PROLINNOVA

PROmoting Local INNOVAtion

in ecologically-oriented agriculture and natural resource management

What can local innovation contribute to adaptation to climate change?

Compiled by Mariana Wongtschowski, Miranda Verburg & Ann Waters-Bayer
PROLINNOVA Secretariat – ETC EcoCulture, Netherlands
Based on studies by Yohannes GebreMichael & Mebratu Kifle (Ethiopia),
Lalita Thapa, Suman Manandhar & Anuja Shrestha (Nepal) and
Magagi Saidou, Abdou Dan Gomma *et al* (Niger)

Paper to be presented and discussed at the 3rd International Conference on Community-Based Adaptation, Dhaka, Bangladesh 18–24 February 2009

Leusden, The Netherlands, February 2009

Contents

List of acronyms 3
1. Introduction 4
2. Climate-change adaptation 5
3. PROLINNOVA 8
4. The pilot studies 8
5. Communities' perceptions on climate change 10
6. Some examples of documented local innovations and practices 13
7. Discussion 15
8. Conclusions 16

List of acronyms

ACCCA	Advancing Capacity to Support Climate Change Adaptation
ACP-EU	African, Caribbean and Pacific (Group of States) – European Union
CBA	Community-Based Adaptation
CIA	Central Intelligence Agency
CLACC	Capacity Strengthening of Least Developed Countries for Adaptation to Climate Change
CRESA	Centre Régional d'Enseignement Spécialisé en Agriculture – Regional Centre for Agricultural Education, Faculty of Agronomy of the University of Niamey
CTA	Technical Centre for Agricultural and Rural Cooperation ACP-EU
DGIS	Netherlands Directorate General for International Collaboration
IIED	Institute for Environment and Development
IISD	International Institute for Sustainable Development
INRAN	Institut National de la Recherche Agronomique du Niger – National Institute for Agronomic Research
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
LI-BIRD	Local Initiatives for Biodiversity, Research and Development
NGO	Non-Governmental Organisation
NRM	Natural Resource Management
PFE	Pastoral Forum Ethiopia
PID	Participatory Innovation Development
PROLINNOVA	Promoting Local Innovation in ecologically oriented agriculture and NRM
SEI	Stockholm Environment Institute
UNFCCC	United Nations Framework Convention on Climate Change
UNITAR	United Nations Institute for Training and Research

1. Introduction

The clear evidence that climate change is already a reality calls for action not just to try to slow down the process by reducing the effects of human activity on the global climate (mitigation) but also to assist those affected or threatened to cope with the changes taking place (adaptation). As a result, governments and international bodies started paying increased attention to measures aimed at adaptation. In most cases, this is done by supporting externally-driven processes often dominated by high-tech, exogenous and large-scale "innovations".

While in certain parts of the developing countries such initiatives will be needed and useful, most of the adaptation efforts will have to take place at the local level. For local people directly suffering the results of climate change, international and macro policies are meaningful (if at all) only when accompanied by local, micro-level initiatives that help them to innovate and adapt, to face the challenge posed by the changing climate. Few of the many organisations and stakeholders involved in the climate-change debate know how to do this effectively.

In agricultural development, there is growing evidence[1] of how local adaptation capacities can be supported by building on the knowledge, interest and innovativeness of local actors. Sometimes referred to as Participatory Innovation Development (PID), this approach brings local people together with external actors, such as researchers and non-governmental organisations (NGOs) and can help accelerate innovation, if these external actors take up a facilitative (rather than a leading) role. The driving seat is then occupied by farmers, a term used in a wide sense to include not only crop farmers but also pastoralists, forest dwellers, fisherfolk and other land users.

How relevant is the PID approach for supporting local climate-change adaptation? Can interventions to support adaptation to climate change build on local people's capacities and innovativeness? Do farmers already try to innovate, i.e. to find new ways to cope with the challenges posed by the changing climate and – if possible – even take advantage of them? What is the wider potential of the link between local innovation to adapt to climate change, on the one hand, to policymaking related to climate change, on the other?

To start looking for answers to these questions, PROLINNOVA – a global learning network seeking to promote local innovation in ecologically-oriented agriculture and natural resource management (NRM) – initiated an exploratory study with funds made available by the Netherlands Directorate General for International Collaboration (DGIS). This paper presents the main outputs of the study, discusses these and points to the many questions that still need to be answered.

---

[1] See, for example: Chris Reij & Ann Waters-Bayer (eds), 2001, *Farmer innovation in Africa: a source of inspiration for agricultural development*, London: Earthscan.

2. Climate-change adaptation

When dealing with issues of climate change, it is important to understand the different terms used in the discussion. “Climate variability” is the fluctuation in climatic parameters from the normal or baseline values, whereas “climate change” is understood as a change in the long-term mean value of a particular climate parameter (Abebe 2008)[2]. “Vulnerability” is defined as the degree to which a system is susceptible to, or unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude and rate of climate change and variation to which a system is exposed, its sensitivity and its adaptive capacity (IPCC 2007)[3].

“Climate-change adaptation” encompasses, according to the Intergovernmental Panel on Climate Change (IPCC), “not just adjustments in ecological, social or economic systems in response to actual or expected climatic stimuli and their effects” (Smit & Pilifosova 2001)[4]. It includes adjustments to moderate harm from, or to benefit from, current climate variability as well as anticipated climate change. Adaptation can be a specific action, such as a farmer switching from one crop variety to another that is better suited to anticipated conditions. It can be a systemic change such as diversifying rural livelihoods as a hedge against risks from variability and extremes. It can be an institutional reform such as revising ownership and user rights for land and water to create incentives for better resource management. Adaptation is also a process. The process of adaptation includes learning about risks, evaluating response options, creating the conditions that enable adaptation, mobilising resources, implementing adaptations and revising choices with new learning. We mean all these things by “adaptation”. But conceptualising adaptation as a process is of greatest importance for formulating public interventions that will have lasting benefits.

“(…) Adaptation to climate is not new. People, property, economic activities and environmental resources have always been at risk from climate and people have continually sought ways of adapting, sometimes successfully and sometimes not. The long history of adapting to variations and extremes of climate includes crop diversification, irrigation, construction of water reservoirs and distribution systems, disaster management and insurance (…) (Adger *et al* 2007).” (Leary 2007)[5]

---

[2] Abebe Tadege. 2008. National Adaptation Program of Action (NAPA) preparation process in Ethiopia. In: Green Forum (ed.), Climate change – a burning issue for Ethiopia: proceedings of the 2nd Green Forum Conference held in Addis Ababa, 31 October – 2 November 2007 (Addis Ababa: Green Forum), pp70–110.

[3] IPCC. 2007. Climate change 2007 – impacts, adaptation and vulnerability: the Working Group II contribution to the Intergovernmental Panel on Climate Change Fourth Assessment Report. Cambridge. Cambridge University Press.

[4] Smit B & Pilifosova O. 2001. Adaptation to climate change in the context of sustainable development and equity. In: McCarthy JJ, Canziani OF, Leary NA, Dokken DJ & White KS (eds), Climate change 2001: impacts, adaptation, and vulnerability. IPCC, Cambridge University Press, New York, pp876–912.

[5] Leary N *et al*. 2007. A stitch in time: lessons for climate change adaptation from the AIACC project. AIACC Working Paper 48. At: www.aiaccproject.org.

Changing views on climate-change adaptation

Initially, adaptation was not central to the discussions around the United Nations Framework Convention on Climate Change (UNFCCC; Schipper 2006[6]). Throughout the 1990s, adaptation was usually taken as a given: those who will have to adapt, will adapt: "capacity to adapt was considered something inherent in ecosystems and society, therefore not requiring explicit policy."[7] When, in the early 2000s, it became widespread knowledge that the climatic changes we are dealing with are much beyond "normal" climatic variability that local people usually dealt with, stakeholders involved in the debate started to wonder if ecosystems and local people could really do the job alone, considering the strong intensity and high speed with which climate changes take place, or if specific efforts towards adaptation were required.

From then onwards, initiatives started sprouting at the international level, mainly at the international/national policy level, not without difficulties. Many have a research character, some focus on capacity building. "All of these initiatives are attempting to define their own approaches and methodology. In developing these frameworks, there is a clear danger that a classic top-down approach will emerge in which adaptation measures are equated with large-scale infrastructure-based interventions associated with physical protection. There will without doubt be many circumstances where large investments in infrastructure are an essential part of the adaptation process, but more focus is needed on non-structural alternatives. In particular, "bottom-up" approaches that are rooted in existing community-based patterns of resource management and that aim at sustaining and enhancing the livelihoods of vulnerable people have not been sufficiently recognised. We believe that these "grassroots" initiatives should be the point of departure for the identification and assessment of adaptation strategies, as they are cheaper, more sustainable and, in many cases, more effective in achieving the core goal of assisting poor communities to adapt to the impacts of climate change" (International Union for Conservation of Nature/IUCN, Stockholm Environment Institute/ SEI, and IIED /IISD, 2003)[8].

Building on the recognition of the need for a bottom-up approach, some more recent programmes/projects have started to employ a more local-level strategy to climate-change adaptation. Among these initiatives are CLACC (Capacity Strengthening of Least Developed Countries for Adaptation to Climate Change) facilitated by the International Institute for Environment and Development (IIED) and ACCCA (Advancing Capacity to Support Climate Change Adaptation) coordinated by the United Nations Institute for Training and Research (UNITAR). Both focus on enhancing the capacity of organisations based in civil society who are working with the most vulnerable groups, and promoting the participation of civil society in policy development.

---

[6] Schipper ELF. 2006. Conceptual history of adaptation in the UNFCCC process. *RECIEL* 15 (1): 1–82.
[7] Ibid, p88.
[8] IUCN, SEI & IISD. 2003. Livelihoods and climate change: combining disaster risk reduction, natural resource management and climate change adaptation in a new approach to the reduction of vulnerability and poverty: a conceptual framework paper prepared by the Task Force on Climate Change, Vulnerable Communities and Adaptation. Winnipeg, Canada (mimeo),

Building on this and other previous experiences, IIED has "championed" the concept of Community-Based Adaptation (CBA), presently also the approach advocated by international organisations such as Practical Action[9]. The concept links local adaptive capacity to climate change to local interventions, by including climate-change risks as part of the initial assessment process to define future work at community level[10].

CBA builds on the practice of starting the process of local intervention by asking people what their problems are, and what exactly they need help with. What PROLINNOVA partners hope to add to the debate (and practice!) is the concept of starting the process by looking at the more positive side of things: by recognising what mechanisms local people have already come up with, and building on these. In this way, we hope to contribute to understanding the role of enhancing local capacity as a means to deal with climate change, as the starting point for an "innovative adaptive community".

The role of local knowledge, practices and innovation

So far, there is very little documentation on local adaptation to extreme climate variability, concludes Pandey[11] in her historical overview on peoples' adaptive systems to (extreme) climate variability. She recommends that this knowledge gap be filled: "… in order to explore options for adaptations to abrupt climate change, several issues need to be explored with rural people. These include learning the spontaneous as well as planned physical adaptation strategies employed by villagers in the event of abrupt climate change. The relevance of such studies could be to create original knowledge needed to design policy and specific actions for societal adaptation to abrupt climate change." She also argues that "institutional and societal" adaptations are as important as (or more important than) biophysical ones.

When reviewing Abler *et al*[12], Pandey points to two modelling frameworks for responses to climate change: static, in which regional capital stocks, technologies, and public and private institutions are exogenous; and dynamic, in which these variables are endogenous. Dynamic responses in capital stocks, technologies and institutions are likely to be the most important adaptations to climate change and its effects on ecosystems, but also the least well understood at the present time.

Pandey's arguments are supported by Osman-Elasha[13], who notes that "there are some African communities that have developed traditional adaptation strategies to cope with climate variability and extreme events. Rural farmers have been practicing coping strategies and other tactics, especially in places where droughts recur, and have developed their own ways of assessing the prospects for favourable household or village seasonal food production.… Experience with these strategies needs to be

[9] Practical Action is a partner of PROLINNOVA in Sudan, Nepal and Peru.
[10] Jones R & Rahman A. 2007. Community-based adaptation. *Tiempo* 64.
[11] Pandey N. 2006. Societal adaptation to abrupt climate change and monsoon variability: implications for sustainable livelihoods of rural communities. Winrock International–India.
[12] Abler D, Shortle J, Rose A & Oladosu G. 2000. Characterizing regional economic impacts and responses to climate change. *Global and Planetary Change* 25 (1–2): 67–81.
[13] Osman-Elasha B. 2007. Africa vulnerability. *Tiempo* 63: 1–7.

shared among communities, although it will be necessary to take into account that some of these techniques may need to be adjusted to deal with additional climate risks associated with climate change.[14]"

Local innovation in adaptation to climate change needs to be assessed together with other environmental, socio-economic and policy changes. This helps avoid the trap of romanticising local practices as if they were evidence of deliberate local adaptation to climate change. Moreover, it implies that the initial scanning of local innovation is only partially addressing the complex and diverse issues of adaptation to climate change.

3. PROLINNOVA

PROLINNOVA is a global learning network aimed at promoting local innovation in ecologically-oriented agriculture and NRM. Its focus is on recognising the ***dynamics*** of local knowledge and enhancing capacities of farmers to adjust to change – to develop their own site-appropriate systems and institutions of resource management so as to gain food security, sustain their livelihoods and safeguard the environment. The essence of sustainability lies in the capacity to adapt.

PROLINNOVA promotes and scales up farmer-based approaches to agricultural and NRM development that start with discovering how farmers do informal experiments to develop and test new ideas for better use of natural resources. Understanding the rationale behind local innovation transforms how research and extension agents view local people. This experience stimulates interest on both sides to enter into joint action. Local ideas are further developed in a participatory process that integrates local knowledge and scientific knowledge: joint action and analysis lead to mutual learning.

PROLINNOVA functions as a network since 2003. It has grown to include more than 130 NGOs, governmental research and extension, policymakers, educational institutions and farmer organisations from 18 countries. Each country programme, coordinated usually by an NGO, has developed its own set of activities within the common goal of mainstreaming PID. Over the past years, the network has studied numerous cases of local innovation processes, encouraged research and development agencies to interact and support these using a PID approach and documented these experiences for use in policy dialogue and mainstreaming activities.

4. The pilot studies

This initial exploratory study started in January 2008 and will last until March 2009. Activities were carried out by three country programmes – in Ethiopia, Nepal and Niger – selected on the basis of expressed interest of country-level partners, their current

[14] Some of the most vulnerable regions of the globe have historically already gone through abrupt climate variations. In the Andes, for example, farmers apply traditional practices to deal with drought and low temperatures. Climate risks as such are not new. What is new is the frequency of certain phenomena and their intensity.

expertise and experience, and the relevance/need of work related to climate-change adaptation in the countries.

The overall objective of the study is to explore the relevance of local adaptation/ innovation and the PID approach to climate-change adaptation at local level. More specifically, the study tries to:

- Systematically document local experimentation processes which come about as a response to a felt need to adapt to climate change;
- Understand local communities' perceptions of "climate change";
- Stimulate documentation of local innovation (processes) at local level;
- Draw lessons on the potential impact/influence of local innovation processes on climate-change adaptation policies and programmes.

In Ethiopia, the study is coordinated by the Pastoralist Forum Ethiopia (PFE), a local umbrella NGO which brings together local and international NGOs dealing with pastoral development issues in Ethiopia, in close collaboration with the Geography Department of Addis Ababa University. In Nepal, Local Initiatives for Biodiversity, Research and Development (LI-BIRD[15]), a local NGO, is taking the lead. In Niger, the work is coordinated by CRESA (*Centre Régional d'Enseignement Spécialisé en Agriculture* – Regional Centre for Agricultural Education), a body of the Faculty of Agronomy of the University of Niamey, and implemented jointly with INRAN (*Institut National de la Recherche Agronomique du Niger* – National Institute for Agronomic Research), ONG D2000, CERRA Tahoua and the Regional Directorate of Agricultural Development in Maradi.

At the international level, the study is facilitated by ETC EcoCulture in the Netherlands.

Study methodology

While each country has designed its specific flow of activities, these all include in some form the following:

1. Literature review of national-level work on the relationship between climate change and local innovation. A literature review also took place at the international level, leading to the development of a background paper;
2. Quick scanning of organisations involved in climate-adaptation programmes for learning from previous experiences, potential engagement in the study and/or discussing future results;
3. Actual documentation in the field, in close collaboration with local actors. In Niger, field studies were carried out in three regions – Maradi, Tahoua and Tillebéri – and, in each region, at two sites (pastoral and arable farming) facing different high and low pressure with respect to climate change. In Ethiopia, studies took place in Gashamo District (Somali Region), Awash Fentale District

[15] Building on their participation in CLACC and on ongoing work supported by the Norwegian Development Fund.

(Afar Region), and in Daasanach District (South Omo Zone of Southern Nations, Nationalities and Peoples Region, referred to as Southern Region). These three areas in Ethiopia face very different problems – drought, land-use conflict and flooding, respectively – and partners wanted to explore this diversity. In Nepal, the flood-prone and drought-prone areas of Kailali and Bardia, respectively, of Western Nepal were selected as study sites. In all three countries, field-study methods included semi-structured interviews with local people, focus-group discussions, community meetings, and interviews with government and NGO staff working at village level;

4. Synthesis of findings: the major findings of the pilot studies were compiled and in part, analysed, and the partners produced a synthesis document per country[16];
5. Sharing findings in a national-level workshop. In Ethiopia, such a workshop took place in November 2008, bringing together 33 participants from Government, NGOs and the Pastoral Standing Committee of the Ethiopian Parliament. In Niger, a similar workshop is planned for March 2009, while in Nepal this will take place shortly.
6. Wider dissemination of results: outcomes of the study have already been presented or/and discussed at three international events, namely, in the seminar "More than Rain: How can the world's poor cope with the changing climate", held in September 2008 in Oslo and organised by the Norwegian Development Fund; the CTA (Technical Centre for Agricultural and Rural Cooperation ACP-EU) seminar on the "Implications of Climate Change for Sustainable Agriculture Production Systems" held in Ouagadougou in October 2008; the "ClimAdapt: Innovative Responses in Sustainable Agriculture" event organised by Agrecol Association in Bonn in November 2008.

5. Communities' perceptions on climate change

Communities' perceptions of climate change, of course, vary according to the phenomena observed, natural conditions, as well as changes in other factors that might influence their capacity to respond to more or less normal climate variability.

In Ethiopia, for example, most of the pastoralist communities in the three different locations feel that the dry season has become longer and that the short and main wet seasons fail more often. Drought is usually accompanied by heavy dust; shortages of water, food and fodder; spread of human and livestock diseases; and high frequency of conflicts, all of which contribute to a vicious cycle of poverty. The start of the rains is also becoming more unpredictable, as they may come early or late.

According to the elders in Gashamo, droughts in earlier times resulted from a failure of either the *Gu* (long rains) or the *Deyr* (short rains) wet season. Gradually, however, this has changed to the failure of both wet seasons. Moreover, the rainfall is highly localised, which puts narrower limits on mobility and leads to higher risk of the spread of livestock

[16] Available upon request from prolinnova@etcnl.nl

diseases and conflicts, because many herds are concentrated in the same areas favoured by the limited rains.

To compare this with the climate data measured over more than five decades: these indicate that the amount of rainfall has been constant on a national average, with a declining trend in the north of Ethiopia, while there has been an increase in rainfall intensity and variability in the central Ethiopian highlands (all of the pilot study areas are, however, in the lowlands where rainfall measurements are scanty). This climate change is also linked with the El Nino and La Nina phenomena, leading to droughts, floods, heavy rain, food insecurity, disease outbreaks and land degradation (Abebe 2008[17], Kassahun 2008[18]). Similarly, in Somali Region, data from 1957–2002 show an increase of rainfall in the *Gu* season and consistency in the *Deyr* rainfall (Devereux 2006[19]).

In Nepal, farmers in Joshipur (Kailali) also feel that the climate is changing. They observe increased intensity of rainfall and frequency of floods, affecting rice production and storage, and an outbreak of human diseases such as diarrhoea and cholera. In Belwa (Bardia), farmers feel they have been affected by droughts of more-than-normal intensity, with less rainfall during the monsoon. Since farmers rely on rainwater for irrigation, in recent years they simply could not plant rice because the rainfall was no longer sufficient. The local varieties of rice, which need a considerable amount of water, could not be cultivated (leading to a potential loss in agrobiodiversity). In addition, whatever could be planted was attacked by a higher density of pests and insects in the smaller areas cropped.

Nepal is a very diverse country in terms of climate, so weather data must be interpreted with caution. When one looks at data from 1977–94, there seems to be indeed a warming trend, but temperature differences are most pronounced during the dry winter season, and least during the height of the monsoon. “There is also significantly greater warming at higher elevations in the northern part of the country than at lower elevations in the south. (…) Significant glacier retreat as well as significant areal expansion of several glacial lakes has also been documented in recent decades, with an extremely high likelihood that such impacts are linked to rising temperatures. There are no definitive trends in aggregate precipitation, although there is some evidence of more intense precipitation events. A somewhat clearer picture emerges in stream flow patterns in certain rivers where there has been an increase in the number of flood days. Some rivers are also exhibiting a trend towards a reduction in dependable flows in the dry season (…) Glacier retreat also contributes significantly to streamflow variability in

[17] Abebe, *op. cit.*
[18] Kassahun D. 2008. Impacts of climate change on Ethiopia: a review of the literature. In: Green Forum (ed.), Climate change – a burning issue for Ethiopia: proceedings of the 2nd Green Forum Conference held in Addis Ababa, 31 October – 2 November 2007 (Addis Ababa: Green Forum), pp9–35.
[19] Devereux S. 2006. Vulnerable livelihoods in Somali Region, Ethiopia. IDS Research Report 57. Brighton: Institute of Development Studies.

the spring and summer, while glacial lake outbursts which are becoming more likely with rising temperatures, are an additional source of flooding risk." (Agrawala 2003[20]).

In Niger, crop farmers and livestock-keepers interviewed in the villages, hamlets and camps also say the weather is changing, with devastating consequences. Temperatures are increasing, violent winds and dust storms more frequent. There is a perceived strong reduction in annual rainfall, leading to shrinking water bodies and lower water table. Rain is also perceived as been poorly distributed, with torrential rains leading to flooding combined with repeated dry periods in the middle of the wet season and before crop maturity. All these have led – according to farmers – to lower production and quality of agricultural products, plant pest and disease attacks at flowering and grain-filling, pasture and harvest losses because of natural disaster, soil degradation, desertification and disappearance of forests, fewer important woody and herbaceous species and insufficient natural regeneration.

Analysis of historical data on daily rainfall "for rainy season parameters of interest to agriculture" suggested that, from 1965, there was a significant decrease in the amount of rainfall and in the number of rainy days in the months of July and August, resulting in a decreased volume of rainfall for each rainstorm. In comparison to the period 1945–64, major shifts occurred in the average dates of onset and ending of rains during 1965–88. The length of the growing season was reduced by 5–20 days across different locations in Niger" (Sivankumar 1992[21]). However, since the mid 1990s, an improvement in rainfall has been noted in Niger, but also greater interannual rainfall variability[22]. This does not coincide with the farmers' perception of strong reduction in annual rainfall, a perception that may still be influenced by the memories of earlier years of drought but also by the greater difference in rainfall between years.

As seen above, farmers' perceptions do not always coincide with the measured data over several decades. This can be attributed to a combination of factors. Firstly, the climate data stations are too small to reflect the reality under spatial distribution of different climatic conditions, especially in countries where climates are so diverse. Secondly, averages are not good indicators of rainfall distribution in space and time. In addition, changes in rain pattern can be attributed to other factors, such as micro-level vegetation cover, which also influences the consequences of rainfall. Rains can have the same intensity, but produce much stronger erosion and therefore seem more intensive, if an area has less vegetation cover. Lastly, changes perceived by farmers as trends may well be part of the normal climate-change variability that these countries are subject to.

---

[20] Agrawala S *et al*. Development and climate change in Nepal: focus on water resources and hydropower. Organisation for Economic Co-operation and Development (OECD), 2003. Available at: http://www.oecd.org/dataoecd/6/51/19742202.pdf

[21] Sivakumar, MVK. 1992. Climate change and implications for agriculture in Niger. In: *Climate Change Journal* 20 (4): 297–312.

[22] Perret C & Jost S. 2008. Climate, climate change and agropastoral practices in the Sahel region. Paper prepared for High-Level Conference on World Food Security: The Challenge of Climate Change and Bioenergy, 3–5 June 2008, Rome; Sahel and West Africa Club Regional Brief (http://www.fao.org/nr/clim/docs/clim_080901_en.pdf)

All in all, what matters here is that – whether talking about climate variability or climate change, micro or macro changes – local people have to adapt. They have to look for opportunities and find new ways of coping with climatic conditions under new situations: with more or less people leaving in a village, for example; with insecure land tenure, with constant conflicts with other communities. These climate-external factors cannot be dissociated from local efforts to adapt to local conditions. In the next section, we describe some of the documented local innovations and practices which are perceived by farmers themselves as being a direct response to climate change.

6. Some examples of documented local innovations and practices

Though the initial focus of the study was on the local capacity to innovate, it soon became clear that not only new ideas and practices were in place as a response to climate change. The communities visited in all the three countries have a long history of dealing with considerable climate variability, and have developed, over time, what are now considered local, traditional practices to cope with extreme weather conditions.

The distinction between local innovation and traditional practices is not always clear. That is also due to the dynamic character of traditional practices, their different application in different areas and, last but not least, the fact that practices might have been there for centuries, but had not been perceived by outsiders until they started to give more attention to how to deal with climate change. In this sense, the present study provided partners with a good opportunity to notice these local practices and their improvements over time, calling their attention to local capacity to create, innovate, adapt and cope.

Here we present some of the practices/innovations documented in the three countries, organised around broad “themes”.

***Settlement and housing*:** In Southern Ethiopia, pastoral communities visited have been changing the orientation of dwellings constructed around the lake. The dwellings used to be aligned uniformly according to the predictable direction of seasonal winds. Because the dust-laden winds now change direction frequently, the community members more frequently re-align their dwellings according to the direction of the wind. Otherwise, there might even be so much dust blown against the door that it could not be opened. Also in Ethiopia, on account of the prolonged drought in their area, the Daasanach prefer to stay on the islands in Lake Turkana in order to have easy access to water, pasture and fish, and to have less risk of livestock raiding by other ethnic groups. In flood-affected communities in Nepal, several of the structures related to daily-life, agriculture and livestock have changed in character. People have started to build houses on the raised land. Goat pens were also found to be built differently: by raising the height of their stands from the floor so as to protect the goats and sheep from the rise of water level during flooding. Stilt houses (*Thati Ghar*) are also being used by farmers for preserving seeds, grains, cereals and utensils during floods. In the drought-prone village visited, people have been migrating to nearby riverbanks ensuring access to river water for crop cultivation. In Niger, some farmers leave their habitual residences

when the first rains come and settle temporarily in more distant but fertile farming areas so that they do not waste time travelling between their homes and their farming areas.

Livestock keeping: Several new practices can be found relating to livestock keeping. For example, in Ethiopia, while there are traditionally no boundaries to moving camels across the territories of different clans and subclans but indeed boundaries for other livestock species, this has changed with the prolonged drought, and pastoralists are now also moving with other species of livestock. In a few places, this has been leading to conflicts because of the fear of spread of livestock diseases. Still in Ethiopia, in the areas visited in Somali Region, there is a shift from raising camels to raising “shoats” (sheep and goats), as it is easier to have small units of livestock to exchange on the market for daily consumables, and the shoats need less pasture than do camels. Moreover, the pastoralists have adopted some better adapted breeds of livestock from the border areas of Oromia Region. In Niger, some livestock-keepers have acquired wells using their own funds and fence them so that only their own animals can drink from them. Some pastoralists sell some of their animals in the dry season in order to be able to buy the rights for their herds to graze the stubble in harvested fields of crop farmers.

Agriculture and food: In Nepal, the people of Joshipur, affected by more frequent flooding, could not continue to cultivate the same crops grown before, as the cultivated land was covered by sand and silt deposits and was unsuitable for growing the traditional (rice) crops. As a response, the community has started cultivating sweet potato, watermelon, groundnuts and sesame, among others. This appears to have led to a change in eating patterns. At the same time, more frequent droughts, as reported in Belwa, have also led to a change in farming and eating habits: farmers now use a higher density of seeds when planting wheat, making sure that “something” survives. They also use mustard and lentil as intercrops, as these increase the productivity of sorghum. Farmers have started to plant more maize, potatoes and vegetables (and less rice). All these changes have led – as in the case of Joshipur – to a change in eating habits. Rice is now more commonly replaced by chapatti (made mainly of wheat) and the local population developed a habit of eating *Goima*, a vegetable that grows wild in maize fields despite the droughts. In Niger, a traditional practice of applying manure to the whole field has been replaced by its application only at the base of the plants. Farmers are replacing sorghum by millet, which is more suited to poor soil fertility and low rainfall.

Community organisation, mobilisation and governance: in Afar, Ethiopia, the community visited underlined that the root cause of their vulnerability was closely connected to the lack of good governance. They concluded that the modern pastoral leaders were highly corrupt and are not accountable to the community. Accordingly, they have tried to strengthen their powers by penalising and/or overthrowing the corrupt leaders. They also work hard to resolve conflicts and have sometimes become successful in coming to mutual understanding to use resources in different geographic locations, at least during drought. In Nepal, families in Joshipur have joined hands and decided to collectively build dams, bunds and walls to check the flood water. This represents a new way of

working together. An example of a socio-institutional innovation developed by women in Illéla, Niger, is that – in contrast to the practice in earlier times when water was more easily available – women are now giving their newly married daughters donkeys in an attempt to solve conflicts over the increasing difficulty of obtaining water. These hardy animals help the young women with the heavy and time-consuming task of fetching water. The donkeys play a social role in increasing the security of water supply and consolidating the bond of the marriage within these rural communities.

7. Discussion

As pointed out above, several of the "adaptations" described in the previous section are derived from or are entirely traditional practices. One would have to look at this in a historical and context-specific way to see which practices have developed more recently. In addition, it is not always evident that these practices are innovations or adaptations that come about as a direct response to perceived climate change. Some of them might be a response to climate variability – a normal phenomenon in arid environments – rather than long-term change. Moreover, changes come about as a response to an ensemble of intertwined factors.

As pointed out in the Ethiopia study report, in the arid and semi-arid areas, drought is part of a normal cycle and pastoralists have developed some strategies to cope with it, such as mobility, livestock species diversity, reciprocity in use of resources, territorial fluidity and social safety nets. However, the vulnerability of pastoralists to drought is very complex and diverse. Some claim that drought as such is not making pastoralists vulnerable. Rather, the increasing marginalisation of their drought-response mechanisms is (Devereux 2006[23]). Restriction on mobility of people and animals, intensification of conflicts and stricter control of cross-border trade are some of the threats (Hesse & MacGregor 2006[24], Yohannes & Waters-Bayer 2002[25]). Some authors underlined that the prolonged droughts combined with environmental degradation and increasing sedentarisation has led to deterioration of pastoral livelihoods (e.g. Ayelew 2001[26]). Others consider the frequency of drought as a crisis of pastoralism and predict that this way of life and production will not be viable; they therefore recommend sedentarisation of pastoral communities (e.g. Devereux 2006[27]).

In the same line, Niger is among the fastest-growing countries in Africa in terms of population, with a growth rate estimated in 2.88%/yr (CIA 2008[28]). That of course means that many more people are using water than in the 1960s and 1970s, which exacerbates the consequences of a drier environment.

---

[23] Devereux, *op. cit.*
[24] Hesse C & MacGregor J. 2006. Pastoralism: drylands' invisible asset? IIED Issue Paper 142. London: IIED.
[25] Yohannes GebreMichael & Waters-Bayer A. 2002. Evaluation of natural resource management programme in the pastoral area of Somalia region, Study commissioned by NOVIB, Addis Ababa, unpublished.
[26] Ayelew Gebre. 2001. Pastoralism under pressure: land alienation and pastoral transformations among the Karayu of Eastern Ethiopia, 1941 to the present. Maastricht, Shaker.
[27] Devereux, *op. cit.*
[28] CIA. 2008. World Fact Book. At: https://www.cia.gov/library/publications/the-world-factbook/fields/2002.html.

Several issues are raised here: the first is that vulnerability is complex. Vulnerability is determined by a combination of factors and events (erosion, demographic changes, macro policies, market changes, etc). And this means that consequences of climate change cannot be clearly separated from those of other events.

The point of the present study is to understand the relevance of local adaptation and innovation to climate-change adaptation at local level. Even if climate change is not an isolated factor, the studies in three countries show that local capacities to innovate and adapt to changing conditions is an important element in reducing vulnerability.

Here, the issue of making a difference between local innovations *per se* and the use of traditional practices loses much of its importance. One advantage of the "climate-change alarm" is that external actors (scientists, extensionists etc) are now beginning to value local practices which have been used for a long time and are, under uncertain climatic conditions, more suitable than many introduced techniques. They are also more commonly trying to build on these practices and understand the current efforts of local communities for coping with and adapting to climate change or variability. This, as such, is a step forward, towards more participatory and farmer-centred local development.

That is not to say that local innovation and creativity is all one needs to adapt to climate change. As said before, other factors affect people's vulnerability than their intrinsic capacity to innovate. Farmers' adaptation to climate change is an inherent part of their social dynamics, but that it also has limits, and should not be romanticised. It is here that other stakeholders have an important role to play: in recognising local capacities and resilience, and helping local farmers to recuperate, strengthen and put their knowledge and creativity into practice. This has been the principle behind PROLINNOVA – one that we argue also fits into the climate-change debate.

8. Conclusions

There seems to be a clear need to continue to investigate the way local practices and innovation respond to climate-change related challenges, if only to better inform policymakers and other stakeholders of the potential role local capacities can play in local adaptation, and to trigger a process of recognition and reflection. The focus here is not on specific innovations, but rather on documenting local innovation as a process. Though, at local level, farmers might be able to benefit from knowing what other farmers are doing to cope – adapting their innovations and practices to their own situations – the documentation of innovations (understood as specific techniques, ideas and technologies) is not an end it itself. It remains, nevertheless, important as a symbol of the local capacity to create and react to local problems.

In this same line, the multi-stakeholder workshop held in Ethiopia came up with a recommendation to establish and strengthen a documentation and information centre, making data and information available for various audiences.

At the present political moment, we risk treating climate change much as agricultural research and development has been in the past, i.e. in a rather top-down way. This paper advocates for a bottom-up approach (complementary to macro policies, which have a role to play), in which local capacities are taken as a starting point. Adaptation to climate change demands a multi-stakeholder approach (just as agricultural research and development does), building on the strengths of each stakeholder group.

Exchanging information and actually working together with different stakeholders demands much stronger communication than what is presently observed in the three countries that took part of this study and at international level. It demands bringing together environmental and agricultural/livestock organisations. At country level, if climate-change adaptation is to play an important role, PROLINNOVA platforms should be broadened to include actors who are actively implementing climate-change adaptation programmes.

As part of an international programme, we clearly see the need to learn from others' experiences and similar studies and share with them our own. This pilot shows that results coming out of this and similar studies are potentially good material for advocacy at country and international level, towards a more participatory approach to climate-change adaptation.

In fact, the network still must learn to make the most of the fact that what PROLINNOVA does within and outside the scope of this study (i.e. supporting local innovation) is largely directly related to strengthening local capacities to adapt and therefore cope with climate change.