a connection.[8] Unfortunately this tells us nothing of how such events influenced each other, nor about how we might more generally predict the possibility for indirect effects.

Adaptation practitioners are faced with the task of doing more than simply acknowledging complexity, but must also somehow incorporate that awareness into the design of specific actions. Hence, there is a need for some practical means by which the potential for indirect effects can be meaningfully considered, preferably in advance (as an input to the design of adaptation actions) though analysis after the fact is also relevant (to assess actual outcomes).

3. A FRAMEWORK FOR ASSESSING INDIRECT EFFECTS

Finding robust metrics by which to assess vulnerability has proved a challenge (Adger 2006). Vulnerability itself is dynamic in nature (for an in-depth discussion, see IPCC 2012), and it is influenced by both social and material outcomes as well as by complex linkages between individuals and systems that can be difficult to "pin down". Thus, it is difficult to precisely measure vulnerability even as a "snapshot in time". Measuring the specific impact on someone's vulnerability of an action by others far away – much less predicting such an impact – can be impossibly difficult, given the number of variables involved.

In the face of these challenges, we argue for an alternative approach: to identify in more general terms *how* the elements underpinning people's livelihoods might be affected by the actions of others. By understanding the core elements of people's livelihoods and what factors influence these, we can identify some of the *pathways by which risk and vulnerability might be transferred* between people and places (what we refer to throughout the remainder of the paper as "risk transfer pathways"). Though such an approach tells us nothing about actual outcomes in specific cases, it still offers a way to assess the possibility that a given intervention will produce indirect effects. Towards this goal, we propose an analytical framework based on the following two-step logic:

1. Any actual indirect effects triggered by an adaptation action will manifest for people elsewhere in terms of disturbances to their livelihood assets, since these form the basis of their capacities and opportunities to respond to their situation.
2. We therefore need to understand how particular livelihood assets for a group of adaptation beneficiaries are connected to those of others, and how changes elsewhere might create or exacerbate vulnerability.

The elements of people's livelihoods that may be disturbed by vulnerability redistribution are the various "assets" (or "capitals") described in so-called livelihoods approaches to poverty

[8] For clarification, there are significant weaknesses in the method by which both papers draw their conclusion that the actions of Vietnamese coffee farmers affected livelihoods of Mexican coffee farmers. The main connection the authors make is a reliance on the popular claim that Vietnamese coffee expansion was partly responsible for the crash in global prices – a claim that is not uncontested (Stockman 2010; Giovannucci et al. 2002, who point also to the contribution of Brazil to global overproduction) – to argue that Mexican farmers suffered because of Vietnamese actions. In reality, the prices received by Mexican farmers are determined not only, nor can we *assume* significantly, by the actions of Vietnamese farmers, but by a potentially wide range of factors: other influences on international prices, local market contexts, national institutional settings, and the political economy of currency exchange rates to name a few. These need to be better understood in each individual context if we are to come closer to identifying real cause-and-effect relationships.

and development. Emerging from development economics, and in particular from earlier entitlements analysis of poverty (Sen 1982), livelihoods approaches focus on specific characteristics of the resources with which people can construct a livelihood, and the way these resources are connected to those of others.[9] Specifically, they draw attention to people's ability to access different kinds of "assets"; Chambers and Conway (1992) identify five crucial asset types: natural, physical, social, financial and human (individual) assets.[10] Examples of each are given in the table below. These assets underpin the livelihood strategies pursued by people, which typically consist of a range and combination of activities and choices, not just a single one, and may change as new opportunities or constraints arise (Chambers and Conway 1992).

Table 1: Types of livelihood 'assets'

Natural assets	Land, water, forests, clean air, biodiversity, environmental services
Physical assets	Livestock, crop stock, shelter, raw material inputs (such as fertilizer), infrastructure (such as for health, education and transportation), energy, mechanical inputs such as tools, production and processing facilities, transportation
Social assets	Sectoral institutions (either private or public) which provide regulatory or knowledge support, local cooperatives and other producer organizations, social networks on the local level such as neighbours and extended families that facilitate learning and companionship
Financial assets	Income, remittances, access to credit, savings, insurance
Human assets	Education, skills, knowledge, ability to labour, personal health, ability to innovate

Source: Own representation, partly based on Jones et al. (2010).

Our framework, represented in Figure 1, directs practitioners to focus on the following questions:

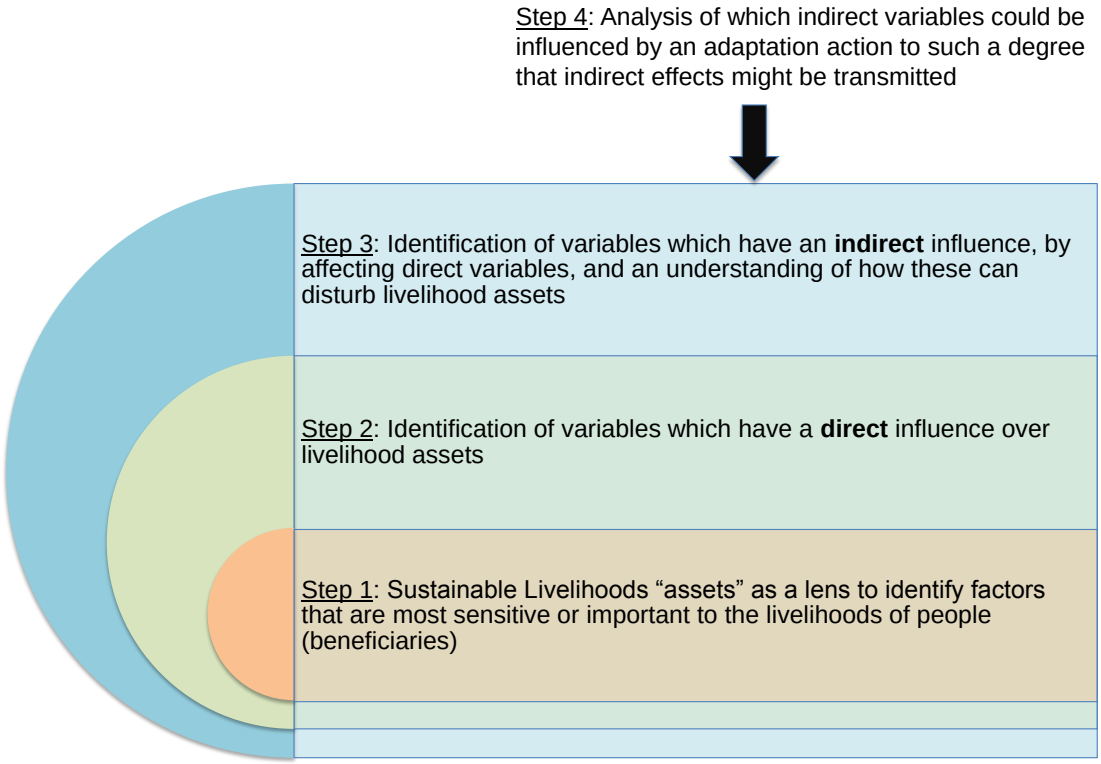
1. What are the main sources of vulnerability for the target group?
2. How do these variables connect with other people, places and events? In other words, what factors affect these variables, directly and indirectly?
3. What kind of adaptation or development interventions might disturb or influence one or more of these connections?

Figure 1 indicates the steps in utilizing this framework to evaluate the potential for adaptation to create indirect effects.

[9] Eakin et al. (2009) describe livelihoods frameworks are an attempt to bridge the literatures on vulnerability to poverty and vulnerability to global environmental change. There are different definitions of "livelihood" in these literatures: some have focused on more materialistic components; for instance, Chambers and Conway (1992) propose that a livelihood is "a means of gaining a living" (p.5) and that "comprises the capabilities, assets… and activities required for a means of living" (p.6). Others have broadened the notion to include how people are able to construct meaning for their lives, and what capability they have to challenge their situation. For example, Bebbington (1999) sees the resources people have available as "vehicles for instrumental action (making a living), hermeneutic action (making living meaningful) and emancipatory action (challenging the structures under which one makes a living) (cf Habernas 1971)" (p.2011).

[10] The Chambers and Conway (1992) classification was adopted and formalized in the UK Department for International Development's Sustainable Livelihoods Framework (DFID 1999). An alternative, but similar construction is offered by Bebbington (1999): produced, human, natural, social and cultural assets.

Figure 1: Analytical framework for identifying risk transfer pathways



The livelihoods approach compels the analyst to look without prejudice across a range of potential variables that might be affected indirectly by action elsewhere, rather than emphasize one (such as household income levels) at the expense of others.

To meaningfully generate the data needed to answer these questions, practitioners need to undertake place-specific analysis of how livelihoods are constructed and how these are connected to others through economic, social and biophysical linkages.[11] As Bebbington (1999) argues:

> The principal assets that people draw upon in building their livelihoods… vary across space and also across different social, gender and ethnic groups. If this is so, it becomes important to have a clearer sense of the most important assets for different people in different places in order to identify the most useful (and most damaging) sorts of public investment in such areas. (p.2031f)

One challenge for adaptation practitioners is that while the intended beneficiaries of adaptation actions are known in advance, those who may experience indirect effects are not. Thus, the analyst is left to trace interconnections outwards from beneficiaries and make assumptions about how changes *here* might be experienced *there*.

[11] Bebbington and Batterbury (2001) acknowledge the significant methodological difficulties associated with trying to empirically analyse transformations in particular places and livelihoods and their connections to processes at other scales. Ethnographic "intensive place-based studies" offer one possible method of inquiry into complex linkages between and within communities. Alternatively, they argue comparative studies (such as between households or between sectors in different countries) may allow conclusions to be drawn about more general patterns that seem to be influential in transmitting signals between local livelihoods and global processes.

4. INDIRECT EFFECTS IN THE COFFEE SECTOR

In this section we apply the framework described above to a case study of the Colombian coffee sector. We examine the ways in which the livelihoods of growers are connected to, influence and are influenced by events outside their immediate geographic environment, generating data on indirect effects and the pathways through which these may be transmitted.

Coffee has been grown in Colombia for around 200 years, and the country has the reputation of exporting some of the highest-quality washed Arabicas on the international market (Stockman 2010; Giovannucci et al. 2002). The crop is both an economic and livelihood staple, as well as a defining cultural feature of the country's social and natural landscapes.[12] It is grown mainly by smallholder farmers, with around 96% of farmers working with an area of less than 1.6 hectares (FNC 2012). Around 19% of Colombia's total land area is under coffee production (Forero Álvarez 2010), spread across more than half of the country's 1,102 municipalities. Colombia is one of the few countries to have retained a strong national industry body after the collapse of the International Coffee Agreement in 1989 and subsequent global market liberalization. The Federación Nacional de Cafeteros (FNC) continues to play a very active role in influencing national policy, managing a national coffee fund,[13] providing extension services to growers, and funding the national coffee research institute Cenicafé. The FNC is also one of the main exporters of Colombian coffee, hence an important market player in its own right, and it has strong links to many of the roughly 500 local cooperatives that buy coffee from farmers.

Freshly picked Colombian coffee cherries. Photo by Aaron Atteridge.

The coffee sector is an appealing analytical case for studying indirect effects. First, like other heavily traded crops such as cocoa, coffee is grown almost exclusively in developing countries, where it is a core part of millions of people's livelihoods. Globally, around 26 million mostly smallholder farmers grow coffee (ICO 2011), and many more depend on the sector for employment. In Colombia alone, more than 563,000 families earn their livelihoods as coffee growers, while nearly 4 million people derive their livelihoods from the crop in

[12] In 2011, the UNESCO declared areas in four departments (Risaralda, Caldas, Valle del Cauca and Quindío) on the ranges of the Cordillera de los Andes in the west of Colombia as world heritage site and recognized the "Coffee Cultural Landscape of Colombia" as an exceptional example of a cultural heritage (FNC 2012).

[13] The Fondo National de Cafeteros (FoNC) was founded in 1940 with the purpose of strengthening the sector and stabilizing the income of producers. Its revenue comes mainly from contributions made by coffee growers; they are directly discounted from the price paid to producers in their local communities for their beans and transferred to the FNC when Colombian coffee is exported (nonfiscal tax). Currently, the contribution to the FoNC is equivalent to 0.027 USD per kilo of green coffee exported. The fund provides public services such as a purchase guarantee at market prices, technical assistance for coffee growers, and scientific research through Cenicafé (Forero Álvarez 2010; FNC 2012). According to the FNC (2012), in 2011 coffee growers received direct benefits from their collective savings of the equivalent of more than four times their total contributions to the FoNC.

some way (including picking coffee), more than any other agricultural activity in the country (FNC 2012). In some poor countries, coffee is a key source of foreign earnings; in Burundi the crop generates an estimated 79% of total foreign income, in Ethiopia around 54%, and in Uganda 45% (Gresser and Tickell 2002). In Colombia, coffee's significance has diminished as other sectors have expanded, but it still generates around 6% of total foreign income (Forero Álvarez 2010).

Second, the coffee market is global, wherein prices received by all growers are determined, either directly or indirectly, by trading on the New York and London stock exchanges for Arabica and Robusta respectively.[14] Thus, coffee growers across developing countries compete with one another. Moreover, as emphasized in previous literature (Newman 2009) and also by a number of interviewees during this study, financial speculation on coffee trade increasingly brings into play an even wider array of factors that could influence global prices but which are unrelated to coffee production and consumption.

Third, economic theory on the "fallacy of composition" (see Mayer 2002 for an overview of the extensive literature) argues that as many developing countries pursue export-oriented development strategies, they start competing directly with one another in ways that undermine their shared goals.[15] The same logic thus prompts a concern about whether specific kinds of adaptation activities focused on export commodities in developing countries might be counterproductive to the livelihoods of other export-focused communities. It points us to look at the way in which developing country producers of coffee compete with one another and can, through global markets, affect one another's livelihood outcomes.

Finally, the coffee sector is a common target for international development assistance. In our own coarse review of a subset of development organization databases and websites, we found more than 170 such interventions between 1964 and 2012.[16] In Colombia, interventions have typically aimed at improving quality, yield and/or "sustainability" of particular growers within the country.[17] Further, some developing countries are already explicitly or implicitly prioritizing the coffee sector for support in their climate adaptation strategies.[18] Various

[14] The two primary coffee varieties commercially grown are Arabicas and Robustas. Arabica beans are generally considered of higher quality and are sold at slightly higher prices. Robustas, more resistant to pests and diseases, have a more acid taste and are widely used for soluble coffee and stronger roasts as well as in blends.

[15] In one configuration of the fallacy, demand-side constraints in the global market ultimately limit the potential for certain kinds of goods to provide export income, because as more and more countries follow a similar strategy, the supply begins to undermine prices, and hence all producers suffer from declining terms of trade and declining profitability. The fallacy of composition is often described in relation to manufactured goods (Mayer 2002; Blecker and Razmi 2010); however, it has been argued that it is also relevant to various agricultural commodities, including coffee, tea, bananas, cotton and cocoa (for example, Bleaney 1993; Akiyama and Larson 1994; Schiff 1995; as cited in Mayer 2002).

[16] This is an incomplete list of all donor activity in the coffee sector, which was compiled to examine patterns in the focus of donors rather than to produce a complete inventory.

[17] Coffee sector interventions in Colombia have been supported by a range of international organizations including the UN Food and Agriculture Organization (FAO), the Inter-American Development Bank (IADB), the United Nations Development Programme (UNDP), the Global Environment Facility (GEF), USAID and Kreditanstalt fuer Wiederaufbau (KfW). The private sector has also been active, including major roasters such as Nespresso, Nestlé, Tchibo and Starbucks (FNC 2012).

[18] For example, several of the National Adaptation Programmes of Action (NAPAs) prepared by Least Developed Countries have identified the coffee sector as vulnerable, and some include specific actions focused on the sector. In Tanzania, land clearing for coffee is said to be driven by climate change vulnerability (United Republic of Tanzania 2007). In Rwanda and Uganda, coffee is identified as a vulnerable sector, as trees are at very high risk of prolonged seasonal droughts, which is problematic for the social and economic development of the countries (Republic of Rwanda 2006; Republic of Uganda 2007). Although Ethiopia's NAPA makes no specific reference to coffee, four out of 11 adaptation priorities are focused on agriculture, which is likely to include coffee as it is Ethiopia's No. 1 export commodity (Petit 2007; Baffes et al. 2005).

private-sector activities listed on the website of the United Nations Framework Convention on Climate Change (UNFCCC) Private Sector Initiative also claim to be supporting adaptation among coffee growers in particular regions.[19]

In sum, the sector involves complex global linkages and is also likely to continue being a target for external interventions.

4.1 Previous studies on indirect effects in the coffee sector

There is a wide literature on the coffee commodity chain and the farmers who derive their income from it, with a significant number of papers published since the market was liberalized in 1989. Analysts generally agree that the international coffee landscape has changed substantially in the last two decades, leading to several episodes of market crises (i.e. price collapses). A range of reasons for this have been presented, as well as some empirical evidence of the consequences for growers and other people who depend on the sector, suggesting some ways in which grower livelihoods might be interconnected.

In terms of causes of the international "coffee crisis", many attribute this to Vietnam's massive expansion in the late 1990s to become a major exporter of Robusta coffees, though others have argued that there is inadequate evidence to suggest a causal relationship between this and the coincident drop in world prices (Stockman 2010).[20] Our review of the literature suggests that there is no simple "yes" or "no" answer; livelihood outcomes for growers seem to be more nuanced. A scan of the wider literature indicates that a sudden oversupply of coffee was one important factor behind the dramatic fall in prices, but several reasons also played a role, including:

- The demise of the International Coffee Agreement (ICA), which significantly diminished the influence of many national coffee institutions in producer countries (Petit 2007; Brown 2004; Baffes et al. 2005; Topik et al. 2010; Bacon 2005);
- Domestic market liberalization promoted (or imposed) by, among others, the International Monetary Fund and World Bank (Petit 2007);
- Changes in global supply, particularly Robusta from Vietnam and Arabica from Brazil, as well as changes in demand – particularly the rise of "niche" markets such as organic and Fair Trade coffee (Petit 2007; Baffes et al. 2005; Topik et al. 2010; Bacon 2005);
- New coffee-processing technologies that allow roasters more flexibility in blending and making greater use of Robusta, which has intensified market competition amongst producers of Arabica beans, whose market share has decreased (Petit 2007; Baffes et al. 2005; Topik et al. 2010; Bacon 2005; Ponte 2001); and

[19] For instance, the Adaptation for Smallholders to Climate Change (AdapCC) project in Peru; grower vulnerability assessments and adaptation projects in Central America and Mexico funded by Green Mountain Coffee Roasters and other partners; and projects supported by Starbucks in southern Mexico. For more information, see the UNFCCC Private Sector Initiative website, http://unfccc.int/adaptation/workstreams/Nairobi_work_program/items/4623.php.

[20] Vietnam's meteoric rise in the coffee sector, which coincided with an increase in Brazilian production, has often been blamed for creating a global oversupply and thus a drop in prices. The Vietnamese case has been linked by some observers to World Bank financing of agricultural reforms in the country (Wild 2004; Wassermann 2002; Pérez-Grovas et al. 2001) – a claim the bank itself denies (Baffes 2005; Giovannucci et al. 2002) – as well as anecdotally to support from the French Institut de Recherche pour le Développement (Giovannucci et al. 2002). Whatever the funding sources that drove the Vietnamese expansion, its global effects have been heavily criticized by development organizations and by coffee industries in other parts of the world (Mitra 2002; Wassermann 2002; Stockman 2010).

- A shift of the power balance within the global commodity chain which means that, compared to previously, value has increasingly accrued to downstream actors such as traders, roasters and retailers at the expense of coffee producers (Petit 2007; Mitra 2002; Bacon 2005).

In terms of the consequences, many papers discuss the impacts of the coffee crisis on farmer livelihoods, for example in Ethiopia (Petit 2007), Nicaragua (Bacon 2005) and other Latin American countries (Topik et al. 2010). Rueda and Lambin (2013) evaluate how changes in market trends and short-term volatilities are actually transferred to land users, and what role those remote forces play in shaping local land use. They show how world coffee prices have driven land use change in Colombia, motivating farmers in regions with good conditions to increase the supply of high-quality and sustainable coffees while leading others regions to reduce production. The authors conclude that "policies designed to improve the livelihoods of rural people need to take into account the high exposure of local actors to international markets" (p.298), although they do not specifically consider the potential for actions at the local rural level to be transferred back through market connections to others.

A coffee picker in Chindina-Caldas carries her harvest. Photo by David Bonilla Abreo. © FNC-Ministerio de Cultura, 2011.

According to Brown (2004) the free market for coffee emerging after 1989 has generated negative spillover effects which are problematic for both producing and consuming countries. In the case of producers, she asserts that in response to the global price crash caused by over-supply, farmers cannot recover their production costs, and this has created a "domino effect" of wider social problems, including pressure on a family's children to work in the fields and decisions to abandon coffee plantations altogether.

Negative social consequences of a change in price have been highlighted elsewhere too. In Colombia and Burundi, links have been demonstrated between coffee market fluctuations and recruitment into guerrilla activity, feeding social conflict (Rettberg 2010; Dube and Vargas 2006; Ndikumana 2001; Summit Oketch and Polzer 2002). While a strong coffee economy provided a shield against violence in Colombia's coffee-producing regions, diminished income during periods of low prices impoverished local people, which opened up windows of opportunity for proponents of illegal activities. It has also been argued that plummeting coffee prices have forced farmers, mainly in Latin American countries, to replace their coffee with illicit crops such as coca (Rettberg 2010; Dube and Vargas 2006; Prince 2002) and landless labourers to shift to work in illegal crops rather than coffee (Forero Álvarez 2010).

Generally, literature on the coffee sector appears to focus on the impacts of international shocks (changes in market conditions), with relatively less emphasis on whether connections between domestic producers within the same country might be also be conduits for redistributing risk and vulnerability. Stein (2002) describes the way Vietnam's expansion has

also created problems for its own farmers. Others have described how expansion of cheap organic coffee in Peru is affecting not only other countries, but also other Peruvian organic growers.[21]

Overall, this literature provides at least cursory insights into the potential for vulnerability redistribution between coffee growers and of the implications, in terms of experienced hardship, impoverishment or greater social conflict. It suggests both the way in which global changes might cascade down to affect local livelihoods, as well as the way changes in local activities in one place influence global systems – which in turn influence local livelihoods in other places. Further, it also highlights that such effects are context-dependent in time and space, which for adaptation practitioners means place-specific assessments are needed in each case.

4.2 Data generation

In order to examine whether (and how) potential indirect effects both to and from the coffee sector in Colombia may manifest on the ground, in late 2012 we conducted a total of 27 semi-structured interviews in the Eje Cafetero (coffee triangle), one of the country's principal coffee-growing regions, and in Bogotá. The interviewees included eight farmers, local cooperatives and private buyers, representatives of the national coffee federation (FNC) at the municipal, departmental and national levels, the national coffee research institute (Cenicafé), exporters, the national government (Ministry of Environment), local government (La Celia) and several coffee pickers.

A farm worker prepares a section of coffee plantation in Colombia's Eje Cafetero. Photo by Elise Remling.

The interviews covered a wide range of topics related to the livelihoods of coffee growers, examining the importance and sensitivity of different kinds of assets (as discussed in Section 3). Interviewees were asked about any perceived connections between changes in the coffee market in one region/group and outcomes for other groups – for instance, whether an increase in quality or productivity or a reduction in cost for one set of producers materially affects lively-hoods for other growers, and if so, how. We also discussed who is competing with whom, who might lose when another gains, and whether such effects might be measured quantitatively, as well as the narrower question of whether international interventions in the coffee sector, either within or outside the country, have had any impact on the relative competitiveness of different domestic producers.

[21] See, for example, this summary by the importer Sweet Maria's Coffee: http://www.sweetmarias.com/coffee/full-description/peru.

The limited scope of the field study means it was not possible, nor was it our aim, to generate an exhaustive list of the ways in which farmer livelihoods might be indirectly affected by the actions of others. The results discussed in the following section should rather be seen as indicative of the pathways by which adaptation interventions might create indirect effects within the coffee sector, and as a way to enable some reflection on the concept of indirect effects and our ability to predict such effects.

5. INDIRECT EFFECTS AND COFFEE-SECTOR LIVELIHOODS IN COLOMBIA

The analysis presented here synthesizes different threads about livelihoods and the construction of vulnerability, which are based on perceptions expressed by the interviewees. It follows a three-step process, in which we:

1. Identify the main triggers of potential vulnerability for growers, as well as the range of variables which have a direct influence on them;
2. Identify factors which may indirectly influence those variables; and
3. Identify the subset of those indirect factors that could feasibly be altered in some way by a distant adaptation intervention in the coffee sector, and how such alterations would manifest on the ground for growers in particular. From this we are able to ascertain some of the most probable risk transfer pathways relevant for consideration by adaptation practitioners.

5.1 Sources of livelihood vulnerability

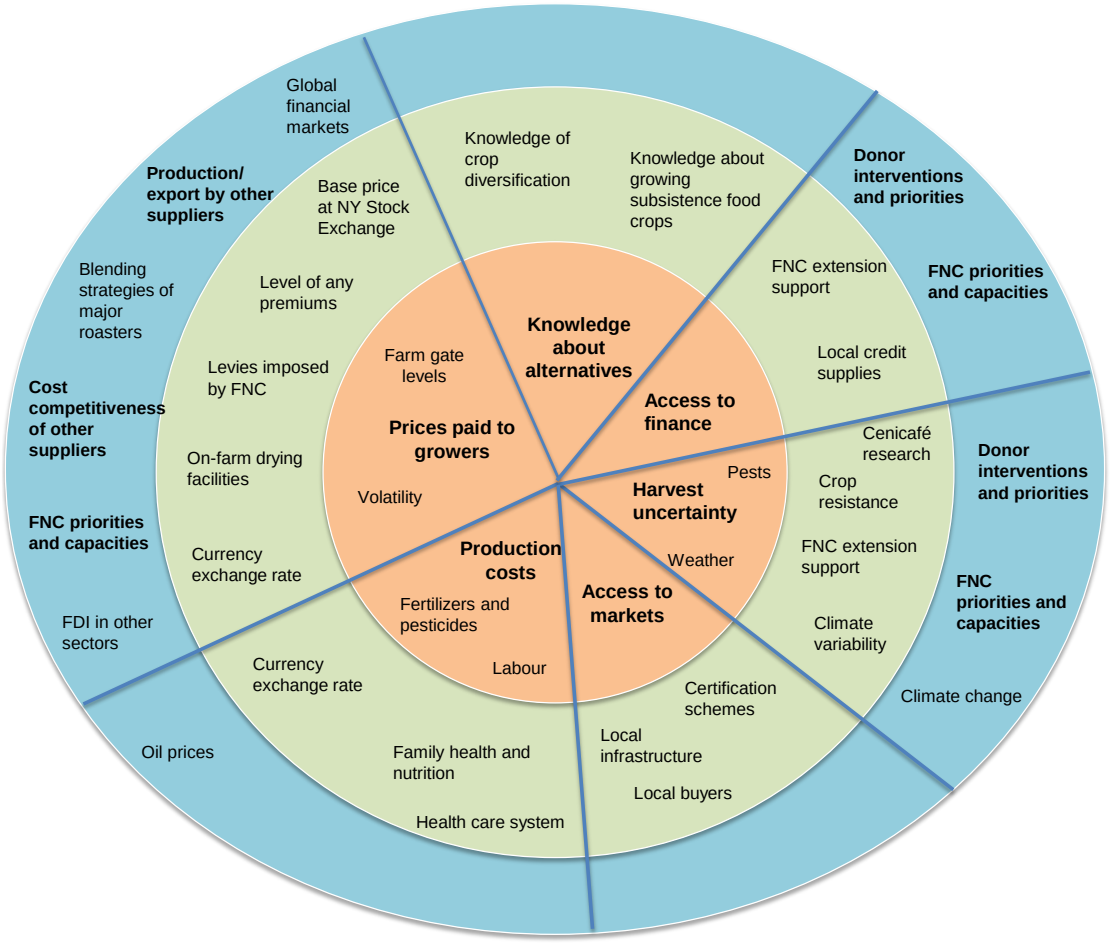
The main triggers of potential vulnerability described were prices paid to growers, including both real price level (farm gate) and volatility (the latter is significant because of the uncertainty it creates); access to markets; access to finance; harvest size and quality; production costs; and knowledge about alternative or complementary livelihood strategies.

Interviews described a wide range of factors that have a direct bearing on these potential triggers of vulnerability. The different variables in the figure are not necessarily of equal significance for the growers even in a single location, nor are the all growers' priorities/sensitivities exactly the same.[22] Note that among these, all five asset types posited as important by the livelihoods approach are visible: for example, the influence of climatic conditions (natural); access to fertilizer and to on-farm facilities for drying coffee beans (physical); the role of extension services provided by the FNC and research by Cenicafé, as well as local health services (social); market prices affecting income, access to credit for replanting or for surviving lean periods of low prices, production costs associated with labour and fertilizers (financial); and individual health, and knowledge about crop diversification strategies to enable food inter-cropping (human).

Figure 2 represents the way interviewees described different sources of vulnerability and risk for coffee growers (the inner orange ring), the direct influences over these variables (the middle green ring), and the way these variables might be affected by indirect factors (the outer blue ring). The direct influences (green) suggest variables which an adaptation action might target to improve local outcomes, such as better farmer access to local health services or markets. The indirect influences (blue) suggest potential sources of indirect disturbance to farmer livelihoods; in other words, these point to possible risk transfer pathways for the transmission of indirect effects.

[22] With some tweaking of methodology, field data generation could have been tailored to produce a weighted figure that better illuminates the relative importance of each variable, though this was not our purpose here.

Figure 2. Sources of perceived vulnerability for growers and variables influencing them



5.2 Indirect influences on grower vulnerability

Indirect influences are shown in the outer blue ring of Figure 2. Note that, based on interviewee perceptions, indirect variables are not presented for all of the potential sources of vulnerability. Those for which important indirect variables were described are the level and predictability of *prices* received by growers for their crop, access to *finance*, uncertainty about the *harvest*, and *production costs*.

Influences on prices for growers

Price is always important for producers, especially in developing countries where agricultural commodities are produced mostly by smallholders rather than by large industrial estates (the latter can sometimes compensate for low prices with high volumes). It is particularly crucial in the case of the Colombian coffee sector because of relatively higher cost/return ratios compared with many other coffee producing countries. At times – as in 2012 during the field study – base market prices are actually below production costs for Colombian growers. That means that in order to secure an adequate income, it is crucial for them to be able to negotiate an additional premium for quality and/or particular certifications (such as organic or fair trade).

Prices were described as being shaped by:

- *Global financial market conditions*, which influence speculative traders in coffee futures and derivatives, and have a major influence on the base market price at the New York and London stock exchanges;

- *Production/export levels in the global market*, which influence supply-demand balance and in turn the market prices; interviewees said this currently has a stronger influence over the level of premiums received for quality and/or certifications rather than the base price itself (unless very large changes in global production occur – see below);
- *Cost competitiveness of other suppliers*, which also influences negotiations about premiums;
- *Blending strategies of major roasters*, which influences the link between market prices for Robusta and Arabica, because as they become substitutable for roasters, the prices for the two become increasingly connected;
- *Currency exchange rates*, which are influenced, among other things, by the level of foreign direct investment in other sectors of the Colombian economy, and hence by government priorities and the overall domestic political economy;
- *Levies applied by the FNC*, which in turn are a function of the priorities and fiscal health of the FNC at any time; and
- *Access to on-farm drying facilities*, which determine whether the farmer can sell the harvest wet or dry (prices are higher if sold dry).

Some of these are direct variables, such as market price and premiums, currency exchange rates, domestic levies and access to coffee drying facilities. The others we consider indirect, and hence of further interest to our search for potential risk transfer pathways.

Influences on access to finance

Finance is needed for investment in the crop and production facilities, in housing and other assets, and to be able to supplement low income levels when prices are too low to make a living (as was the case for some growers at the time of interviews in December 2012). Variables described as directly influencing access to finance include the availability of, and access to, local credit supplies (banks and other lenders), and the level of support provided by the FNC extension services to growers to help negotiate and structure loans. Interviewees said the latter is itself influenced indirectly by broader FNC priorities and capacities at any time, and by the effect that donor activity in the sector might inadvertently have on the FNC.

Influences on the harvest

Uncertainty about the annual harvest is a challenge that all agricultural producers face. While most production costs are known, the size of the crop is not, since it depends on a variety of factors that differ from year to year, in particular on weather conditions which affect productivity of the crop and also the conditions for pest outbreaks, as well as a grower's ability to apply fertilizer and/or pesticides (see influences on production costs, below).

The voracity of pest outbreaks is a function of the resistance a grower's particular crop (tree variety) has to the specific pests and to farmers' knowledge of cropping techniques that might mitigate exposure to pests, which are in turn influenced by factors such as Cenicafé research to develop new resistant varieties of coffee tree, and by the level of technical extension support provided by the FNC to growers. Support for Cenicafé research and for FNC extension services is, in turn, influenced indirectly by the FNC's priorities and capacities at any time, and again by the effect that donor activity in the sector might inadvertently have on the FNC. Weather is influenced by local climate variability and patterns of long-term climate change.[23]

[23] The FNC (2012) has noted that changes in the climate can affect coffee producers by, for example, has described potential impacts on coffee production thus: "Changes in climate affect the plants in different ways; for example, the accumulation of biomass in the fruit is affected by higher temperatures; the changes in rainfall cycles affect

Influences on production costs

Production costs are a function of fertilizer and pesticide inputs, labour costs and individual and family health and nutrition. The latter is important for small farmers in particular, since their own labour can reduce the need to hire workers to pick the cherries. Fertilizer and pesticide prices are influenced by both currency exchange rates and, indirectly, global oil prices, while health is the product of (among other things) access to and quality of the local health care system.

5.3 Possible indirect effects and pathways for transferring risk and vulnerability

Of the indirect factors mentioned above, not all might be affected by specific adaptation actions. The conditions which influence speculative investors in the global finance market, for instance, are too diffuse to be meaningfully affected. However, several are variables that might be influenced by adaptation activities (boldfaced in Figure 2), and hence are relevant for consideration of potential indirect effects. Specifically:

- The production levels and competitiveness of other producers can certainly be altered by adaptation activities, in which cases economic competition between coffee producers at the global level provides a viable pathway for transmitting indirect effects to other coffee growers; and
- The intervention by donors within the coffee sector has already been observed as altering the resourcing and orientation of extension services provided to growers by the FNC, with implications for both access to finance and the size of the harvest. In this case, the data highlights not only a potential risk transfer pathway but also specific indirect effects of interventions that are already visible to interviewees.

To evaluate the *significance* of these risk transfer pathways, we need to understand how they function – in other words, how they might actually trigger vulnerability redistribution for Colombian growers. Based on in-depth discussion with interviewees, we describe below the functioning of these pathways in more detail.

Economic competition between producers and effects on prices

Overall, competition between coffee growers was always framed by interviewees in terms of Colombia (as a single entity) competing with producers in other countries. There was no suggestion that producers within Colombia also compete with one another.

Economic competition between Colombian coffee farmers and growers in other countries, on the other hand, occurs on four levels, [24] according to interviewees: (i) high-quality washed Arabicas, of which Colombia is a producer; (ii) speciality ("certified") coffees such as Organic, Fair Trade and Rainforest Alliance; (iii) washed Arabicas of all quality; and (iv) all coffees, including not only Arabicas but also Robustas. Interviewees' perceptions of both domestic and international competition are summarized in Table 2 below.

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flowering and fructification, and consequently crop productivity; plagues and diseases increase, and vulnerability in terms of soil stability and nutrients negatively affect the sustainability of coffee growing" (p.208).

[24] In the interviews, coffee growers often provided the most in-depth insight into key (perceived) sources of vulnerability for their own livelihoods, while institutional interviewees from the FNC, Cenicafé and exporters provided more detail on how different factors affect these livelihood variables, through the operation of the international market in particular. Some farmers indicated a general sense of domestic competition, but they rarely described it in any detail or considered it important; instead, they emphasized the way in which international prices translated to local market prices – their specific point of sale.

Table 2: Interviewees' perception of economic competition between growers

Arena of competition	How does this affect Colombian growers?
Between growers within Colombia	There is no competition between producers within Colombia. An increase in Colombian production will not adversely affect other Colombian growers because the demand for soft washed Arabicas is growing, so Colombia can continue to fill an unmet niche. Coffee from different regions tastes differently and hence appeals to different markets.
Producers of high-quality washed Arabicas	Colombia competes directly with **Kenya** and **Tanzania**, which grow the same soft, washed Arabicas as Colombia (i.e. similar quality). If Kenya increases production, Colombia "could lose clients".
Specialty ('certified') coffees	Colombian organic coffee growers compete with organic producers in **Mexico** and **Peru** because these are cheaper. The Colombian premium for organic coffee is 0.50 USD higher per kg than the base price at the New York stock exchange, while **Mexican** and **Peruvian** organic coffees cost only about 0.05 USD more. There is strong competition with Rainforest-certified coffee from **Peru** and **Honduras**, where production costs are much lower. The consequence for Colombian growers depends on individual buyers, but falls into two categories: those who want the cheapest coffees that meet their certification needs, and those interested in higher-quality coffees. Roasters who want the cheapest certified coffee will go for **Peru** and **Honduras**; this was the case with Kraft, for example, which used to buy Rainforest coffee from Colombia. If the market supply of a particular certification expands (for instance, through a donor-supported intervention) to the point where it exceeds total demand, this could reduce the (averaged) premium for all Colombian producers of that certification.
Washed Arabicas of all quality levels	Colombia directly competes with producers of washed Arabicas, in particular **Central American countries (Honduras, Peru, Guatemala**). If those countries or **Kenya** expanded production, this could have an impact on Colombia. Similarly, an increase in Colombian production could possibly affect countries like **Honduras**, because Colombia has a strong image of producing high quality coffee (i.e. would attract buyers). The effect of other countries increasing production while Colombia simultaneously declines in production could be that buyers would shift supply "for a year or two". Increased supply in the market does not affect the base price, which depends much more on factors related to speculation at the NY exchange. If **Kenya** or **Tanzania** triple their production, this may have no effect at all on the base coffee price at the NY exchange. However, increased supply will likely affect the level of the premium Colombia earns for its higher-quality beans.
Producers of all coffees, including both Arabicas and Robustas	Very large production changes elsewhere, such as those seen in **Brazil** and **Vietnam**, could affect base market price. New Robusta production regions (**Vietnam**, **Indonesia**) caused market prices to crash, and therefore some Colombian growers left coffee production. Vietnam was a big factor for tipping the Colombian coffee sector into crisis. Because of the financialization of coffee, traders were more readily swapping between suppliers. In addition, it encouraged new trends in the coffee market, increasing demand for i) cheap coffees (Robustas, mainly used for blends or flavoured coffees), and ii) traceability of origin. Other interviewees, however, said that **Vietnam**'s flooding of the market did not directly affect Colombia, but that there may have been a slight indirect effect. Increased availability of cheap Robusta has encouraged the demand side of the international coffee market to shift. Some roasters blend both types, and more Robusta supply has encouraged them to look for ways of substituting in this cheaper variety, especially when Arabica prices are high. This creates a link between Arabica and Robusta prices, though there is a limit to how much Robusta roasters will use in a blend. Present exports from Colombia are below market demand for high-quality Colombian washed Arabicas, but after production reaches the level of market demand for Colombian quality, the behaviour of roasters switching between coffee types *may* have some effect on Colombia. FNC and the Colombian government behave competitively when it comes to the exchange and sharing of research results, as do other countries. There are no collaborative projects under the ICO; instead all coffee-producing countries generally want to find out about other countries' production and research but not share their own data. It is not in the interest of Colombia to support other countries' development in coffee research, because they are economic competitors.

Source: Summarized from interviews.

The main avenue through which interviewees described these forms of competition as being able to affect the livelihoods of growers in Colombia is through a *change in production*. Specifically, this creates two risks:

- An increase in production by competitors may influence the market price obtained by Colombian growers, in particular the premium paid for higher-quality Colombian coffee; and
- A production increase by competitors at the same time as Colombia suffers a decline in production could result in buyers shifting away from Colombia towards other suppliers, especially in the categories of high-quality Arabica producers and/or certified coffees.

Effects on the prices obtained by Colombian growers

Only a very large change in supply could potentially affect the "base price", which for Arabicas is determined by trading on the New York stock exchange (and for Robustas on the London stock exchange).[25] A few examples of market phenomena at such scale were cited in interviews and are also commonly described in the literature. One is the major declines in Brazilian production when the country suffers severe frosts (e.g. in 1994 and 1999), which can push up world prices. Another is the massive expansion in Robusta exports from Vietnam that occurred in the late 1990s and early 2000s. However, according to key interviewees, activities by international donors to support local production improvements are usually not of sufficient scale to upset the market's base price.

However, much smaller changes in production do have an effect on the premiums that individual countries are able to negotiate for their coffee on top of the base price. Premiums are paid by discerning roasters on the basis of coffee quality, and Colombia – which is among the highest-quality producers of washed Arabicas – typically earns among the highest. As mentioned, the size of this premium is particularly important to Colombian growers, effectively making the difference between profit and loss because they have relatively higher production costs than many competitors.

Premiums are also paid for certified coffees, and this example was frequently raised by interviewees: Coffee roasters can be crudely split into two categories – those who are after high quality coffee and those who are interested in acquiring only the cheapest available certified coffees. The priority of the FNC is to sell Colombia's certified production to the former category although supply of certified coffee may sometimes exceed demand – in which case it also has to sell to the latter category of roasters. This means that if low-cost organic producers such as Peru or Honduras increase their supply, demand for the more expensive Colombian organics may fall to the extent that some certified production will have to be sold as regular coffee (i.e. without obtaining any premium for certification). This has the effect of reducing the premium gained by all Colombian growers of that certification, since the FNC (as the major exporter of certified coffees) effectively spreads the total earned premium across all certified growers.

Since the four levels of economic competition identified by interviewees effectively span the whole market, from high-quality washed Arabicas to low-quality Robustas, changes in

[25] The price received from buyers is generally composed of (i) a base price, which relates to the international market price; (ii) a premium relating to coffee quality (as relevant), which in the case of Colombia is high relative to other countries; and (iii) a premium relating to particular certifications such as organic or Fair Trade (as relevant). The high volume of speculative trading in coffee certificates, as previously described, means that a range of factors other than the supply-demand balance now have a major influence on the base coffee price.

production in any coffee type could potentially affect Colombian growers. However, the impact becomes less direct, and thus probably less pronounced, moving down through the categories in the table.

The effect of increased Robusta supply is certainly less direct than in the case of washed Arabicas. Increasingly, some major roasters have adopted strategies to boost the amount of Robusta they use in blends, and interviewees attribute this shift to increased Robusta production by countries such as Vietnam over the past two decades. This roaster strategy reduces demand for Arabica, and thus has a similar effect to changes in the supply-demand balance described above. Robusta and Arabica are not totally substitutable, since there is a limit to the amount of Robusta roasters will use in blends, which means the consequence for Arabica growers is less direct and thus less severe than, for instance, major changes in Arabica supply. Nonetheless, such changes in the character of the coffee market can have long-term effects on market behaviour, especially as roasters find new ways of processing Robusta to reduce or hide its undesirable traits.

Effects on seller-buyer relationships

If a competitor increases exports at the same time that there is a decline in Colombian production, the effects are amplified in that they may also trigger changes to commercial relationships between exporters and international roasters. Interviewees suggested a rather fragile relationship between sellers and buyers in the present coffee market. If Colombia were temporarily unable to meet demand for its high-quality Arabicas, producers in Kenya and Tanzania could – if production expanded – encourage buyers to buy from them instead. The effect of this change could extend beyond the short disruption in Colombian supply, since once buyers have established a reliable supply, there are incentives for them to keep this rather than change every year (e.g. transaction costs).

Interviewees expressed the idea that Colombia has no problem selling all of its production, because it has the reputation of producing high-quality beans. In this case, the main risks of losing a buyer seems to be (i) the potential for indirect effects on prices, since these need to be renegotiated with the new buyer, and (ii) transaction costs in establishing new relationships. The latter costs, while borne by the FNC or other exporters, are indirectly passed through to growers as either increases in the export levy (if agreed by FNC members) and/or as reduced sectoral support for farmers, such as fewer FNC extension workers.

It was stressed several times that among growers, the most vulnerable to reduced incomes would be medium sized farms who typically have high production costs, particularly related to labour. Small farmers provide their own labour through family networks, while large farms can better absorb the effects of lower prices because they have high production volumes.

Donor interventions and effects on domestic institutional priorities

Grower access to finance and uncertainty about the harvest are both influenced to a degree by the availability of extension services provided by the FNC. The federation's extension workers assist farmers with negotiating loans, sometimes provide subsidized finance for specific infrastructure, and provide technical advice on crop production, disease prevention and fertilization. In other words, the social assets embodied in the national federation are crucial determinants of a grower's livelihood.

The priorities of the FNC can be altered not only by the members themselves (who are growers) but, as described in interviews, also by both the arrival of international donors in the sector and by perceptions of future climate risks. Of these, the former is a particularly relevant pathway for risk transfer that needs to be considered by adaptation practitioners.

According to interviewees, the ability of the FNC to fund extension services – and the specific activities it prioritizes – can be affected by the presence of international donors in Colombia, if the latter inadvertently divert domestic resources away from current sectoral priorities defined by the FNC and towards donor priorities. It might be argued that since donors usually (not always) work with the FNC, then this diversion is sanctioned by the national federation and thus should be in line with sectoral needs. However, the opportunity to work with international partners is of strategic value to the FNC, not only because of the access to additional resources, but also because this is perceived as a "show of trust" in the national institution. Therefore, the FNC may support donor projects even if the activities do not match the FNC's own priorities for growers. At the same time, donors' financial contributions are not always enough to implement the projects they choose, in which case the FNC often provides co-finance. This means diverting resources that would have been used for other purposes, such as reassigning extension workers to the donor project.

An FNC extension worker, right, talks with a farmer in Colombia's Eje Cafetero. Photo by Patricia Rincón. © FNC 2011.

There are other ways, too, in which donor activities within the sector were described as creating indirect effects, and are examples of vulnerability redistribution. One example – not visible in Figure 2, since the figure is focused on coffee *growers* – is that actions by farmers to decrease their production costs can reduce the availability of work for coffee *pickers*, and thus transfer vulnerability from growers to another group. For example, interviewees spoke about a recent project in the vicinity of Medellín. A major roaster has financed a central processing mill for local farmers, which means farmers have more spare time, because they no longer have to process their own coffee before taking it to market. This appears to have generated clear benefits for growers, and in some areas growers have created a local "taskforce" to together pick cherries on one another's farms. But that has also reduced the need for coffee pickers, who in Colombia are often landless migratory workers. Reduced demand for farm labour tends to be unequally transferred to certain groups; for instance, women coffee pickers are the first to suffer reduced work because farmers prefer to hire men and boys if available.

How the FNC perceives future growing conditions as a result of climate change can also redistribute vulnerability between groups. For example, national institutions and donors may shift support away from what are predicted to be "marginal" coffee-growing areas in the future (i.e. low altitude growers), and may not financially support plantation renewals. This response would increase vulnerability for those farmers who are already at greatest risk from climate change, pointing to the need for programmes to at least support these groups in transitioning to another livelihood.

6. DISCUSSION

Given the highly and increasingly interconnected social, economic and environmental systems in which we live, it may be that the creation of unintended and unwanted effects is the norm rather than the exception. When adaptation actions are placed in their broader context, there are many insights from the literature on globalization processes that compel us to (i) be aware that adaptation activities do not occur in a vacuum, and that effects might be transmitted in sometimes unpredictable ways to different people and locations, and (ii) acknowledge that risk and vulnerability outcomes will therefore depend not only on what happens in the target region of an intervention, but also on the ways in which those taking (or benefiting from) action are connected to other people and systems. However, as a number of previous attempts demonstrate, tracing such outcomes from cause through to effect is highly challenging – and perhaps impossible.

Yet in order to ensure that adaptation is effective and reduces overall vulnerability, rather than just transferring it, practitioners need to do more than simply acknowledging complexity. If indirect effects are to be avoided, or at least minimized, there needs to be some means to assess the potential for vulnerability redistribution in the design of interventions.

Our study of Colombian coffee growers brings to light a range of different pathways by which livelihoods may influence and be influenced by changes – including deliberate interventions targeting social, economic and/or environmental objectives – elsewhere. Colombian actors described a range of different pathways through which the livelihoods of coffee growers might be connected to and affected by the actions of others. For the most part, these involved economic links shaped by features of the global coffee market, though a number of avenues by which donor interventions might disrupt social or biophysical connections and thus compromise livelihoods were also highlighted. Together, these point to ways in which risks and vulnerability might inadvertently be transferred between different growers and between growers and other groups in society.

Through *economic* pathways, a change in production, either within Colombia or among other producers, can affect prices, especially the premiums negotiated for high quality and for certified coffees, and disrupt buyer-seller relationships if domestic production declines (which itself translates into price effects and/or transaction costs in establishing new relationships).[26]

Through *social* pathways, several mechanisms can disrupt the support provided by the national coffee federation to growers. One seems to be an unfortunate effect of donor interventions in the coffee sector, which can shift limited FNC resources to donor projects at the expense of basic extension services. Markets can also play a role, when lower prices reduce the income of the FNC and hence the resources it has available to provide extension services, lobby policy and support research.

[26] Note that the variable "price competitiveness of other competing suppliers" in Figure 2 is influenced by the rest of the diagram – that is, the livelihoods of growers elsewhere are improved or degraded by changes in production costs, harvest durability, access to finance and markets in those locations. Therefore, adaptation activities that boost, for instance, harvest durability in one place can actually influence outcomes elsewhere by changing competitiveness and/or production.

As the case of coffee pickers shows, negative effects are not necessarily limited to the coffee growers themselves. Social networks also act to transfer negative impacts more widely beyond just the coffee sector. For instance, interviewees (confirming the conclusions drawn in previous literature) suggested there is a risk that when coffee is not providing enough income, guerrilla groups or illegal crops become a more viable alternative, which has implications for peace and security. Low coffee prices can be accompanied by an increase in local crime; this was linked specifically to the loss of employment among coffee pickers during periods when farmers tighten their belts to cope with reduced incomes.

Coffee tree seedlings on a farm in Colombia's Eje Cafetero. Photo by Aaron Atteridge.

Interviewees did not focus strongly on the way in which *biophysical* pathways might transfer risks and vulnerability, but two specific possibilities were raised (not shown in Figure 2 because it focused on grower vulnerabilities) that are worth mentioning here as examples. The first relates to national government incentives currently in place for local governments to buy land for conservation. While this is positive for the environment, it can reduce local governments' income from property taxes, since some agricultural land is taken out of production, and it may result in the forced relocation of people who live on the land. The second example cited is a concern about the way expansion of coffee plantations increases local soil erosion, which affects downstream water users.

The results indicate that in Colombia's coffee sector, economic risk transfer pathways extended farther into the global arena than social or biophysical pathways. In the cases of social and biophysical disturbance activated by interventions, vulnerability redistribution occurred *within* the same region as the intervention (either on another social group or downstream in environmental terms). By contrast, economic pathways reached around the world, highlighting how global commodities markets make it possible for growers in other countries and regions to influence and be influenced by Colombian growers.

6.1 Designing future adaptation interventions

By demonstrating how efforts to reduce vulnerability of people in one setting might increase vulnerability of people in another, we argue it is imperative that donors and development practitioners recognize and evaluate *net* outcomes when designing interventions and evaluating them, rather than considering only outcomes in the immediate local context for a limited set of beneficiaries. This is particularly challenging in that – for good reasons – current adaptation research and practice emphasize the local nature of adaptation, and the need to tailor interventions to local needs. We do not disagree, but would urge those local efforts to also consider the global perspective. Doing this meaningfully, in turn, requires some way of practically identifying and assessing possible indirect effects, including – as this paper has shown – those which may be experienced in faraway and seemingly unconnected locations.

Our framework provides a lens that directs practitioners to understand which variables the livelihoods of target beneficiaries are most sensitive to, and how these are influenced. In doing so, this process highlights pathways by which vulnerability might be transferred to and from other groups in other places, rather than specific outcomes on the ground.

This point also shows a limitation of our method, that conclusions about indirect effects are drawn from the perspectives of the beneficiaries of an adaptation action, rather than from those who might actually experience indirect effects. This is a practical necessity, since the practitioner knows in advance only the intended beneficiaries of an adaptation action, but not who else might be affected. Looking for potential indirect effects therefore means studying target beneficiaries, and from this imputing some conclusions about how signals of vulnerability might be transmitted in both directions (not only inwards to the beneficiaries themselves). One advantage of this limitation, however, is that it avoids having to make assumptions in advance about which groups will be affected and how, since this understanding should emerge from the study itself.

Focusing on the coffee sector, our results suggest that very few adaptation interventions are likely to be large-scale enough to alter the global supply-demand balance to the point that the market's base price for coffee is affected. Essentially, this would be achieved only through changes in major producers such as Brazil and Vietnam, and then only very large changes, such when Brazil has lost harvests to frost or when Vietnam undertook its rapid and massive sectoral expansion. Still, the results suggest that even relatively small changes might affect premiums for different growers.

Among recent international interventions in the Colombian coffee sector, there are some which might fit our profile above of potentially triggering indirect effects. Two recent projects (anonymized here) express the aims of "increasing the volume of organic coffee" and "increasing the competitiveness and sustainability of the Colombian specialty coffee sector (and) significantly expanding the quantity of coffee produced and exported". Another project has the key objective to "increase the international competitiveness of Colombia's small coffee producers". As noted above, however, even if these projects create indirect effects, the consequences are unlikely to be felt as strongly as fluctuations in global market forces.

Our analysis should not be taken to mean that adaptation is a zero-sum game where one person's gain must necessarily create an equal loss elsewhere. Rather, we argue that vulnerability – which is composed of and influenced by many factors – can be transferred, and through this transfer, it can be either increased or reduced in a *net* sense, or may result in no overall change in vulnerability but simply a transfer. That is, if we set the lens wide enough, we will see that sometimes the net outcome is an increase in vulnerability rather than a reduction.

6.2 Concluding remarks

To further our understanding of indirect effects of adaptation and be able to meaningfully incorporate it into adaptation practice, more empirical analysis of actual indirect effects is needed, from a wide range of examples. Such research could help us to better understand complexity and what that might mean when complex systems are affected by, for instance, adaptation actions. We need some analytical framework to help predict how vulnerability might be redistributed and thus how indirect effects might be generated.

The framework we propose is one approach, but there are also other tools available for studying behaviour and response in complex systems. Agent-based modelling, for instance, is essentially aimed at modelling behavioural responses under specific scenarios (e.g. a development or adaptation intervention) in order to reveal possible *system-level outcomes* that

might not be predicted using "common sense". Neither approach offers robust probabilistic outcomes. One strength of taking our approach is that it could help practitioners identify some potential indirect effects that are not immediately obvious, and also help overcome some of the limitations of modelling approaches, which usually require intensive data inputs (i.e. a reasonable understanding of variables in the system and how they interact) and yet are still gross simplifications of reality. The framework we propose here could, in fact, provide useful input to such modelling exercises, by identifying in the first instance the kinds of interactions that might be important to understand and model.

Many of the examples highlighted by interviewees pertain to economic and market linkages. This may be because coffee growers work in a highly competitive and complex global market, and because they are usually relatively poor and thus have limited financial capacity to withstand hard times. As a consequence, external market factors may present the greatest source of uncertainty for growers. However, this pattern in our data could also be partly a product of our methodology, in particular the sectoral lens we used (studying the coffee sector specifically). This raises a question for practitioners, regarding how to set the boundary of such an analysis.

We also need to highlight a number of limitations of our framework, especially since our hope is to inspire further work on this topic and to improve the way we deal with the concept of indirect effects.

First, it is incomplete. For example, the choice of a framework based on livelihoods approaches means the approach focuses on the vulnerability and adaptive capacity of particular individuals or groups of people (i.e. on human livelihoods). Practitioners may also want to consider how *ecosystems* might be indirectly affected; the identification of risk transfer pathways might have some value in helping the analyst identify likely environmental impacts, even if they cannot predict all ecosystem effects.

Second, using livelihood assets as a point of departure tends to focus the analyst on identifying variables that are important at the *individual* or *household* level, which won't necessarily identify risks transferred to other scales. As Adger (2006) has pointed out, it is also important to consider vulnerability at the whole-system level, where the influence of governance and institutions, for instance, is more relevant than it might be at the individual or household level.

Third, a focus on pathways by which impacts might be transmitted says nothing about actual outcomes (indirect effects) on the ground. Individual risk/vulnerability outcomes are almost impossible to trace in a direct cause-and-effect way, given the number of global linkages that must be chased through in any specific example. For practical reasons, therefore, such analyses rely on using proxies of indirect effects – in this case, risk transfer pathways – and these identified from the perspective of the adaptation beneficiary rather than those who might experience indirect effects. Ultimately, even if we identify pertinent pathways for transfer of vulnerability, it is another matter altogether to assess eventual livelihood outcomes for specific individuals or groups, since people have different capacities to cope with, or adapt to, changes in their access to livelihoods.

As highlighted earlier, some subjectivity is required of the analyst in assessing the relative significance of different sources of vulnerability and different risk transfer pathways. While there are ways of minimizing the need for subjectivity, it cannot be removed altogether, particularly from a method such as this, which attempts to construct a deep understanding of a particular group of people and their place in the world.

Finally, we do not address the next important question for practitioners: how to make trade-offs once an awareness of potential indirect effects has been created. What a practitioner does with this awareness involves normative judgments about the best course of action, assessing or weighing the known (likely) benefits for one target group against the possible (and lesser-known) indirect outcomes for others. What we know from psychology research is that people diminish the value of negative outcomes that are distant in place or time (Markowitz and Shariff 2012), so meaningfully addressing indirect effects remains not only a technical challenge related to identification and measurement, but also a cognitive and ethical one.

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SEI - Headquarters
Linnégatan 87D, Box 24218
104 51 Stockholm
Sweden
Tel: +46 8 30 80 44
Executive Director: Johan L. Kuylenstierna
info@sei-international.org

SEI - Africa
World Agroforestry Centre
United Nations Avenue, Gigiri
P.O. Box 30677
Nairobi 00100
Kenya
Tel: +254 20 722 4886
Centre Director: Stacey Noel
info-Africa@sei-international.org

SEI - Asia
15th Floor
Witthyakit Building
254 Chulalongkorn University
Chulalongkorn Soi 64
Phyathai Road, Pathumwan
Bangkok 10330
Thailand
Tel: +(66) 2 251 4415
Centre Director: Eric Kemp-Benedict
info-Asia@sei-international.org

SEI - Oxford
Florence House
29 Grove Street
Summertown
Oxford, OX2 7JT
UK
Tel: +44 1865 42 6316
Centre Director: Ruth Butterfield
info-Oxford@sei-international.org

SEI - Stockholm
Linnégatan 87D, Box 24218
104 51 Stockholm
Sweden
Tel: +46 8 30 80 44
Centre Director: Jakob Granit
info-Stockholm@sei-international.org

SEI - Tallinn
Lai str 34
10133 Tallinn
Estonia
Tel: +372 627 6100
Centre Director: Tea Nõmmann
info-Tallinn@sei-international.org

SEI - U.S.
Main Office
11 Curtis Avenue
Somerville, MA 02144
USA
Tel: +1 617 627 3786
Centre Director: Charles Heaps
info-US@sei-international.org

Davis Office
400 F Street
Davis, CA 95616
USA
Tel: +1 530 753 3035

Seattle Office
1402 Third Avenue, Suite 900
Seattle, WA 98101
USA
Tel: +1 206 547 4000

SEI - York
University of York
Heslington
York, YO10 5DD
UK
Tel: +44 1904 32 2897
Centre Director: Lisa Emberson
info-York@sei-international.org

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