

Participatory climate-change adaptation building on local innovation

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Abstract

The challenge of climate change calls for action to help affected people deal with the new conditions. For people directly suffering the impacts of climate change, macro-level policies are meaningful only when accompanied by micro-level initiatives that support local climate-change adaptation (CCA).

Partners in Ethiopia, Nepal and Nigeria within the international multi-stakeholder PROLINNOVA (PROMoting Local INNOVATION) network explored the relevance of the PID (Participatory Innovation Development) approach to CCA at local level. PID involves multi-stakeholder experimentation that builds on local ideas and initiatives. The study sought primarily to document local experimentation in response to a felt need to adapt to climate change and to draw lessons on the potential influence of local innovation processes on CCA policies and programmes.

Though the initial focus was on local innovations, it soon became clear that responses to climate change involve not only new practices. The communities studied have long histories of dealing with considerable climate variability, and have developed over time what are now considered “traditional” practices to cope with extreme weather conditions. Even if climate change is not an isolated factor for these people, the study showed that their capacities to innovate to adapt to changing conditions is an important element in reducing vulnerability.

There is currently high risk that CCA is treated in a top-down way. The study revealed the potential for a bottom-up approach, in which local innovations and practices serve as starting points for a more participatory approach to CCA, drawing on the strengths of each stakeholder group. Studies of how local people respond positively to challenges related to climate change are important to help inform policymakers and other stakeholders of the role of local creativity in CCA, and to trigger a process of recognition and reflection.

1. Introduction

The challenge of climate change calls for action not only 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 by climate change to be able to cope and adapt. Governments and international bodies are paying increased attention to measures aimed at adaptation. In most cases, these involve externally driven processes dominated by “high-tech”, exogenous and large-scale interventions. While such interventions may be needed and useful in certain parts of the developing countries, most of the adaptation efforts will ultimately have to take place at the local level. For local people who are directly suffering the results of climate change, international and macro-level policies will be meaningful only when accompanied by local, micro-level initiatives that help the local people to innovate and adapt in the face of the challenge of climate change.

In agricultural development, there is growing evidence (e.g. Reij & Waters-Bayer 2001) of how local adaptation capacities can be supported by building on the knowledge, interest and innovativeness of local actors. Known as Participatory Innovation Development (PID), this

approach shows how local people together with external actors, such as researchers and non-governmental organisations (NGOs), can be effective in accelerating innovation, if the external actors take on a facilitating rather than a leading role. Farmers (including pastoralists and other local resource users) are in the driving seat.

In 2007, some partners in the PROLINNOVA network (see Box 1) who were involved in the CCA debate began to ask themselves: How relevant is the PID approach for supporting local adaptation to climate change? Can interventions to support CCA build on local people's capacities and innovativeness? Do farmers already deliberately try to innovate, i.e. to find new ways to deal with the challenges posed by a 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 national policymaking related to climate change, on the other?

In 2008, the network decided to start up an exploratory study to seek answers to these questions, with funds made available by the Netherlands Directorate General for International Cooperation. This paper describes the main ideas behind the study, outlines the methodology used, presents the main findings and draws conclusions for the way forward.

Box 1: PROLINNOVA

PROLINNOVA is an international learning network aimed at **Promoting Local INNOVATION**, i.e. farmer-led joint innovation processes, in ecologically oriented agriculture and natural resource management (NRM). It recognises the **dynamics** of local knowledge and seeks to enhance 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 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 researchers 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.

Since the network started in 2003, PROLINNOVA has grown to include more than 130 NGOs, governmental research and extension, policymakers, educational institutions and farmer organisations from 18 countries. Each country network, coordinated usually by an NGO, has developed its own set of activities within the common goal of mainstreaming farmer-led participatory innovation processes. Network members have studied numerous cases of local innovation processes, have encouraged research and development agencies to interact and support these using a participatory approach and have documented these experiences for use in policy dialogue and mainstreaming activities. An International Support Team handles network facilitation, capacity strengthening, coaching, information management, international policy dialogue and publishing.

The overall objective of the study was to explore the relevance of local adaptation and innovation and a farmer-led participatory approach to CCA at local level. More specifically, the study tried to:

- Understand local communities' perceptions of "climate change";
- Systematically document local experimentation processes that come about in response to a locally felt need to adapt to climate change;
- Stimulate documentation of local innovation processes at local level;
- Shed light on some of the factors that enable and accelerate local resilience and capacity to adapt to climate change;
- Draw lessons on potential impact/influence of local innovation processes on CCA policies and programmes.

2. Methodology

The study was carried out over a period of two years from mid-2008 to mid-2010. It started with a literature review on local-level adaptation to climate change in agriculture and NRM. This review gave the PROLINNOVA partners in the country networks a brief overview of the debate on CCA and of the role of local knowledge, practices and innovations in adaptation.

The exploratory studies were carried out by three PROLINNOVA country networks:

- Ethiopia, focused on pastoral systems in arid areas;
- Nepal, focused on agriculture and NRM in mountainous areas; and
- Niger, focused on mixed-farming systems in semiarid areas.

In this paper, only the experiences in Africa are described, but the experiences in all three countries provide the basis for the lessons learnt. In Ethiopia, the work was coordinated by the Pastoralist Forum Ethiopia (PFE), a local umbrella NGO that 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 Niger, CRESA (*Centre Régional d'Enseignement Spécialisé en Agriculture*), a body of the Faculty of Agronomy of the University of Niamey, coordinated the work together with INRAN (*Institut National de Recherche Agronomique du Niger*). At the international level, the study was coordinated by ETC AgriCulture in the Netherlands, the host organisation of the PROLINNOVA International Secretariat.

While each country network designed its specific flow of activities, they all included in some form the following:

- Literature review of in-country work on links between climate change and local innovation;
- Quick scanning of organisations involved in CCA programmes for learning from previous experiences, potential engagement in the study and/or discussing future results;
- Actual documentation in the field, done by as many committed local organisations as possible;
- Synthesis of findings: the major findings were compiled into a report that reflected the situation and perspectives of different communities and development actors;
- Sharing findings in a national-level workshop, to which policymakers and organisations dealing directly with CCA were invited;
- Deepening of the study focused on particular area or type of innovation;
- Compilation of a final case-study report per country.

In addition to using the results for information exchange and policy influence during the actual study, the outcomes are to be used subsequently in training courses and higher education.

3. Findings from the case studies

3.1 Case study in Ethiopia: focus on pastoral systems in arid and semiarid areas

The case study in Ethiopia was carried out by PFE staff members and a researcher from the Geography Department of Addis Ababa University. The focus was on innovation by pastoralists in arid and semi-arid areas. A preliminary study on pastoralist innovation to adapt to climate change was followed by an in-depth study of local innovation by Afar pastoralists.

The main aims of the preliminary study in 2008 (Yohannes & Mebratu 2009) were to scan local perceptions of climate change, to document local innovations in adapting to climate change, and to draw lessons for policy influence and global clarity of concepts. Four areas were purposely selected for the fieldwork: Awash Fentale District in Afar Region, an area of chronic conflict; Dasanach District in the Southern Region¹, an area that frequently experiences flooding problems; and Gashamo District in Somali Region, an area that frequently experiences serious droughts.

¹ Southern Nations, Nationalities and Peoples Region (SNNPR), referred to here as the Southern Region

Villages were chosen to address different clans and subclans in the localities. A question checklist was used to guide semi-structured discussions with different groups of community members: elders and leaders, women, men and youth. Some discussions were also held with government and NGO staff working at village, district and zonal level.

The deeper-going study on pastoralists' innovativeness in adapting to climate change was made in Awash Fentale District in Afar Region (PFE 2009). It sought to understand the process of innovation and adaptation to climate change among different groups within a pastoralist community, to identify indicators for innovativeness in CCA in a pastoralist context, to analyse how the local innovations were diffusing within the community and to draw lessons about integrating local innovation in CCA into development interventions. Focus-group discussions were held with male and female pastoralists and with elders in four communities. Data on rainfall and temperature over the past 40 years were obtained from Melka Warar Research Centre.

In pastoral areas of Ethiopia, drought is part of a normal climatic cycle and pastoralists have developed strategies to cope with it, such as mobility, livestock species diversity, reciprocity in use of resources, territorial fluidity and social safety nets. The literature review revealed that the vulnerability of pastoralists to drought is very complex and is evident in diverse forms. It is not drought itself that is making pastoralists vulnerable, but rather the increasing marginalisation of their drought-response mechanisms (Devereux 2006). Their livelihoods and the very system of pastoralism are being threatened by decreasing access to land and water resources for livestock husbandry, increasing restrictions on mobility of people and animals, intensification of conflicts and stricter control of cross-border trade (Hesse & MacGregor 2006, Yohannes & Waters-Bayer 2002). As a result of government policy for development, which is biased to arable farming, some pastoralists have settled for part or all of the year. The drought periods, combined with increasing sedentarisation and environmental degradation, have led to deterioration of pastoral livelihoods. There is widespread perception, especially among pastoralist peoples themselves, that droughts are becoming more frequent and more severe, leading to a crisis of pastoralism and concern whether their way of life and production will continue to be viable.

Changes perceived by the pastoralist communities in the study areas included population growth, more settlement, greater diversification of income sources, influx of migrants, longer dry periods, higher incidence of livestock diseases, lower availability of water sources and more conflict. The local people saw these changes as directly or indirectly linked to climate change. Their own innovations in response to what they perceived as climate change included the following:

- **Developing their own cut-and-carry feeding system:** Afar pastoralists who faced dwindling grazing resources started to collect forage from a national park (that the Government has set up in their former grazing area) and transport the forage to their livestock (see Box 2).
- **Creating private and community waterpoints:** In some parts of Somali Region of Ethiopia, man-made waterpoints in the form of in-ground cisterns (*birkas*) are increasing in number and are often privately owned. Many pastoralists sell some animals to be able to pay for water. Some communities – either on their own initiative or with the help of NGOs and government agencies – have developed communal sources of water by harvesting run-off water, digging deep wells or establishing community *birkas*.
- **Purchasing commodities on credit:** During periods of scarcity, some pastoralists have started buying different commodities on a credit basis from small shops (often set up by pastoralists) in small towns in the pastoral areas. This mutual relationship between people in the urban and rural areas serves as a new form of safety net in the face of high risks.
- **Changing herd composition:** Because of problems with water, pasture and recurrent drought, pastoralists are increasingly replacing cattle with sheep, goats and camels.
- **Settling on islands in dryland lakes:** In Southern Ethiopia close to the border to Kenya, on account of the longer dry seasons being experienced, some Dasanach agro-pastoralists now prefer to stay on islands in Lake Turkana so as to have an easy access to water, pasture and fish, and to face less risk of livestock raiding by other ethnic groups.

- **Diversifying livelihood sources:** In Southern Ethiopia, some ethnic minorities, often called hunter-gatherers, who used to depend almost solely on fishing for their own consumption, have started selling fish and use modern fish traps they have brought in from the Turkana area in Kenya. They have also begun to rear small ruminants. This is a case of people who were originally non-pastoralists gradually tending towards more pastoralist-like activities.
- **Using motor vehicles:** In many places in Ethiopia, some richer pastoralists have sold some of their livestock in order to buy trucks, which they use in a flexible way to transport livestock for grazing or marketing and to transport marketable commodities for buying and selling. The same trucks are used to load watertanks when the truck owners need water for their own families and herds. They also generate income by transporting water to *birka* owners. As a result on these activities, the rich pastoralists are becoming even richer.
- **Empowering traditional institutions:** In Afar Region, the community underlined that the root cause of their vulnerability is closely linked to the lack of good governance in their local socio-political institutions. Their perception was that the traditional pastoral leaders have – with the attractions of modern and individualistic lifestyles – become corrupt and are no longer accountable to their communities. Accordingly, some pastoralists “elders” (married men both young and old) have built up pressure within the communities to penalise and/or overthrow corrupt leaders. They also work intensively on resolving conflicts and have sometimes successfully negotiated with other ethnic or clan groups to use resources in different geographic locations, at least temporarily during drought and on a reciprocal basis. Generally, these efforts have contributed to improving governance at the grassroots level. This reduces vulnerability of the communities to external threats, including climate-related ones.

Box 2: Developing their own cut-and-carry feeding system

Already several decades ago, the Awash National Park in Afar Region of Ethiopia took over large areas of prime grazing land and water points formerly used by Afar pastoralists. These people have gained no benefit from the income from tourism, and their herds have no official access to the park during dry seasons and droughts. Therefore, frequent violent conflicts between Afar pastoralists and park (State) authorities have taken place. Recently, however, with the increasing number of droughts, some Afar pastoralists have developed their own cut-and-carry system of collecting forage from the park and transporting the forage on the head or in carts drawn by horses or donkeys. This innovation includes collective action by community groups that rent carts jointly, using money contributed by group members, and then distribute the forage within the community. This innovative way of managing forage resources has several benefits: 1) it reduces conflict between the pastoralist community and the State; 2) the cut-and-carry system reduces the risk of disease transmission between livestock and wildlife; 3) the pastoralist community has come to regard the park as a reserve pasture area; and 4) the community has developed a collective financial management mechanism that could serve as a basis also for other economic activities.

The in-depth study in Awash Fentale District, Afar Region, brought evidence of increasing climate variability and a decreasing trend in amount of rainfall. This led to poor regeneration of pasture and shortage of water, which led, in turn, to more frequent drought-related shocks and greater vulnerability of the pastoralists. Because of the series of droughts in recent years, the households had more limited opportunity than usual to rebuild their assets – particularly in terms of livestock – and some became locked into a spiral of chronic food insecurity and poverty. However, other Afar households were found to be adapting to the changes in a creative way. The study confirmed the importance of traditional pastoral strategies such as flexibility in terms of herd mobility, managing herd structure, herd splitting, managing household labour resources and managing grazing reserves in giving pastoralists some degree of resilience to climate change – as long as they were able to continue with these strategies. Specific new responses to recent changes included:

- Diversification of income sources, including crop cultivation and engagement of some Afar pastoral family members in wage labour on large commercial farms that have been set up in former grazing areas;

- Sending at least one if not more of the children in the family to school in an effort to reduce the risks of future shocks, including climate shocks;
- Reviving the use of traditional house-construction materials (wood, palm leaves, mud) and style (with a flat mud roof) to replace the recently introduced corrugated iron roofs, which become too warm with the perceived increase in temperatures;
- Merging of “modern” and traditional systems of conflict management, in the face of greater volatility of relations among pastoralist groups with increasing incidence of drought;
- The cut-and-carry feeding system mentioned in Box 2.

The main motivations for the innovation were to provide food for family consumption, to increase the household income and to supply fodder to the livestock during the dry season, with the aim to become more food-secure.

3.2 Case study in Niger: focus on mixed-farming systems in semiarid areas

In Niger, the study was coordinated by CRESA, part of the Faculty of Agronomy of the University of Niamey, and was implemented jointly with INRAN, two NGOs and the Directorate of Agricultural Development in Maradi Region. It was carried out in Tahoua, Illéla, Keita and Abalack Districts in Tahoua Region and in Guidan Roudji, Dakoro and Madarounfa Districts in Maradi Region. It looked at local innovation in both mixed (crop-livestock) farming and agro-pastoralism. Full details of the study in Niger can be found in Magagi *et al* (2010).

Niger is among the fastest-growing countries in Africa in terms of population, with a growth rate of almost 3% per annum (CIA 2008). This means that many more people are using water than in the 1960s and 1970s, which would exacerbate the consequences of a drier environment.

In semi-arid Niger, innovations/adaptations that had been developed by Peul and Tuareg pastoralists to deal with perceived climate change included:

- **Changes in herd composition:** Because of problems with water, pasture and recurrent droughts, pastoralists are replacing cattle by goats, sheep and camels. Agro-pastoralists are keeping more donkeys because of their multiple functions for drawing water from deep wells, transporting water, transporting goods to and from markets and as marriage gifts (see Box 3). Moreover, donkeys are less demanding in their feeding than are other livestock.
- **Privatisation of wells:** Because water sources are drying up and becoming further apart, some livestock-keepers (both settled and nomadic ones) have acquired their own deep wells which they fence so that only their own animals are watered there; this helps them maintain their animals in good condition and reportedly avoids conflicts with crop farmers.
- **Reserving pastures:** During their transhumance through crop-farming areas, the livestock-keepers have now started to sell some of their animals to be able to buy the rights for their herds to graze crop residues (e.g. sorghum) in irrigated farming areas. They also buy crop byproducts and hay, which they feed to their animals in periods of stress.
- **Destocking:** Some pastoralists have started to sell their most vulnerable animals when forage is scarce, and use the proceeds to buy food for the family and fodder for the remaining livestock, so as to maintain their herds.
- **Storing forage:** Crop residues and dry grass in the bush were reportedly not used before but are now collected and stored after harvest to serve as fodder in periods when grazing is in short supply (dry season and early wet season). Some farmers now also sell crop residues and hay to livestock-keepers, and have thus been able to diversify their sources of income.

Box 3: Donkey as marriage gift

The drying up of water sources and the lowering of the watertable has made it more difficult for women to fetch water. Women travel by donkey or on foot for several kilometres to fetch water for the

household. Because of the work involved, young women had started to refuse to marry young men in villages that frequently experience water shortages. Older women in one such village therefore introduced an innovation into the marriage arrangements. They started to buy donkeys to give a marriage gifts to their daughters. Donkeys ease the work of drawing water from the wells and carrying the water to the family home. In some cases, the husband uses the wife's donkey for transporting merchandise to the markets. The donkey thus plays a social role in securing water availability and consolidating marriage ties within the rural communities.

It was also observed that contracts were made between pastoralists and crop farmers to corral their cattle overnight on farmers' fields to deposit manure and urine as fertilizer, but it is not clear how new this is and whether it is in response to climate change. It is a practice that has been common throughout West Africa for decades, before anyone thought in terms of climate change. Many of the changes that farmers and pastoralists in Niger are experiencing and trying to respond to are not primarily due to climate change but rather to other political, economic and demographic changes that are limiting the possibilities for local people to adapt. Climate change is exacerbating these problems, but is not the most immediate cause of them. Identifying and doing something about the most immediate causes could help the local people more than just focusing on helping them adapt to climate change.

4. Discussion

It was striking – and may be due to the fact that most of the researchers involved in the fieldwork were men – that few cases of innovation by women were recorded. This does not mean that women do not innovate. For example, in pastoral areas in Ethiopia, the PARIMA (Pastoral Risk Management) project recorded inspiring examples of how women pastoralists, when faced with climate change and other pressures that threaten their families' lives, took the initiative to form mutual-help groups and to diversify into petty trading, small-ruminant marketing and other forms of income generation (Coppock *et al* 2009). There is obviously a need for deeper-going investigation with a gender lens in order to recognise the role of women in local adaptation and innovation.

In addition, it is not always evident that these practices are innovations or adaptations that come about as a direct response to locally perceived climate change. Some of them may be a response to climate variability rather than to long-term change.

During the process of trying to recognise and understand local innovation in CCA, the following insights were gained:

- **Vulnerability to climate change is determined by multiple factors.** Vulnerability is complex, being determined by a combination of different factors (demographic changes, macro policies, market changes etc). Consequences of climate change cannot be clearly separated from those of other pressures on the livelihoods of rural people. For example, in the case of pastoralists, the root causes of their vulnerability to climate change lie in their marginalisation in national or regional decision-making about resource use and, in many areas, the unfavourable government policies towards these groups. When trying to address CCA, primary attention should be given to these root causes of vulnerability. Focusing only on technical adaptation to climate change would be blind to the still greater and more immediate challenges to the livelihoods of communities and could exacerbate the vicious cycle of impoverishment, completing undermining their capacity to survive, let alone adapt.
- **“Traditional” practices emerge from dynamic innovation.** Smallholder farmers and pastoralists have generations of collective knowledge and experience in adapting to ecological and socio-economic changes and have developed a wealth of indigenous knowledge and practices to deal with them. Their indigenous knowledge system is dynamic. It is characterised by flexibility and adaptability and is strongly integrated into their sociocultural system. It is not easy to distinguish these traditional practices from more recent processes of local innovation, which is equally a reflection of flexibility and adaptability. Moreover, outsiders may have

difficulties recognising local innovations that consist of small incremental changes in what appear to be still “traditional” practices. It is not important to differentiate between local innovations *per se* and the application of traditional practices. One advantage of the “climate-change alarm” is that external actors (scientists, extension workers, academics etc) are now starting to recognise and accord more value to some long-standing local practices that are, under uncertain climatic conditions, more suitable than many introduced technologies.

- ***Adaptation to climate change is a continuous process.*** Adaptation is a process that needs to deal with both current and future vulnerability. Some forms of adaptation may be appropriate at the current time but not necessarily for the future. This implies that adaptation mechanisms need to be regularly assessed for their current and future relevance. To reduce vulnerability and strengthen resilience, it is not important to try to perpetuate any specific form of adaptation (innovation) to climate change (or other pressures) that has been developed at a given point in time. Rather, in order to reduce vulnerability and increase resilience, it is important to strengthen the capacity of the local resource users to continue to adapt to changing conditions – of whatever kind – in good collaboration with other relevant stakeholders.
- ***Not all local innovations have positive impacts.*** It does not help the local people to romanticise all the results of their innovativeness. In some cases, the people may not recognise the longer-term repercussions on the environment, or the innovations may be practised by more powerful people who are disadvantaging other resource users in the area. For example, the building of private and communal waterpoints in pastoral areas of Ethiopia has encouraged some pastoralists to settle at least part of their family – often the women and children – close to the water sources. Over time, this innovation could easily lead to problems with water pollution and degradation of land around the waterpoints. Similarly, the innovation by crop farmers who cut and sell hay from communal areas may mean that resources that herders formerly used freely for grazing their animals are now collected by the farmers and used for their own animals or are sold, and the herders become worse off than before. Innovation in the direction of privatisation of common property resources could have serious socioeconomic repercussions. The impact on poorer people – often women – who depend highly on these resources needs to be considered by the communities involved.
- ***Climate-change adaptation requires more than only local innovation.*** Even if local people accustomed to coming to terms with variable nature have an intrinsic capacity to innovate, there are other factors that affect their vulnerability – and attention needs to be paid to these factors which may, at first glance, not seem to be directly linked with climate-change issues. Moreover, as mentioned above, local knowledge and innovative capacities have their limitations. Contributions from external bodies of knowledge and agencies can help to stimulate local creativity. Other actors, working together with local people, have an important role to play in recognising local capacities and resilience, and helping local people to enhance their knowledge and creativity and to engage in joint innovation processes. This has been the principle behind PROLINNOVA from the outset – one that also fits into initiatives to support CCA.

5. Conclusions and the way forward

Local innovation in CCA needs to be assessed together with other environmental, socio-economic and policy changes. This helps avoid the trap of romanticising locally developed practices as if they were evidence of deliberate adaptation to climate change. Nevertheless, it is important to give attention to local innovations, because they are sources of valuable new knowledge based on deep-rooted experience of the local people. Farmers and pastoralists living in marginalised and risk-prone areas have survived for generations through informal experimentation, flexibility and adaptation. Their traditional practices and more recent innovations can bring insights into hitherto unexpected possibilities to adapt to climate change.

There is a clear need to continue investigating how such farmers and pastoralists respond to challenges related to climate change, in order to inform policymakers and other stakeholders of the potential role that local people’s capacities can play in local adaptation, and to trigger a process of recognition and reflection. The focus should be not so much on specific innovations, but rather on

documenting local innovation as a process. To be sure, at the local level, farmers and pastoralists may be able to benefit from knowing what others in similar conditions are doing to cope, and then adapting the innovations and practices to their own conditions. Disseminating information about local innovation could stimulate appropriate adaptation by resource-poor communities, as it would help increase their self-confidence and motivation to adapt. Although documentation of innovations is not an end in itself, it remains important as a symbol of the local capacity to react creatively to local problems.

Seeking to understand current efforts of local communities to cope with and adapt to climate change or climatic variability reveals local innovativeness. This provides an entry point for a bottom-up approach to supporting CCA, starting with and building on local capacities and ideas. Rapid adaptation to climate change demands such a multi-stakeholder approach, building on the strengths of each stakeholder group. Recognition of local innovation could lead to more equal partnership in formal research and development activities. Moreover, the results of such joint innovation processes would have a higher likelihood of sustainability than would external interventions foreign to the local people. The very process of multi-stakeholder interaction in research and development, starting with recognition of local innovation and involving also policymakers at various levels, promises to strengthen local capacities to adapt and therefore to cope better with climate change.

This would avoid the risk of dealing with CCA much like agricultural research and development has been dealt with in the past: in a top-down way. An approach of farmer-led joint innovation to adapt to climate change, using local creativity as a starting point, would be complementary to macro-level policies, and will be key to increasing local resilience.

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Acronyms

CCA	climate-change adaptation
CIA	Central Intelligence Agency
CRESA	<i>Centre Régional d'Enseignement Spécialisé en Agriculture</i> – Regional Centre for Agricultural Education, Faculty of Agronomy of the University of Niamey
INRAN	<i>Institut National de la Recherche Agronomique du Niger</i> – National Agricultural Research Institute
NGO	non-governmental organisation
NRM	natural resource management
PFE	Pastoralist Forum Ethiopia
PID	Participatory Innovation Development
PROLINNOVA	Promoting Local Innovation in ecologically oriented agriculture and NRM