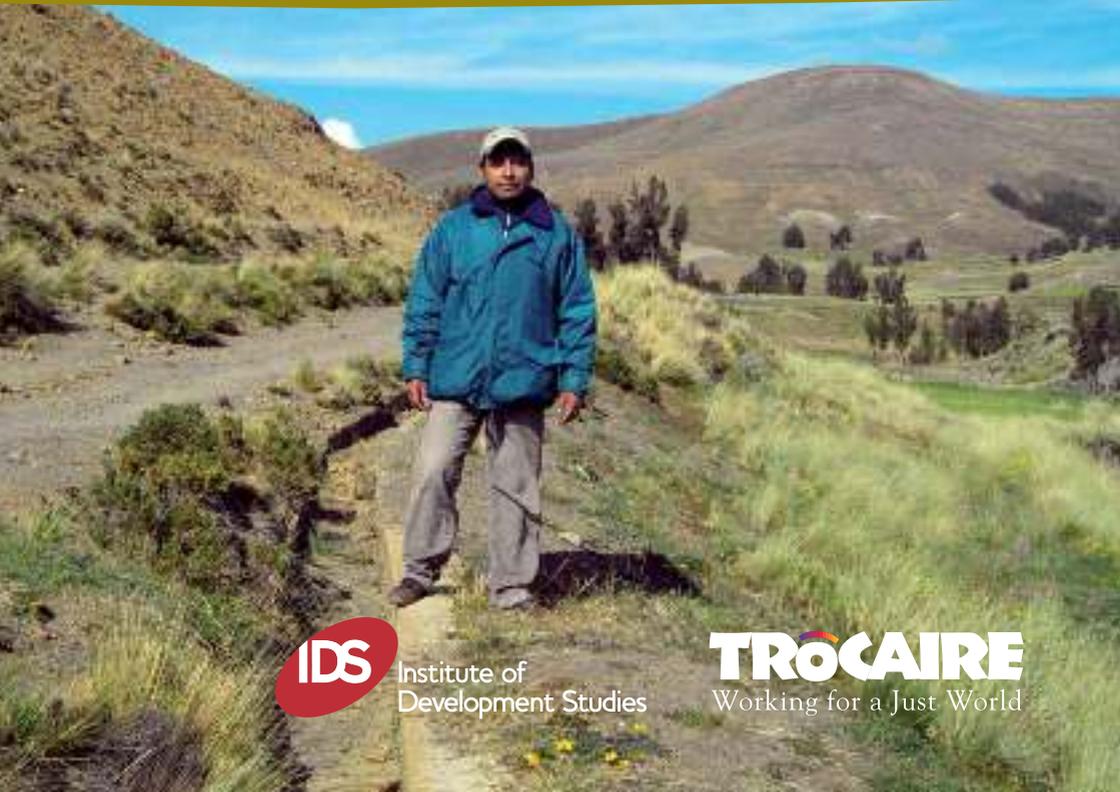


SHAPING STRATEGIES: factors and actors in climate change adaptation

Lessons from two-year case studies in Africa and Latin America

EXECUTIVE SUMMARY



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The evidence behind human-induced climate change and the need for adaptation is now beyond doubt. Even if we could stop all human-induced emissions today, global temperatures would continue to rise for several decades to come. Unless current emission reduction commitments are increased, analysis suggests that we are heading toward a global mean temperature increase of about 3.5°C by 2100 compared to 1990 levels – breaching the 2°C increase many governments consider as a benchmark for avoiding ‘dangerous’ climate change.

Climate change will manifest itself differently in different parts of the world. The effects of climate change on people’s lives, wherever they are in the world, will depend on how prepared they are to face these changes. This is determined by their individual, household, and community level resources, and how they are helped or hindered by external supports and governance structures. Climate change has to be seen in the context of current climate-related risks around the world. Between 2000 and 2004, some 262 million people globally were affected each year by climate-related disasters. The UN estimates that by 2020, between 75 and 250 million people in sub-Saharan Africa may have their livelihoods affected by changing weather patterns. Agriculture, upon which 75 per cent of the poor in developing countries rely directly or indirectly for their income, is particularly at risk. Some countries in Africa could see agricultural yields from rain-dependent crops decline by 50 percent by 2020.

Beyond the clear and urgent imperative to reign in climate change by reducing greenhouse gas emissions, the need to reduce societal vulnerability to climate change and assist adaptation to changing, but uncertain, future climates, is more important than ever.

INTRODUCTION

This report outlines the findings of a two-year research project exploring household vulnerability and resilience in the context of climate variability and change. The key concern of this research is to contribute to understandings of how households are experiencing and responding to climate shocks and stressors, what is supporting or undermining their capacity to respond, and whether or not these livelihood responses move people onto a path to becoming more resilient in the face of a changing climate.

Trócaire, as a development organisation working to support secure and sustainable livelihoods in the developing world, recognises the threat climate variability poses to vulnerable individuals, households and communities we work with. The findings of the research will make a direct contribution to Trócaire and Trócaire partners' work, but are relevant for all development actors designing and implementing climate change adaptation activities. The study also seeks to contribute to the wider research and development community, adding to the empirical knowledge base on vulnerability and adaptation to climate change through the use of case studies to inform policy and practice.

To date, case studies of vulnerability and adaptation typically examine vulnerabilities in particular localities at particular times. Less attention has been paid to examining findings in different localities, and over a time period spanning more than one season. This research draws on local-level case studies conducted over two years in communities in the Bolivian Highlands, the Aguán Valley in northern Honduras, Tharaka district in Kenya, and Balaka district in southern Malawi. Using qualitative and quantitative methods, data was collected on livelihood responses taken by households to tackle climate and non-climate related shocks and stressors, the constraints and opportunities they faced in doing so, and the impact of external support and regulations on these responses.

RESEARCH APPROACH AND METHODOLOGY

Three research questions guided the study, examining

- i) the status and trends in vulnerability to climate variability and change in the four research communities
- ii) the strategies communities and households are adopting to respond to climate variability, and
- iii) the factors, including those in the policy arena, that influence the effectiveness of strategies for building resilience to climate change.

While these questions guided the overall direction of the study, space was given to allow a particular focus to emerge in each case study so that the investigation could be both relevant and manageable.

Bolivia

Irrigation and adaptation in the Bolivian Highlands

Water scarcity is a key limiting factor to households achieving adequate and reliable agricultural production in the communities where this research was conducted. Irrigation is emphasised as an important strategy to address this problem by community members, the government and other institutional actors working in these communities. This case study therefore explored what is supporting or undermining households' capacity to take up or enhance their use of irrigation, and whether or not irrigation is seen as supporting them to become more resilient in the face of a changing climate.

Honduras

Small-scale agriculture and waged labour in northern Honduras

In the Aguán valley in northern Honduras, tropical storms, hurricanes and flooding are increasing in frequency and intensity. Most households in the research community have shifted from small-scale farming to a reliance on waged employment in local palm plantations and cattle ranches, and the issue of the livelihoods mix in the community was identified as a key issue. A focus on the factors supporting or undermining livelihood strategies and how different livelihood options affect resilience to climate shocks formed the basis of this case study.

Kenya

Changing farming systems in semi-arid Kenya

The research in Kenya took place during a period of drought in the region, offering the opportunity in this case study to investigate livelihood strategies in the context of extreme conditions. Changes in farming systems, in particular the shifting emphasis between crop

production and livestock keeping, and the incorporation of improved seed varieties and livestock breeds, were considered the most significant changes being made in livelihood practices. These areas were explored to understand the factors affecting the adoption of such strategies and whether these strategies are supporting increased resilience in the face of increasing climate variability.

Malawi

Drought and diversification in southern Malawi

Food security remains a key challenge in Malawi. Given its dependence on rain-fed agriculture and its vulnerability to climate variability and change, the integration of adaptation measures into food security strategies is of critical importance if this challenge is to be tackled in the long-term. This study looked at how farmers are adapting their agricultural practices in the face of these challenges, for example adopting improved seeds and diversifying their crops, the factors that are supporting or hindering them to do so, and whether strategies being adopted are contributing to increasing household resilience.

This research was designed to encompass a number of fieldwork visits over a two-year period, an approach which offered the possibility of engaging with households across all seasons, thereby allowing for a more nuanced view of vulnerability. Although the communities selected in Bolivia, Honduras, Kenya and Malawi have important differences in geography, social, political and institutional contexts, individually and collectively they provide a rich source of evidence for stakeholders to build a better understanding of vulnerability and adaptation in the context of a changing climate.

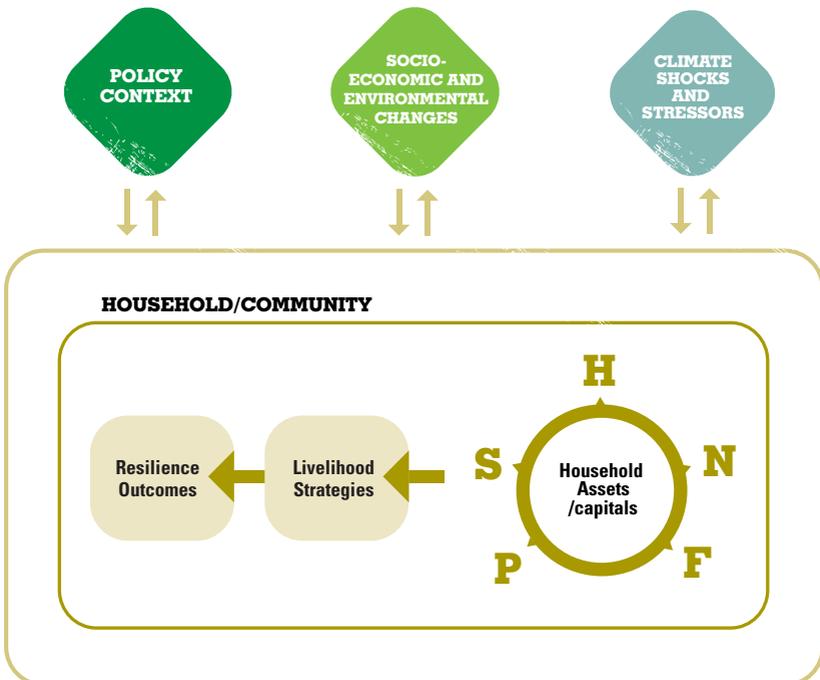


Jaime Coarite of CIPCA in a focus group with women from Calahuancane Baja, Bolivia.

Analytical Framework

The sustainable livelihoods framework forms a starting point for the analysis in this study. Key strengths of the framework include a focus on assets as a basis for livelihoods, the emphasis on context-specific analysis, and the role of institutions in adaptation. For the purposes of this study, the sustainable livelihoods framework has been modified to highlight the linkages across different scales. Our framework recognises that a variety of actors and factors exist at various scales (local, national, international) external to the household, which are simultaneously impacted by climate variability and change, and which impact on household livelihood strategies. Livelihood strategies are seen as an outcome of assets and/or capital at household level, the shocks and stressors affecting these, as well as the policy and institutional environment in place at this time. The approach adopted recognises that not all actions aimed at tackling climatic shocks and stressors support longer-term adaptive capacity and that trade-offs may exist between short and long-term concerns. For the poorest, actions to tackle recurrent drought may mean running down assets, thereby reducing longer-term adaptive capacity and entrenching poverty and vulnerability. In order to break these cycles we need to understand better how these negative cycles occur and what are the barriers and opportunities for change.

Figure 1. Analytical Framework

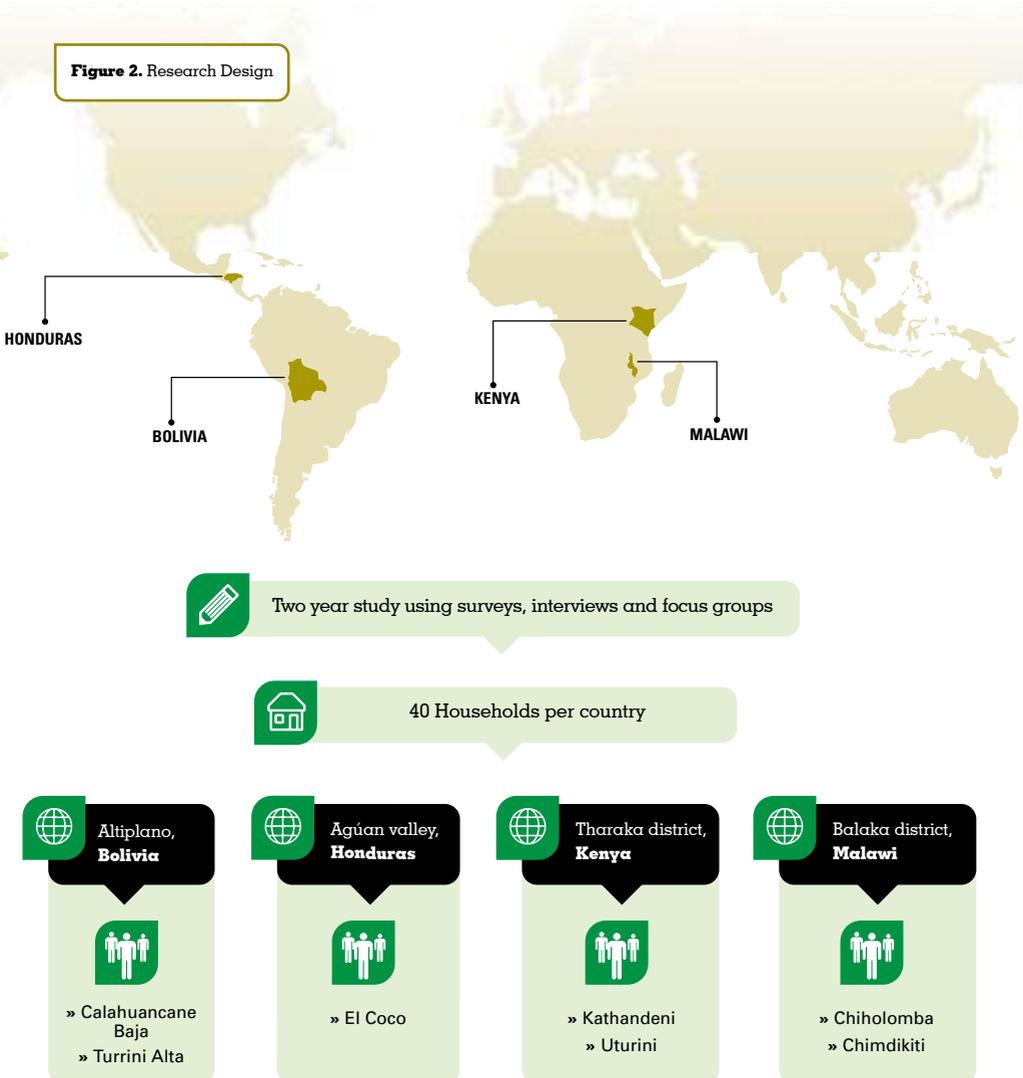


Source: Authors' illustration. H=human capital; N=natural capital; F=financial capital; P=physical capital; S=social capital

Methods

In total, six fieldwork visits were conducted at intervals of four to six months across seven communities over a two year period of study. Both qualitative and quantitative methods were employed during the fieldwork, comprising of a survey, semi-structured interviews, and focus group discussions using PRA (participatory rural appraisal) techniques. Forty households were selected to participate in the study, proportionately representing each of the main wealth groups identified, including both male- and female-headed households.

Figure 2. Research Design



FINDINGS AND RECOMMENDATIONS

Households in the case study communities face multiple livelihood stressors. High poverty levels, socio-economic and political marginalisation, rapid population growth, increased pressure on natural resources, especially land and water, limited livelihood opportunities, and illness, are some of the key factors contributing to vulnerability. Climate variability and change are experienced by households as additional stressors on already vulnerable livelihood systems. Research participants cited changes in rainfall patterns, increased drought and more frequent extreme weather events as undermining their agricultural production, food security and on- and off-farm incomes. Climate variability and change is affecting people and their livelihoods directly, as well as interacting with and exacerbating other drivers of vulnerability, such as natural resource pressure in Kenya, and livelihoods that are vulnerable to both local and global shocks such as waged labour in Honduras.

Key findings from across the case studies

1. Household responses to perceived climate changes are shaped by multiple factors and stressors

Changes in livelihood strategies in general, and agriculture strategies in particular, have been identified across the four case study areas. Households have been changing the balance between crops and livestock, diversifying their crop production and livestock assets, increasing their use of improved varieties and breeds, adopting technology such as irrigation, or moving out of small-scale agriculture entirely in response to resource constraints, market forces, institutional incentives and increased climate variability. Responses are driven by multiple stressors and not by any single factor. In Kenya, for example, improved seed varieties have been adopted for their greater drought tolerance and potential to produce more food on less land, but also as a result of external support. Similarly in Honduras, increasing risks associated with agriculture as well as limited access to land reinforced by government policy has driven a shift in livelihood strategies away from small-scale farming.

In addition to their main livelihood strategies, most if not all households are also engaging in activities to supplement their income and reduce risk, such as casual labour, petty trade/services or nature-based enterprises. Migration is a strategy employed in particular in Honduras, and increasingly in Kenya as a result of the ongoing food crisis there. Whilst diversifying livelihoods is seen as key to spreading risk in the face of increasing climate variability, in most cases, these supplementary income-generating activities, such as casual agricultural labour, are also vulnerable to climatic factors.

Access to natural resources such as land and water emerged as key limiting factors in households' options and abilities to adapt their livelihoods to the changes they are experiencing. Population pressures coupled with more unreliable productivity linked to perceived climatic changes are increasing pressure on resources and aggravating vulnerability. In Kenya and Malawi these processes are limiting the options for alternative livelihood strategies whilst in Bolivia, competition for water resources is creating heightened tensions within and between communities. Furthermore, government policy plays a key role in determining access to resources as in the case of Honduras, where it reinforces an inequitable distribution of land thus limiting livelihood options.

2. A variety of strategies are being promoted by a range of actors, with evidence of tensions, trade-offs and limitations in livelihoods outcomes and resilience

Governmental and non-governmental support, and government policy, is key in influencing livelihood strategies and adaptation options. The evidence shows that some of these strategies are contributing to increased food and income security. Households in the study are cognisant of both the benefits and trade-offs of strategies being promoted with regard to their future resilience. These include the trade-off between increasing productivity using high external inputs against their affordability and environmental impact over the longer term in Malawi and Kenya, and the promotion of crops in Bolivia which fetch a good market price but which are irrigation-dependent in a context of increasing water scarcity.

Responses also indicated that certain strategies being promoted and adopted in agricultural production or waged agricultural labour are ultimately limited in their potential to offer resilient livelihoods. During severe drought in Kenya, even drought tolerant crops failed; in Honduras, waged labour appears as risky as farming in terms of climatic and other shocks, despite climatic risk associated with farming being a factor in why some households moved out of farming originally. Across all four case studies, whatever changes households have been making, it remains the diversity and flexibility in households' livelihood strategies that determines resilience.

3. Inadequate and incoherent external support, and inappropriate government policies, limit the livelihoods outcomes and resilience of vulnerable households

Many options for increasing resilience exist and there is significant scope for building on those strategies to improve on positive outcomes seen, such as the effects of crop diversification in Malawi or small-scale irrigation in Bolivia. However it is also clear in these case studies that support, whether governmental or non-governmental, does not reach all households, and households face constraints in adopting strategies that are promoted. External support was often seen to be limited in its scope and coverage, poorly targeted, and inappropriate for particular households. In Malawi for example, only a small percentage of households in Chiholomba and Chimdikiti reported receiving the governmental subsidy for farm inputs. In El Coco in Honduras, external support for diversified livelihoods, farming

or other rural livelihoods, is extremely limited. Across each of the case studies community members highlighted financial costs, time and labour constraints, and skills and education deficits as affecting their ability to take up new strategies or to implement such strategies effectively.

Key Recommendations

1. Broad-based rural development strategies are required to increase resilience

Households' overall livelihoods mix determines their resilience. Increasing agricultural resilience, while necessary, may not be sufficient to increase overall resilience. More broad-based rural development strategies that reduce dependency on a narrow range of climate dependent livelihood options are required, especially those that support the creation of non-farm livelihood strategies.

2. The design and implementation of adaptation support should be embedded within agricultural and rural development programmes

Development actors must recognise climate variability and change as an additional stressor on vulnerable livelihood systems, affecting households and their livelihoods directly, as well as interacting with and exacerbating other drivers of vulnerability. This research highlights the need to go beyond a snapshot view of household strategies at any one point, and for adaptation interventions to take account of the multiple livelihood stressors households are responding to. While vertical programmes to address climate change can support the scaling up of resources, care must be taken to ensure adequate recognition of the context within which climate vulnerability is occurring. Institutional support must be adequate, appropriate and adaptable. The barriers and constraints that some households face in accessing or benefitting from support highlights the need for institutional actors to improve their strategies for targeting and tailoring support.

3. Investment in agriculture, in particular low-input, agro-ecological approaches, and rural development, needs to be scaled up

This study has found that institutional support is inadequate and is resulting in limited impacts and unreached potential. This highlights the need for increased investment in agricultural and rural development, placing the rights and resilience of the most vulnerable communities at the centre. Such increased investment should include increased investment in agricultural research, in particular in low-input, agro-ecological approaches, as well as piloting and extension services as close to the community level as possible, incorporating and building on existing knowledge, practices and institutions. Assistance in the creation of non-farm income sources is also critical for diversified livelihoods and increased resilience to multiple livelihoods shocks and stressors.



Research participants from El Coco, Honduras.

4. Governments, NGOs and other institutions with greater access to information and technology should assess and address the implications of tensions and trade-offs in strategies being promoted

The findings of this study acknowledge and reflect the fact that there is no silver bullet that will solve and serve adaptation, and that strategies must be both context specific and dynamic to enhance resilience in managing uncertainty. In situations where existing poverty levels render people ill-equipped to deal with current climate events, short-term needs may be met without addressing long-term vulnerability, or at the risk of undermining long-term resilience. The implications of promoting intensive agriculture on the fertility and productivity of the soil need to be acknowledged and addressed, as do the risks associated with locking households into pathways where they are dependent on high cost external inputs. Where tensions or trade-offs are unavoidable in the short-term, these must be managed and a strategy for transition to strategies which are socially, economically and ecologically sustainable incorporated.

5. Socio-economic integration, political participation and the realisation of rights of vulnerable households is critical to securing resilient livelihood outcomes

Across the four case studies a variety of government policies such as agriculture, land and water are seen to impact on households' ability to adapt. Indications are that while some policies have been developed partly in response to climate change adaptation imperatives, others have not. A holistic and horizontal approach to development at national level is needed, ensuring that all policies and sectors, whether rural/agricultural or otherwise, take into account climate change adaptation imperatives. A critical question, however, is what or whose interests are

at the centre of these policies, and who stands to lose or gain in their implementation. This study has reaffirmed the case that those who are most vulnerable to additional stressors presented by increased climate variability are those households whose ability to cope with existing livelihoods shocks and stressors is already in deficit. Trócaire promotes a rights-based approach to ensure policies and support for adaptation focus on the most vulnerable and empower them to secure their rights, whilst enhancing governments' abilities to promote, protect and fulfil them.

6. Inequitable access to resources (land and water) must be addressed to improve climate resilience

Declining access to natural resources is a key limiting factor in households' options and abilities to adapt their livelihoods. Policies and frameworks ensuring equitable access to resources are needed at national and local levels to address the current and future challenges around increasing competition for resources for small-scale producers and vulnerable groups' access to land and water.

There is also lack of coherence in support. While policy rhetoric in many cases supports diversified low input approaches to sustainable agriculture, in practise government support emphasises higher input systems, involving improved seeds, and using additional inputs such as fertilisers and pesticides. At the same time, progress being made by various actors in promoting low input models of agriculture is being hindered by the lack of consistency between policy and practice. In Honduras, government policy is focused on large-scale agro-industry, and has played a part in the movement of many households in El Coco out of small scale agriculture into a more dependent agricultural waged labour. Lack of access to land limits households' livelihood options and promotes a dependence on wage labour that is very vulnerable to both climatic and economic shocks.



A man from Calahuancane Baja setting up his sprinkler irrigation system.

Voices from the communities

BOLIVIA

Cristobal is 24 years old and lives in Turrini Alta with his wife and three children, two girls and a boy, aged 6, 3 and 6 months. He works the land and keeps some animals. There are not many young people left in Turrini Alta, many have moved to the cities. He too had been in the city but moved back because of lack work and to be nearer his mother since his father died a few years ago.

In Turrini Alta, thanks to the river, there is water year round. However, the overall level of the water has reduced and the amount available is insufficient to meet the needs of the community.

When I was a child there used to be much more water; I have no idea why is has reduced.

There are problems between us. You have to get the water at four or five in the morning and even then it is likely that you will have an argument with someone. Therefore the one that wakes up earlier is the one that can irrigate.

He spoke about both the advantages and downsides of irrigation.

Irrigation allows us to cultivate everything. When the rain does not come, you simply replace it with irrigation. Mine works well, but I don't have a sprinkler. It works well on the flat land but when used on sloping land the water takes the soil with it.

I think a solution could be to build a zanja (an irrigation channel to capture rainwater) but we would need pipes for that. I have a water source on my land, I would like to be able to dig a well to have the water coming up from below, for the crops and perhaps even for breeding fish.

Voices from the communities

HONDURAS

Jose is 39 years old and lives with his wife and three children in El Coco. He owns four hectares of land, on which he grows cassava, beans, pineapple and banana and he keeps pigs. These are mostly for his family's consumption but sometimes he sells some pineapples or pigs when the family needs some extra income. He also works as a carpenter. Jose feels it is important to have all of these income sources.

When he was younger Jose worked on the Palm plantations. He worked thirteen-hour days in return for low wages and it wasn't long before he wanted a change. He bought a small piece of land eighteen years ago and has been buying more whenever he can manage to ever since. He says:

I work the land and grow crops because it is what I like most. I always have food because I have my land.

It has not been without its challenges however.

Three years ago I rented some land but I lost all the crops because of flooding. I'm not interested in having more land than what I have now because I could lose everything again.

Despite the risks Jose feels he is now better able to cope during storms due to the variety of income sources he has.

For Hurricane Mitch it was really bad, I didn't have a job, I had to kill some pigs and rely on external help. In 2005 [Hurricane Beta and Hurricane Gamma] I was working at the palm plantations but I was also growing maize and beans so it was a bit better. By 2008 I had my carpentry business, pigs and land with crops so I felt much better. We usually get by much better during storms if we have stored maize and beans.

SUMMARY OF CASE STUDY FINDINGS



Bolivia

- Households in Calahuancane Baja and Turrini Alta are experiencing a variety of changes in climate patterns, including rising temperatures and changes in precipitation, including increasingly unpredictable and intense rain. These changes are affecting their ability to produce food for consumption and sale. There are also indications of social strains as a result of increasing competition for water.
- Changes in climate patterns, external institutional support and market signals are combining to encourage many households in the communities to take up or increase their use of irrigation.
- Evidence was found of positive impacts as a result of the adoption or increase in the use of irrigation, including increased food security, rising incomes and household investment.
- Also clear is the variety of constraints and challenges, including access to water, cost of equipment, and time and labour demands, that inhibit or prevent certain households in the community from practicing irrigation and/or benefitting from institutional support offered.
- The Calahuancane Baja and Turrini Alta case study reveals tensions in certain strategies being promoted, such as support for crop or seed varieties that fetch a better market price but are irrigation dependent in an area where water availability is a key challenge. The

impacts of some forms of irrigation on soil erosion are also highlighted as a concern.

- In this case study, while coverage remains limited, external support is addressing the key limiting factor in the ability of households in the community to use irrigation to adapt to climate variability. External NGO and government support is seeking to enhance access to water by repairing, reinforcing or building water and irrigation infrastructure. In the face of uncertain climate scenarios, however, the importance of explicit consideration of both short-term and long-term water availability has emerged clearly as a crucial factor in building long-term resilience.



Honduras

- Wage labourers and small-scale farmers, though being impacted in different ways, are both vulnerable to climate shocks and stressors. Wage labourers are incurring losses in income as access to and availability of work is hampered by weather events such as flooding, while farmers suffer losses to crops and livestock and are unable to access markets to sell their produce. Drought is also increasingly affecting these livelihood activities.
- Livelihood options are limited in El Coco. A variety of factors including climate shocks and

land, agriculture and rural development policies, have resulted in inward and outward migration and shifts in perceptions about desirable livelihood options. As a result people are more dependent on external options for their livelihoods than in the other three case studies.

- Inadequate and inappropriate support for rural livelihoods is failing to build robust livelihoods. People in El Coco are ill-equipped to cope with livelihood shocks and stressors, resulting in a deficit in their ability to cope with and adapt to the added challenge of current and future climate impacts.
- There are trade-offs and tensions within and between the livelihood strategies of both wage labourers and small-scale farmers. Wage labourers have the advantage of earning an income, albeit insecure, without the risks of individual investment, but are dependent on external opportunities and thus particularly vulnerable to external shocks. Small-scale farmers have more autonomy over their means of production and consumption, but run higher personal risks with potential loss of investments.
- With few options for self-sufficiency and a reliance on income sources that are negatively affected by climate events, most households in this study are poorly equipped to respond to climate shocks and are vulnerable to falling into deeper levels of poverty.



Kenya

- Changes in rainfall patterns, in particular a decrease in rainfall volume and reliability, have been widely reported. This is impacting upon agricultural production and food and income availability.
- Research participants have been adapting their farming systems, shifting the balance between crop production and livestock keeping. They have also been increasing the use of improved seed varieties and livestock breeds.
- Changes are being made in response to a combination of factors including changing rainfall patterns, changes in the land tenure system, and as a result of support from government and non-governmental external actors.
- Households face various constraints and barriers in adopting certain livelihood strategies, such as lack of financial resources, limited availability of inputs, lack of appropriate training and information, plus constraints owing to the limitations of the strategies themselves.
- There are inherent trade-offs in some of the strategies being adopted; although the use of improved seed varieties and livestock breeds produce benefits, they are, for example, more susceptible to disease and require additional inputs and household investment.
- Extreme climatic events combined with a significant existing deficit in adaptive capacity mean many strategies being adopted have limited potential in the current context.

Voices from the communities

KENYA

Mary is 35 years old and lives with her two children in Uturini village. She grows crops and keeps livestock and has been making changes to the varieties and breeds over the past number of years.

I started changing crop varieties in 1997 because the rainfall amounts were low and nylon [improved green grams] gets a lot of money in the market. But it is prone to disease so it's expensive to manage as you have to buy chemicals. In case of the rains failing, it doesn't grow so there is a big loss margin because of the expenses to buy and maintain it. Now the rains are much less, so the harvest is not sufficient.

Mary changed from local small East African goats to Galla goats and she spoke of the benefits and disadvantages of this change:

There is high milk production and I get good prices in the market. The money from the sales goes towards school fees, food and other family needs. The disadvantage is that they require lots of food, they consume more than the small goats. They require good management – dips, sprays etc. - which is expensive.

However because of the drought in Tharaka over the past seasons, there are difficulties with the livestock:

The livestock do not have enough feed so they don't have good health. This means there is decreasing production; low levels of milk are being produced, and they have a lower market value. If there are not enough rains, they'll die.

Mary's husband has had to migrate to Mombasa to find work in order to support the family.

- Land is a key limiting factor affecting the viability of livestock and crop production strategies, as well as access to natural resources, which in turn is inhibiting people's ability to practice diversified livelihoods.



Malawi

- Changes in rainfall patterns and challenges in meeting food security needs are prompting many farmers to both grow a wider range of crops and to use improved seeds together with external inputs.
- Significant resources are required for crop diversification and the use of improved seed varieties, including access to adequate land and technical training/knowledge.

Furthermore, diversifying crop types comes with additional labour demands, whilst adopting improved varieties requires additional financial investment in inputs (fertiliser and pesticides) for pre- and post-harvest management.

- Lack of access to such resources listed above or to external institutional support which could enable access to them (e.g. through NGOs or the Farm Input Subsidy Programme), limits the extent to which certain groups, especially the elderly and poor farmers who are not included in support, can take up these strategies.
- There are inherent tensions and trade-offs in relation to the use of improved seeds. While they offer higher yields and drought tolerant properties, the need for chemical inputs requires additional financial outlay and may foster dependency on external inputs while having negative environmental consequences.
- Weaknesses in the design and implementation of the Farm Input Subsidy Scheme to promote crop diversification is undermining its potential effectiveness as a food security and adaptation measure.

Village scene, Malawi.



Voices from the communities

MALAWI

Ruth is 62 years of age and lives with her two children and 5 grandchildren in Chiholomba village. She has started to grow a wider range of crops and to use improved varieties in recent years due to changing rainfall patterns.

I introduced new crops gradually, one new one this year, another one the next year while also keeping on the others. I was encouraged to do this because if one crop fails I can rely on the others. Local varieties will not give any produce.

She has introduced rice, cassava and sweet potato and improved early-maturing varieties of groundnuts and maize. While there are direct benefits from these changes, Ruth faces challenges in terms of labour and ill-health.

We have seen improvements in food security as we can harvest a bit from all the crops. All are high yielding so production is higher. We have a more varied diet, and can season the vegetables with groundnut flour. However I was caring for my sick mother during the last season so production was not as high as it should have been. I also fall ill after intensive work in the fields, and have been advised to reduce the work I do, but if I stop working I stop eating. At least I have had some income from the sale of some of the crops so this is another benefit of growing these crops. I can't see any disadvantages.



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