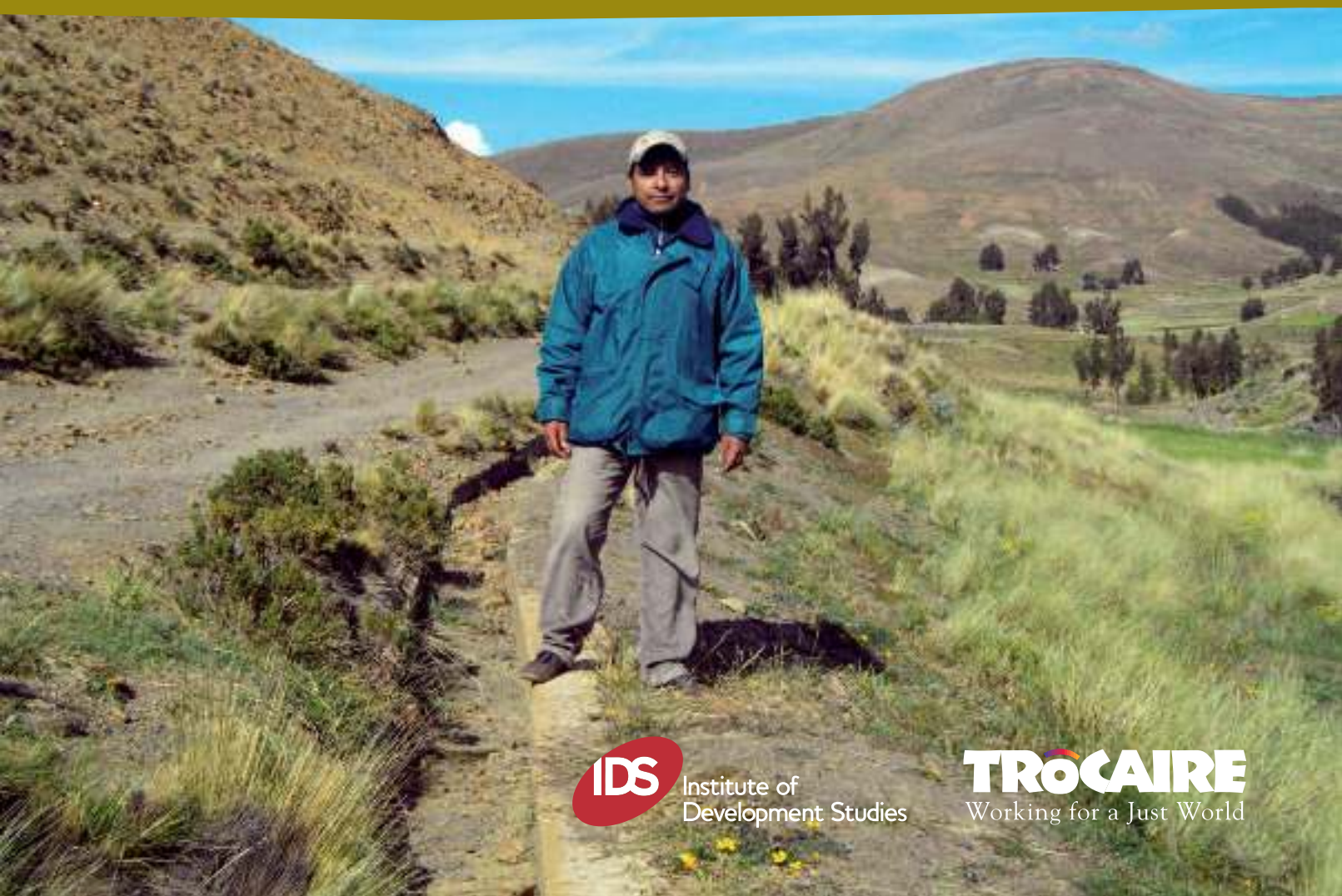
SHAPING STRATEGIES: factors and actors in climate change adaptation

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



IDS Institute of Development Studies

TRÓCAIRE Working for a Just World

Dublin City Resource Centre
12 Cathedral Street, Dublin 1
Tel/Fax: +353 1 874 3875

Northern Ireland Resource Centre
50 King Street, Belfast BT1 6AD
Tel. +44 28 9080 8030
Fax. +44 28 9080 8031

Munster Resource Centre
9 Cook Street, Cork
Tel. +353 21 427 5622
Fax. +353 21 427 1874

Derry Office
Carnhill Resource Centre,
Derry, BT48 8DA,
Tel: +44 28 7135 7288

Authors: Ciara Kirrane, Cliona Sharkey and Lars Otto Naess

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For further information please contact:
ciara.kirrane@yahoo.ie
csharkey@trocaire.ie
l.naess@ids.ac.uk

FOREWORD

This Trócaire report, Shaping Strategies: factors and actors in climate change adaptation, is the culmination of two years of research and has brought huge learning to the organisation. I extend my sincere thanks to all those involved, in particular the individuals and families who gave us their time and shared their personal experiences, and our partners without whom the research would not have been possible.
The reaffirmation in this report of the challenge that climate change presents to us is a stark reminder to governments as duty bearers, to development practitioners, and to all of us as responsible citizens of our responsibilities to act urgently to deal with this most vital of issues.

We know that climate change is impacting on the people we work with, undermining their capacity to work themselves out of poverty and secure their rights. Back in 2007 Trócaire conducted a survey with its partners in Africa, Asia and Latin America to investigate whether people were experiencing changes in the weather. Of those surveyed 95% reported that they had experienced significant changes in rainfall patterns, and 90% reported that this had led to decreased crop yields. Climate change is now the context in which development is taking place. The eradication of global poverty and hunger are inextricably linked to our responses to this phenomenon.

As an organisation we decided to embark on this research to better understand how families experience climate change at a household level on a day to day, month to month, and year on year basis. We wanted to hear from them about what they are doing in response and what is helping or hindering them. We were not surprised to find ingenuity and innovation, with families adopting both new and traditional strategies to cope with the climate impacts and other challenges they are facing. While we saw successes we also found that support is limited, and that there are many for whom innovation is impossible without tailored support. The research highlights clearly the influence of external actors on families' ability to manage climate impacts and the need to address the socio-economic and political marginalisation that makes people vulnerable in the first place.

Trócaire is committed to responding to the findings of this report to ensure our programmes are equipped to provide the best support possible to the people with whom we work. We will bring the findings to bear in our engagement with governments and our partners and colleagues in the development sector as a contribution to research and practice. Beyond that, this research underscores once again the need for a serious step change in the urgency and ambition of responses to both climate change and broader sustainable development imperatives at national

and international levels. Existing climate impacts will pale in comparison with projected changes if current greenhouse gas emission reduction commitments are not urgently and significantly increased. Adaptation remains significantly underfunded and progress on commitments to provide predictable additional financial resources to support developing countries to take action is slow and uncertain.

Trócaire advocates for a just, rights-based response to climate change. We will continue to reach out to the public across the island of Ireland to build understanding of the causes and consequences of climate change, and of the need for individual action and political engagement to achieve the changes needed. With current and historically high national emission levels and greater capacity our governments have a particular responsibility to lead the response and to ensure the most vulnerable people are placed at the centre of concern. Trócaire will continue to call on them to do so.

Justin Kilcullen, Director

Acknowledgements

This research would not have been possible without the cooperation and commitment of a great number of people. Firstly our sincere thanks go to the households that took part in this study, for giving their time and opinions freely and for their patience with the research teams' tireless questioning. To the staff in our partner organisations for their willingness to take on the additional activities associated with the research, for their local insights, translation and for the respectful manner in which they conducted the investigation. To the Programme Officers, both present and past, who oversaw the research in their respective countries and whose dedication to their work ensured the research was of the highest quality. Their interest, perseverance and good humour was greatly appreciated. To Sorcha Fennell and Niamh Garvey, who saw the need for a rigorous investigation of the issues explored in this research and developed much of the groundwork. To Tom Crowley, whose analysis helped shape the final report and whose support and encouragement helped bring the project to completion. We gratefully acknowledge the financial support received from Irish Aid to hold a cross-country workshop during the course of this research. Finally our thanks go to the reviewers and copy-editors for their assistance in refining the content.

EXECUTIVE SUMMARY

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 the research was to contribute to the understanding 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 them on a path towards 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 equally 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 study 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. Data was collected using qualitative and quantitative methods on livelihood responses taken by households to tackle climate and non-climate related shocks and stressors, constraints and opportunities faced, and the impact of external support and regulations.

KEY FINDINGS

1. Household responses to observed 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 studies. 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 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. 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 climatic changes are increasing pressure on resources and aggravating vulnerability. In Kenya and Malawi these processes are limiting the options for alternative livelihood strategies while in Bolivia competition for water resources are creating heightened tensions. 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 governmental 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 communities 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 that 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 fail; in Honduras, waged labour appears as risky as farming to climatic and other shocks, despite climatic risk associated with farming being a factor in why some households moved out of farming. Across all four case

studies, whatever changes households are making, it remains the diversity and flexibility in households' livelihoods 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 where households are seeing positive outcomes, such as crop diversification in Malawi or small-scale irrigation in Bolivia. However it was also clear in these case studies that whether governmental or non-governmental, support 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 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 as affecting their ability to take up new strategies or to implement them effectively.

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 requiring 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 move of many households in El Coco out of small scale agriculture to become more dependent agricultural wage 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.

KEY RECOMMENDATIONS*

1. Broad-based rural development strategies are required to increase resilience
2. The design and implementation of adaptation support should be embedded within agriculture and rural development programmes
3. Investment in agriculture, in particular low-input, agro-ecological approaches, and rural development needs to be scaled up
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
5. Socio-economic integration, political participation and the realisation of rights of vulnerable households is critical to securing resilient livelihoods outcomes
6. Inequitable access to resources (land and water) must be addressed to improve climate resilience

* For full recommendations see Chapter 7

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INTRODUCTION

Climate science and the need for adaptation

The scientific evidence behind human-induced climate change and the need for adaptation is now beyond doubt. The Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report in 2007 concluded that most of the observed global warming over the past 50 years was caused by emissions of greenhouse gases.[1] Recent research suggests that at least three quarters of this observed warming is due to human activity.[2] An IPCC assessment of extreme weather events and their implications also found an increasing trend in some climate-related hazards due to human-related emissions of greenhouse gases.[3]

It is clear that both emission reductions as well as adaptation will be needed to address climate change. Given the slow pace of the international negotiations to reduce carbon emissions, there is a strong likelihood that there will be further warming of the earth's average temperatures of more than 2^0C – breaching the limit agreed by the international community. An increase of 2^0C has been considered by some governments as a benchmark for achieving the goal of the Climate Convention from 1992, which is to avoid 'dangerous' climate change. Governments of many vulnerable countries as well as civil society actors continue to highlight the need for a lower temperature limit given the projected impacts at even 2^0C. With the current pace of negotiations, analysis suggests that we are heading towards a global mean temperature increase of about 3.5^0C by 2100 compared to 1990 levels. The decision at the 2011 Climate Conference in Durban (COP 17) to delay entry into force of a new agreement on global emission reductions until 2020 means that further emission reductions could be delayed even more. Given the time lags in the climate system, any delays in emission reductions mean that cuts will have to be larger and more rapid when they are carried out. Emissions to date have 'committed' us to warming for several decades to come: even if we could stop all human-induced emissions today, global temperatures would continue to rise for several decades to come because it takes time for the atmosphere to regain natural concentration levels of greenhouse gases.

Vulnerable people and places

Climate change will manifest itself differently in different parts of the world, with the largest absolute temperature increases expected in polar areas. Wherever they are in the world, however, the effects of climate change on people's lives ultimately depend on how prepared they are to face the changes, which is determined both by their individual, household, and community level resources and how they are helped or hindered by external governance structures. For example, the ability to tackle climate change depends on how well-built the houses are, how much savings individuals and households have, the knowledge and skills they possess, and how much land they own, but also how much support they can draw on from government and non-government sources. As demonstrated by the effects of recent floods and droughts in different parts of the world, many people and societies suffer from climate-related shocks and stressors under current levels of climate variability and change. For example, between 2000 and 2004 some 262 million people globally were affected each year by climate-related disasters.[4] The recent drought in the Horn of Africa is affecting 13 million people, with an estimated 3.75 million of these in Kenya.[5]

The immediate cause of the drought was that rains failed, but what caused famine was not the drought but people's *vulnerability* to drought, determined in this case crucially by government policy failure and conflict.[6]

For developing countries, there are particular concerns about the effects of climate change on agriculture and food security. A widely cited Food and Agriculture Organization (FAO) report suggests that agricultural production will need to increase by 70 per cent by the year 2050 to feed an estimated 9 billion people.[7] Evidence suggests that the biggest challenge to achieving this is not in the technology to increase production, but one of securing access to food for those who currently have inadequate or insecure access to it.[8] Climate change adds a number of challenges to this goal, by increasing risks such as floods and droughts, and gradual changes to farming seasons and agro-ecological zones. With the impacts of climate change, by the 2080s, agricultural production is projected to increase by eight per cent in developed countries and could decrease by nine per cent in developing countries,[9] highlighting the inequity of the impacts of climate change. These are not trivial changes, and would add considerable stress at household and societal level and make food markets more volatile. Food price rises have been a trigger for social unrest in recent years, and there are concerns that these price rises and potentially further unrest could increase with climate change.[10]

Such aggregate figures of projected food production changes hide large regional variations: estimates suggest that some countries in Africa could see agricultural yields from rain-dependent crops decline by 50 per cent by 2020.[11] The UK Foresight report found that by the 2050s, an additional 100 million people may be subjected to an increasing risk of hunger because of climate change,[12] disrupting agricultural production and further locking people into a cycle of poverty. It is projected that by 2030, 310 million people will have suffered illnesses due to climate change, with nine out of ten of these people being in the developing world[13], and 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.[14]

Motivations for the study

Beyond the clear and urgent imperative to reign in climate change by reducing current and projected greenhouse gas emissions, the above highlights the need for an emphasis on reducing societal vulnerability to climate change and assisting adaptation to changing – but uncertain - future climates. Trócaire, as a development organisation working to support secure and sustainable livelihoods in the developing world, recognises the threat climate variability poses to the vulnerable individuals, households and communities we work with. Trócaire's programme work has been responding to the challenge of climate shocks and stressors in recent years. From a survey undertaken with 31 partner organisations* in 2007 it was clear that climate variability was impacting on communities, and on Trócaire's and our partners' work with them. It is recognised that an understanding of how households and communities are managing climate-related shocks and stressors is needed to improve Trócaire's ability to provide appropriate and effective support. A two year research project was therefore established to explore this area. The lessons from this research are intended to enable Trócaire and its local partner organisations to improve support to households and communities in order to build their resilience to climate variability and change - towards more robust and resilient rural livelihoods.

Details on the research questions, approach and methodology are provided in Section 2. Sections 3-6 then address the research questions as they relate to each individual case study. Each case study explores the local area context and findings in relation to their respective research focus, and draws a number of main conclusions and recommendations. The final section outlines some overall conclusions and recommendations from this study.

* A partner organisation is another civil society organisation that Trócaire supports in some form to achieve mutually agreed objectives, with the ultimate aim of serving the basic needs and supporting the rights of poor and marginalised people in the developing world.

2

RESEARCH APPROACH AND METHODOLOGY

The key concern of the research is to improve Trócaire's understanding 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 actions that are taken move them on a path towards becoming more resilient in the face of a changing climate.

The research questions guiding the study were:

1. What are the status and trends in vulnerability to climate variability and change in the communities Trócaire and Trócaire's partners work with?
2. What strategies are communities and households adopting to respond to climate variability?
3. What factors, including in the policy arena, influence the effectiveness of strategies for building resilience to climate change?

The communities selected in Bolivia, Honduras, Kenya and Malawi have important differences in geography, social, political and institutional contexts, but 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. This will make a direct contribution to Trócaire and Trócaire partners' work but is equally 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.

Country focus

While the research questions guided the overall direction of the study, after an initial mapping of the livelihoods/vulnerability context in each of the case study areas, a particular focus was decided upon for each case study so that the investigation could be both relevant and manageable. These were:

Bolivia	Irrigation and adaptation in the Bolivian Highlands
Honduras	Vulnerable livelihoods and climate variability in northern Honduras
Kenya	Livelihoods crisis and change in semi-arid Kenya
Malawi	Drought and diversification in southern Malawi

Identifying these themes was a participative process, involving significant discussion and consultation with communities, partner staff and the research team. In some cases the theme was quite clear from the start, as in Kenya where changes in the agro-pastoralist systems stood out as the main strategies people were adopting in response to increasing drought, while in others it took some time for the most relevant adaptation strategy to emerge. In doing so we also took into

account where Trócaire and Trócaire's partners have capacity to engage, where further research could add value and whether there were relevant policies under development or processes into which the research could feed. This iterative and bottom-up approach to applying the research questions to the local context was important to make them relevant, useful, and to avoid a 'one-size-fits-all' approach.

What makes this study different?

Numerous studies have been undertaken to highlight the impacts of climate variability and change on communities in the developing world,[15] the findings of which are contributing to a broad evidence base for use by policy-makers, governments and NGOs. Many previous studies have examined vulnerabilities in particular localities at particular times. This research was designed to encompass a number of fieldwork visits over a two year period. This offered the possibility of engaging with households throughout the seasons, allowing a more nuanced view of vulnerability – from the post-harvest period of relative food security in Malawi to the anxiety experienced in Honduras during the pre-hurricane season. Another important advantage of this design was the process of on-going dialogue with research participants afforded by repeat visits over the two years. The research team did not begin with particular assumptions but rather took an inductive or 'bottom-up' approach, allowing the issues to arise from the fieldwork through consultation and discussion. In this way, the ability to build up 'a story' of households' vulnerability and response strategies by adding another layer with each repeat visit is a particular contribution of this research.

The research was undertaken in order to deepen Trócaire and Trócaire partners' understanding of vulnerability and adaptation to climate change to inform programme strategies, including targeting and policy recommendations. It offered Trócaire and partner staff the opportunity to spend significant periods of time with households and communities in villages where Trócaire and partners were supporting development interventions. This degree of engagement was designed to provide a deeper level of understanding, learning and reflection for the research team and Trócaire so that the lessons from this process could be 'internalised' and would enrich future planning and decision-making.

2.1. ANALYTICAL FRAMEWORK

The meaning of vulnerability

Box 1 provides definitions of the concepts of adaptation and vulnerability. Vulnerability assessments are key to understanding how climate change may affect households and where assistance is needed. In climate change research, vulnerability has been understood in two different ways: either as the residual impacts after adaptation has occurred (vulnerability = impacts minus adaptation), or a condition determined by multiple institutional and individual factors and processes. O'Brien et al.[16] call these 'end-point' or 'starting point' interpretations, respectively. The first interpretation is typically used in connection with climate scenario projections, and the emphasis is on mapping impacts and determining responses to those.[17] The present study uses the second interpretation, drawing on a livelihoods approach which focuses on the role of household assets in determining vulnerability and capacity to adapt, as well as highlighting the role of external institutions, structures and processes. Scenario projections are less at the forefront in this interpretation, but form part of the uncertain risks that individuals and households are facing. Chambers' distinction between internal and external vulnerability helps to frame understandings of this approach; internal vulnerability being conditioned by access to resources at a household level, and external vulnerability depending on access to institutions and external sources of support.[18]

Box 1. Definition of vulnerability and adaptation

Vulnerability describes characteristics of a given unit of analysis in relation to (in this case) climate variability and change. This study uses the following definition: 'the propensity of human and ecological systems to suffer harm and their ability to respond to stresses imposed as a result of climate change effects'.[19] Vulnerability is a function of both biophysical (e.g. exposure to climate events) and social factors (e.g. ability to respond successfully).

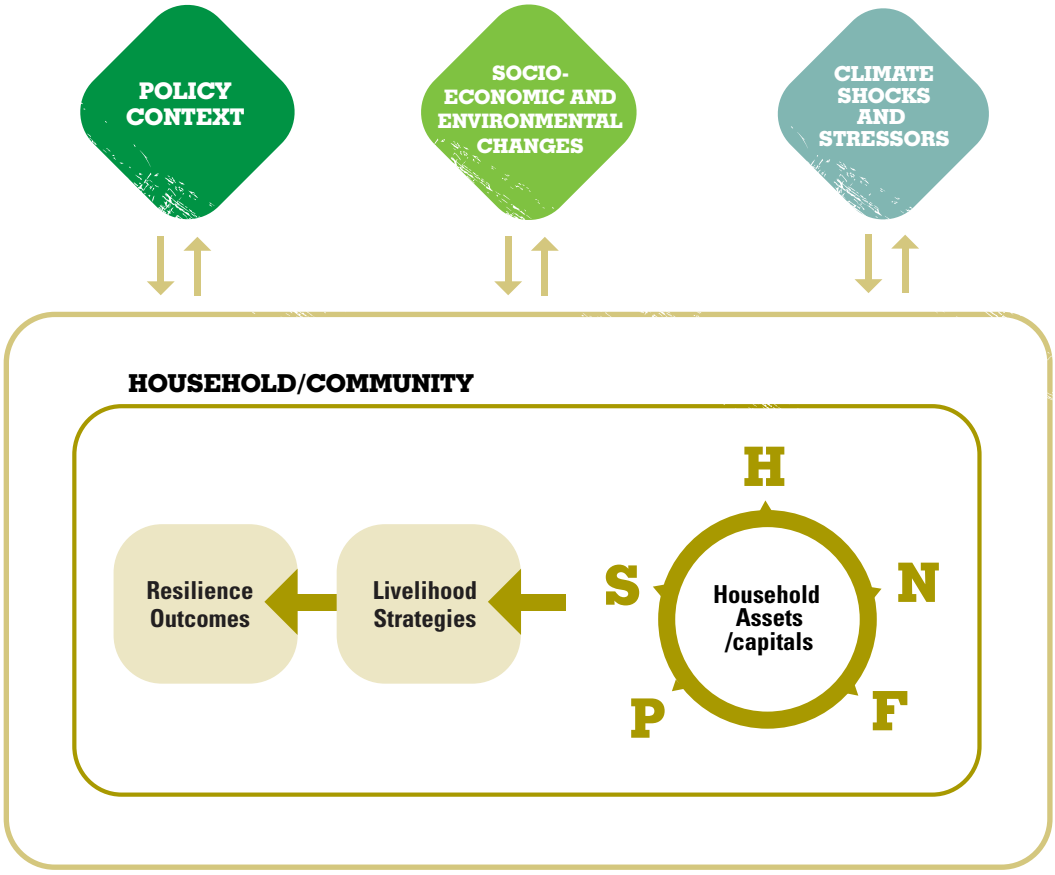
Adaptation is a process that involves reducing vulnerability. It is normally seen as an incremental as well as transformative process of change in response to problems and opportunities,[20] in contrast to coping which tends to be considered as short term, reactive actions to tackle problems and not involving permanent changes in behaviour.[21] In practice, however, the distinction is not always clear: for example, coping may develop into adaptation. Adaptation can be planned by governments, organisations, or households and people. Adaptation is not a new concept: people have always adapted to change, whether climate-related or not, and there is considerable historical evidence of individual and collective strategies to cope with and adapt to adverse conditions.[22]

Analytical Framework

The main concern of this research is to look at changes to household-level livelihood strategies in the context of climate variability and change. The sustainable livelihoods (SL) framework[23] forms a starting point for the analysis. The SL framework has been used widely in development research, and more recently applied to climate change adaptation. Key strengths of the framework include the 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 SL framework has been modified to highlight the linkages across scales (a common critique of the SL framework is that it fails to show these linkages). Our framework (Figure1) 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 or capital at household level, the shocks and stressors affecting these, as well as the policy and institutional environment.

Throughout the study, there was no prior assumption that climate variability and change is the most important or defining factor in people's decision making. What was of interest was to see how changes made to livelihood strategies, in response to climate variability but also to other factors such as market forces, national policy and NGO intervention, are affecting people's vulnerability and their resilience to a changing climate. During fieldwork, 'climate change' as a subject was not used as the starting point of questioning or as the single focus of any activity, as it was felt this could influence the answers. The decision was taken to use livelihoods, resource use and access as the starting point, then look at shocks and stressors experienced by households, and to explore climate change when the subject was introduced by participants.

Figure 1. Analytical Framework



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

Vulnerability and capacity

A key focus for the study was individuals and households' capacity to respond to observed changes in climate shocks and stressors, and the effects of these responses on household vulnerability. Responses undertaken at this level are often called 'autonomous adaptation'[24], reflecting peoples' reliance on their own resources, as opposed to adaptation actions that are planned by external agencies or organisations. There is a large body of research on local knowledge and people's capacity to respond to climate variability and change, and over the past ten years there has been increasing focus on local knowledge and skills in climate adaptation.[25] However, the treatment of such knowledge and capacity in adaptation research and practice is not straightforward. One challenge is the scepticism that persists towards local knowledge on the grounds that it is not 'scientific', although some of this has been overcome by studies showing how local knowledge of, for example, weather forecasting, is based on principles well recognised by science.[26] Other concerns lie in the fact that traditional practices developed under one set of climate conditions will no longer be relevant with climate change.[27] For example, there is evidence that traditional weather indicators are no longer trusted by people due to changes in climate patterns.[28] At the same time, there is an increasing recognition that local knowledge is not confined to practices and skills, but that it is part of dynamic knowledge-practice-belief systems.[29] These systems are highly dynamic and have proven to be adaptable to considerable shocks in the past.[30]

Implications for practice: guiding adaptation processes and measuring success

There is increasing focus on measuring and evaluating successful or 'sustainable' adaptation.[31] This is partly prompted by the need to prioritise scarce funding for adaptation and to make sure the funds are used to support the poorest and most vulnerable, related to concerns about equity and justice in adaptation outcomes. Attention to measuring and evaluating adaptation also relates to the need for an understanding that not all actions aimed at tackling climatic shocks and stressors support longer-term adaptive capacity. Indeed, there is a growing literature showing that climate policies may have negative or maladaptive outcomes for vulnerable populations.[32] At a household level, adaptive actions are taken in response to a range of issues, of which climate stressors are one. 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.

Reducing vulnerabilities and enabling responses that increase adaptive capacity will in most cases require challenging power structures that made individuals and households vulnerable in the first place. For example, if the problem of food insecurity is caused by farmers not being able to afford farming inputs or having too insecure land tenure to have an incentive to invest in it, food aid or provision of better climate information will not do anything to reduce vulnerability. These concerns are also central to work in the area of climate change and development, which has been an expanding area of research and policy starting in the late 1990s and early 2000s[33] up to the more recent focus on terms such as Climate Resilient Development and Climate Compatible Development.[34] These concepts are to a large extent donor-driven, and it is still unclear what they mean in practice and what synergies and trade-offs they involve.

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

Adaptation and poverty reduction differ in important respects. Development interventions may increase people's incomes but leave societies more vulnerable to change. An example is shrimp farming that involves the clearing of coastal mangroves, which in turn makes people more susceptible to the effects of coastal erosion or storm surges. Likewise, tourism may increase incomes but the incomes may be sensitive to changes in climatic patterns or changes in behaviours. Also, improved roads may attract people to move to areas with high risk of flooding. It is clear that in many areas, society is not fully adapted to the current climate: we have what we call an 'adaptation deficit'.[35] In some cases, this adaptation deficit is increasing with more settlements in exposed areas, or through loss of knowledge and skills on how to manage climate risks.

How can we then know whether we are moving in the right direction? This study draws on different approaches on how to assess 'successful adaptation'. Adaptation outcomes may be viewed against criteria for resilience, which include institutional flexibility, ability to bounce back, ability to withstand shock, justice, ability to self-organise, and livelihood diversification.[36] Another approach by Eriksen et al.[37] focuses on four key criteria for moving towards 'sustainable adaptation': first, to recognize the context for vulnerability, including multiple stressors; second, acknowledge that differing values and interests affect adaptation outcomes; third, integrate local knowledge into adaptation responses; and fourth, to consider potential feedbacks between local and global processes. Barnett and O'Neill's approach, alternatively, focuses on whether actions taken for adaptation avoid being maladaptive, defined as 'action taken ostensibly to avoid or reduce vulnerability to climate change that impacts adversely on, or increases the vulnerability of other systems, sectors or social groups'.[38] They outline five key factors that would render actions maladaptive: increasing emissions of greenhouse gases, disproportionately burdening the most vulnerable, having high opportunity costs compared to alternatives, reducing incentives to adapt, or locking future actions into particular pathways.

2.2. METHODS

The findings contained in this report are based on data collected during fieldwork conducted between September 2009 and November 2011 in a number of communities in Bolivia, Honduras, Kenya and Malawi. Selection of these four countries was aimed at achieving a diversity and geographical spread in the results. Within the four countries, seven villages were selected as case studies[39] of how people are experiencing and responding to climate variability.

Tools used in fieldwork

Various methods were used in order to answer the research questions. As outlined above, in order to get a thorough understanding of the nature of the impacts and responses to climate variability, a longitudinal approach was undertaken. In total six fieldwork visits were conducted at intervals of four to six months across the four locations over a two year period of study. Both qualitative and quantitative methods were employed during the fieldwork, through a survey, semi-structured interviews and focus group discussions using PRA (participatory rural appraisal) techniques.[40]

A 'wealth ranking' exercise was conducted at the beginning of the fieldwork. Based on this, 40 households were selected to participate in the study, proportionately representing each of the wealth groups identified in the ranking exercise. Another layer of stratification was added by incorporating an approximately representative number of male and female headed households within the sample. The head of household was the primary respondent throughout the research, except in cases where this was not possible. The sample of 40 households per research location took part in the survey and interviews, and a wider group took part in the focus group discussions.

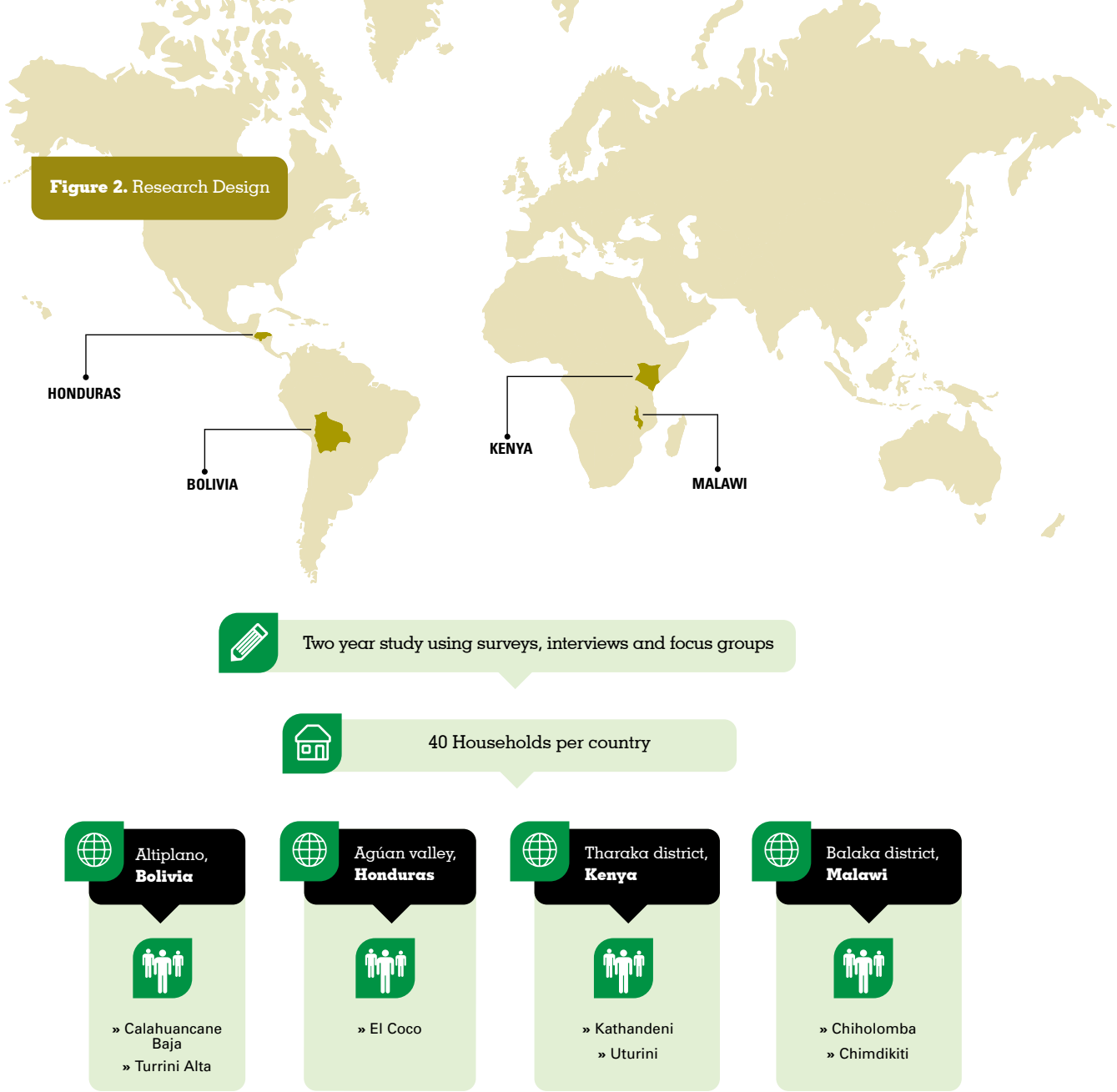


Figure 2. Research Design

The survey was a standardised format, composed of four key areas: i) household data; ii) household resources – land and crops, livestock, forest and fisheries, drinking water, and income and assets; iii) social networks; and iv) livelihood challenges and responses. Questions and response options were modified to use locally appropriate terms and concepts. A baseline survey was conducted at the beginning of the fieldwork to establish a general reference point on these key areas, and the 'regular' follow-up surveys were composed of the same core areas and questions but captured information only on changes that had occurred in these areas since the previous visit.

Qualitative activities were conducted in conjunction with the survey at each visit. PRA activities such as 'village hazard mapping', 'seasonal calendars', 'trendlines/historical timelines' and 'social institutions mapping' formed the basis of early focus groups discussions.

As the focus of each case study became clear, data collection tools were developed specifically for each case study.

Finally, semi-structured interviews were used to complement and in some cases replace the survey in the final stages of the research as the questions became more focused and as the need for 'filling the gaps' become greater.

Interview questions were semi-structured and were designed for each case study individually. Table 1 outlines the different tools used for data collection over the course of the study. All activities were conducted in the local language.

Box 2. Research Process

The fieldwork was implemented by teams composed of Trócaire staff and staff from local partner organisations (CIPCA – Bolivia, Popal Nah Tun – Honduras, Diocese of Meru – Kenya and CADECOM – Malawi). Technical support and analysis was provided by the Institute of Development Studies (IDS). This working model, which required a substantial investment of time by all involved, was devised to ensure maximum learning for both Trócaire and Trócaire partners. It offered a unique opportunity for staff to spend significant periods of time with households and communities and to become more familiar with the day-to-day challenges they face – an understanding which is often assumed to exist between NGOs and beneficiaries but which is rarely questioned. The approach yielded significant outcomes for Trócaire, not only in terms of responding to the research goals, but in learning about 'research in action' and identifying learning for undertaking a project such as this in the future.

A research workshop was held annually with the Trócaire/IDS research team to track progress, discuss methodologies and collectively analyse the data. In one workshop the research team discussed the advantages of the research model as well as the challenges this presented.

Advantages

- Exchange and learning from peers
- Deeper understanding of target communities and their vulnerability
- Relationship building through direct contact with community members
- Evidence from the field to discuss with stakeholders such as donors and policy-makers
- Learning new skills

Challenges and lessons from the research

- Importance of defining the limits around what can and cannot be researched based on capacity
- Applying the conceptual framework in a practical way
- Turnover in staff and households and the need for consistency
- Managing communities' expectations
- Multi-level translation (e.g. English, Spanish, Aymara)

Box 3. CIPCA

Centro de Investigación y Promoción del Campesinado (CIPCA) is a Bolivian organisation, which emerged in the 1970s. CIPCA conducts research, livelihoods interventions and advocacy in support of small scale farmers and works in seven of Bolivia's nine departments including the Altiplano as well as the tropical lowlands. CIPCA's work in Ancoraimes (research area) focuses on helping small farmers to participate in local governance through making and following up on development proposals; this work also has a specific livelihoods intervention that includes support for irrigation, improved agriculture and livestock rearing.

Table 1. Topics and Tools used for data collection

	1st Fieldwork	2nd Fieldwork	3rd Fieldwork	4th Fieldwork	5th Fieldwork	Final Fieldwork
Bolivia	- Survey - Wealth ranking - Village profile - Venn diagram	- Survey - Risk mapping - Trendlines - Natural resources	- Survey - Daily Activity Clocks - Diversification	- Survey - Sources of weather information	- Changes in the agricultural system	- Interviews on irrigation practices
Honduras	- Survey - Wealth ranking - Village profile	- Survey - Daily Activity Clocks - Land & Agriculture	- Survey	- Trendlines Economic, Social, & Environmental - Livelihood Options	- Interviews - Wage labour & Livelihoods	- Interviews - Trendlines - Livelihoods
Kenya	- Survey - Wealth ranking - Village Profile - Seasonal calendars - Trendlines - Venn diagram	- Survey - Daily Activity Clocks - Changes in agriculture & diversification	- Survey - Changes in livestock & crops	- Survey - Challenges with changing farming systems	- Survey - Interviews - Drivers of changes & resources needed	- Interviews - Institutional support
Malawi	- Survey - Wealth ranking - Village profile	- Survey - Risk mapping - Seasonal calendars - Trendlines - Venn diagram	- Survey - Farm Input Subsidy Scheme	- Survey - Crop & Livelihood diversification	- Survey - Interviews - Drivers of diversifcation	- Interviews - Actors & barriers to diversification

Considerations on research methods

The emphasis from the outset of the research was on the qualitative approach, and as such a small sample size was favoured instead of a large, statistically significant sample. Therefore the findings of this study represent the experience of a small number of people in seven communities, and should not be inferred to be representative of the districts, regions or countries within which they live. The findings are examples of how a particular population have reported their experiences of vulnerability and response strategies in the face of climatic and non-climatic challenges.

Research participants in a focus group discussion, Kenya.

Triangulation was of central importance to ensure the validity of the data. Issues raised during focus group discussions were frequently interrogated during interviews, and vice versa, to ensure the researchers had reached a 'saturation' point in the information being collected.[41] As a different theme was explored in each of the case studies, the data collected during the fieldwork varies in its content across the four locations. Therefore the case studies are comparative at the level of findings only. However, to ensure a common approach in research practice and data collection, as well as to enrich the analysis, certain members of the research team visited all of the case study locations.

Efrain Hernandez, Fundación Popol Nah Tun, El Coco, Honduras

Box 4. Fundación Popol Nah Tun

Fundación Popol Nah Tun (PNT) is a Honduran network of regional grass roots farmer organisations, small cooperatives and other community development organisations. Since 2001 they have been working on capacity building, agro-ecological production, risk management, natural resource management and policy. PNT predominantly work with poor farmers, many of whom rely upon subsistence farming. Their climate change work is based upon techniques which allow families to be food secure and includes agricultural techniques (to complement traditional techniques), artisanal seed banks, permanent crops as well as promoting the principles of ecology.

PNT's work in the Aguán Valley has predominantly focused on farmers, helping them to form co-operatives, work on disaster preparedness and risk reduction and adopt agro-ecological techniques in their farming. Interventions in El Coco focus on responding to disasters through food for work programmes, providing construction material for housing improvement and reinforcement, as well as rehousing programmes for people whose houses are damaged or at risk of damage by flooding

Participants in the research were both beneficiaries and non-beneficiaries of support from partner organisations/Trócaire. The ability to draw on partner organisations' knowledge of the local area and livelihoods context, as well as the access granted by communities because of partners' prior or on-going involvement in the area, reaped positive results in terms of trust and acceptance of the research process by community members.

Proportional piling in a focus group discussion, Kenya.

However, it is inevitable that a certain level of bias is present within the data, and taking into account Denscombe's assertion about the identity of the researcher having 'a bearing on the amount of information people are willing to divulge and their honesty about what they reveal'[42], the influence of Trócaire and partner organisations' staff involvement in the collection of data should also be acknowledged from the outset. Efforts were made to minimise the effect this may have on data collected by making it explicitly clear to participating households that this research was not linked to livelihood support and that the information gathered during the fieldwork was for the benefit of Trócaire and partners' planning activities across all of their programme work.

The sample size did not remain constant throughout, perhaps unsurprising in a study of this length, and approximately five per cent of households per country dropped out of the process over the two-year period. This was generally due to migration, death or illness of the primary respondent or household members. If this occurred during the first or second round of fieldwork efforts were made to replace households with others of a similar profile.

Box 5. Caritas Meru

Caritas Meru is the social development arm of the Catholic Diocese of Meru in Kenya. Its mission is 'to promote and facilitate communities to meet their needs through capacity building, social economic development, lobbying and advocacy for sustainable development'. The Diocese of Meru work in the drought-prone districts of Meru South and Tharaka and interventions in livelihoods focus on improved practices around livestock husbandry, irrigation projects, soil and water conservation and the promotion of nature based enterprises. It also provides humanitarian assistance and runs a micro-credit scheme with approximately 12,000 female members.

Box 6. CADECOM

CADECOM Mangochi is the diocesan sub-office of the Catholic Development Commission in Malawi (CADECOM). CADECOM work to improve food and income security with vulnerable communities by promoting sustainable management and use of natural resources, with a particular emphasis on disaster risk reduction, as well as addressing the challenges of HIV/AIDs and access to water and sanitation.

CADECOM have been promoting diversification with farmers as a response to food insecurity and changing rainfall patterns. Strategies to encourage the adoption of more drought tolerant crops and fast maturing maize varieties began around 2001 in response to a food crisis at that time. Changes in the climate, decreasing soil fertility and the desire to increase incomes through selling excess production are other factors driving CADECOM's strategy towards crop diversification. Small livestock are also distributed to households through a pass-on scheme.

3

IRRIGATION AND ADAPTATION IN THE BOLIVIAN HIGHLANDS

3.1. INTRODUCTION

The combination of Bolivia's physical geography and its socio-economic profile leave the country and its people particularly vulnerable to the impacts of climate change. Bolivia's receding tropical glaciers are symbolic of the increasing challenge of water availability across many regions of the country as climate change advances.[43]

In Bolivia the research took place in two communities, Calahuancane Baja and Turrini Alta, indigenous Aymara communities in the Ancoraimes municipality in the Bolivian Highlands. This region is considered to be one of the most vulnerable in Bolivia, due, among other things, to its harsh physical geography and historical socio-economic and political marginalisation. Households in the communities depend mostly on agriculture for their food security and income.

Water scarcity emerged clearly in the course of the research as a key limiting factor in people's ability to adapt to the climatic changes they are experiencing. Given the importance placed on water availability and irrigation by both the communities and institutional actors, including the government and NGOs, this case study focused on the uptake and increase in use of irrigation. The aim was to identify factors and actors that support or undermine the use of irrigation and to explore this as a strategy aimed at building their resilience to climate change.

KEY FINDINGS

- Households in Calahuancane Baja and Turrini Alta are experiencing a variety of climatic changes, 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.
- Climatic changes, 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 was the variety of constraints and challenges, including access to water, the 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 which are irrigation dependent in an area where water availability is a key challenge. The impacts of irrigation on soil erosion were also highlighted as a concern.
- Importantly, in this case study, 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 water availability 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 emerged clearly as a crucial factor in building long-term resilience.

3.2. CASE STUDY CONTEXT AND FOCUS

Ranked 108 on the Human Development Index, Bolivia is one of the poorest countries in South America. While the percentage of people living in poverty came down from 62.4 per cent to 55 per cent between 2002 and 2009, almost a third of the population continues to live in extreme poverty.[44] Bolivia is also among the most inequitable countries in South America. With a population of around 10 million, historic discrimination and marginalisation have concentrated poverty among the country's indigenous population which make up around 60 per cent of the population.[45] The significance of the election of Evo Morales, an indigenous social movement leader, to the national presidency in 2005 (re-elected in 2009), and the passage of a new constitution endowing greater rights to indigenous people cannot be overstated. The government faces a number of challenges, however, in meeting the expectations of a redistribution of wealth that brought it to power. While it has successfully introduced a number of social protection schemes in recent years, the government continues to be criticised for inadequate spending on social issues and under-investment in the sectors that would benefit the majority of people living in poverty in the country, including in particular small-scale agriculture.[46]

Agriculture accounts for 12 per cent of Bolivia's GDP but accounts for at least 40 per cent of the labour force.[47] The majority of people living in poverty live in rural areas in the Highlands and high valleys, with livelihoods closely linked to small-scale agriculture.[48] With the arrival of the Spaniards, indigenous communities lost control over their ancestral territories in the highlands. However, thanks to the 1953 land reform they recouped most of their lands, although the most productive lands in the east, mainly in Santa Cruz, have been occupied by elites since then.

With basic production techniques and infrastructure, high relative cost of inputs, high levels of soil erosion, small plots of land and insufficient water, production levels are generally low, as are the market prices small-scale farmers can expect. The remote and often scattered nature of rural communities presents challenges in accessing markets, information and many services.[49]

Figure 3. Location of Calahuancane Baja and Turrini Alta, Bolivia

Source: United Nations, Department of Peacekeeping Operations, 2004. Adapted by authors.

Bolivia is exposed to various natural disasters such as floods, severe hailstorms and drought, and in 2007 the country entered the ranks of the top ten countries in the world most affected by disasters.[50] Bolivia is home to around 20 per cent of the world's tropical glaciers and their accelerated retreat threatens both the urban dwellers and rural communities that depend on the water from them for household consumption and agriculture. Other key factors in Bolivia's vulnerability to climate change include a high rate of deforestation, removing natural protection from storms and floods, and the high levels of poverty in the country.[51] With more than 50 per cent of the population living in poverty, there is already a deficit in people's ability to cope with and bounce back from existing climatic and non-climate-related shocks and stressors. While variable and extreme weather events such as floods and severe hailstorms are not new in Bolivia, an increase in the frequency and intensity of disasters coupled with slow onset changes presents considerable additional challenges for poverty eradication and development in the country. As Table 2 depicts, a range of climatic changes and impacts may be anticipated across the country as climate change advances.

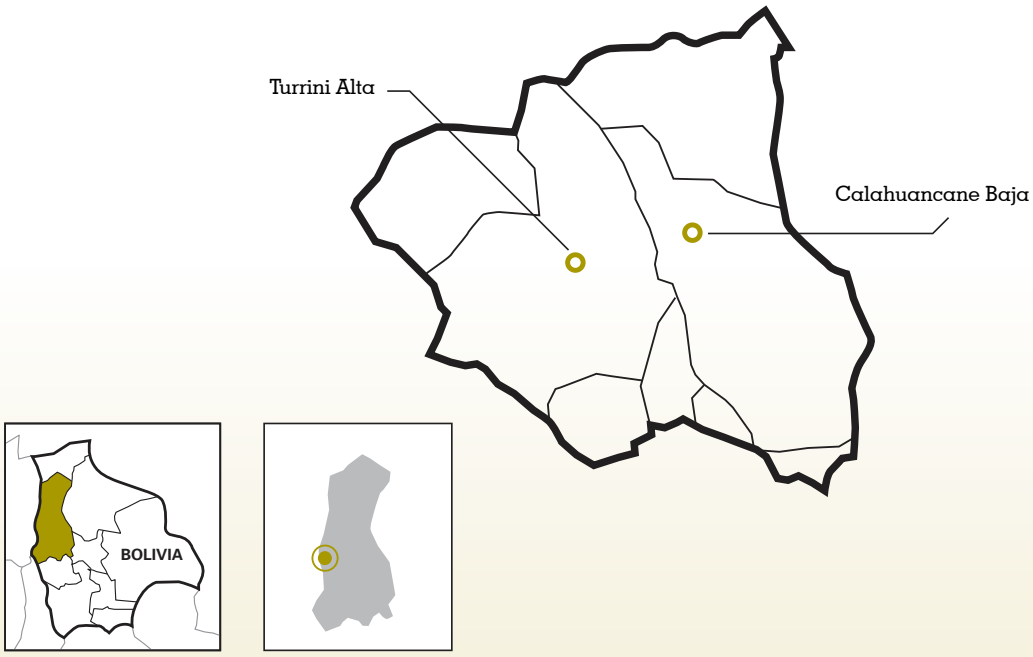
Table 2. Predicted climate scenarios across Bolivia's four ecological regions

Region	Change Scenarios	Expected Impacts
Highlands	■ Greater concentration of rainfall ■ Increased frequency of storms with higher number of rainy days ■ Increased frequency of hail ■ Less waterflow in rivers	■ More frosts ■ More need for water for irrigation for long periods without rain ■ Problems with electricity generation ■ Glacial retreat ■ Little availability of water for human and animal consumption ■ Little refilling of aquifers, high altitude wetlands ■ Increased competition for water use
Andean Valleys	■ Greater concentration of rainfall ■ Increased frequency of storms with higher number of rainy days ■ Increased frequency of hail	■ Increased competition for water use ■ Biodiversity loss ■ More need for water for irrigation during long periods without rain ■ Increased risk of mudslides, problems with electricity generation ■ Soil erosion and desertification
Chaco	■ Less rainy days ■ Less days of rain during planting season ■ Intense and recurrent droughts ■ Lower waterflow in rivers	■ Increased competition for water use ■ Biodiversity loss ■ Increased incidence of hot periods during the summer ■ Soil erosion and desertification ■ Increased pollution of water sources
Amazon Flatlands	■ Higher volume of water per event ■ Increased cloudiness rate ■ High atmospheric humidity in summer and severe droughts in winter	■ Frequent flooding, infrastructure damage and loss ■ Winter crop failure ■ Livestock loss due to lack of water ■ Biodiversity loss ■ More insect plagues and outbreaks of infectious water-related diseases

Source: Taken from original, PNCC. 2007. *El cambio climático en Bolivia: Análisis, síntesis de impactos y adaptación.* La Paz, p. 83.

The case study communities Calahuancane Baja and Turrini Alta are located in the Highlands to the west of the country. Both belong to the Ancoraimes municipality, Omasuyos Province in the Department of La Paz. A mountainous terrain, the environment in the Highlands is harsh and the soil quality poor compared to other areas of the country.[52] According to the 2001 Census figures for Ancoraimes the population of the Municipality was 15,199, of whom only 47 people had their basic needs met; 98.4% of the population were living in poverty, down from 98.8% in 1992.[53]

Figure 4. Map showing the geographical location of the municipality of Ancoraimes



Source: Plan International CBA Concept (www.UNDP-adaptation.org)

Calahuancane Baja and Turrini Alta were selected for the study so as to build on research carried out by CIPCA and others in recent years in communities in the Department on local perceptions of climate change, to contribute to the building up of data and analysis on climate change impacts and responses in this area.[54]

Despite some differences in their physical and social characteristics, Calahuancane Baja and Turrini Alta have much in common. Only approximately 13 kilometres apart, both are nestled at the foot and along the sides of surrounding hills. As their names denote, each is one of a succession of communities along the respective high valley. Calahuancane Baja is neighboured by Calahuancane Alta and Turrini Alta by Turrini Centro and Turrini Baja. Turrini Alta is situated in a former mining area and Calahuancane was previously an estate. While the land would have been handed over to the community members after the agrarian reform of the 1950s, the communities in their current administrative form exist only since the Law of Popular Participation of 1996.

Turrini Alta is the larger of the two, with 70 listed households and around 60 living there permanently, while Calahuancane Baja has 37 households formally listed, with only around 26 families reported as permanently resident.[55] Among the 40 households surveyed during the research, the average household size was four people, ranging from young children to elderly household members. Around two thirds of household members are fully literate, and while Aymara is the principal language used many also speak Spanish, particularly the younger generations. Houses are almost exclusively mud-walled with galvanised metal roofing. More than a third of households surveyed did not have electricity in their homes and only a minority, less than 20 per cent, had piped water in their home.[56]

Subsistence agriculture, combined with livestock and crop sales and casual labour are the mainstay livelihoods of households in Calahuancane Baja and Turrini Alta. For the households in the higher wealth category, livestock (cows, sheep, llama and various smaller animals) was identified as the main source of income, while for households in the poorest wealth category waged labour was most important. Crop sales were the second most important source of income for all households in the survey, and across the Highlands this would tend to be the primary source of income for all.[57] Crops being grown in the communities include a range of traditional crops (potatoes, oca, papalisa) and newer crops, a range of vegetables including onions and improved potato varieties promoted by the Government, NGOs and other external actors, a significant amount of which is for families' own consumption.

Unsurprising given the local geography, many households farm on sloping land, with some on steep to very steep slopes. The average landholding of households in the communities surveyed was 3.7 acres.[58] It is common in the Highlands that families hold small plots in different places and altitudes as a risk reduction strategy. These are distributed based on a system of collective and individual rights. In the Aymara culture, the communal authorities determine the activities to be undertaken in the collective lands or *aynokas,* and although each family is designated to a particular plot within these lands, all of them must comply with the authorities' decisions.

The majority of households surveyed spend most of their income on their children's education, followed by food and then farm inputs, with the households in the lowest wealth category spending most on food. While the majority appeared to be food secure throughout the course of the year, a small number of households consistently reported food shortages and reducing their consumption to cope.[59]

Irrigation, soil conservation (including terracing and use of organic fertilisers and pest repellents), and planting of new crops and seed varieties were identified by community members as the most important positive changes they were making in their livelihood strategies. When asked to prioritise the changes they were making in their agricultural practices, female and male focus groups in both communities ranked irrigation as either the most or second most important change they were making in their agricultural practices.

Table 3. Pairwise ranking of positive changes in livelihood strategies by female focus group in Turrini Alta, April 2011

Change	Frequency	Ranking
Water for irrigation	5	1st
Bio and organic fertilizers	4	2nd
Soil conservation	3	3rd
Improved seeds	2	4th
Cultivation of forage	1	5th
Greenhouse	0	6th
Drinking water	0	6th

Table 4. Pairwise ranking of positive changes in livelihood strategies by male focus group in Calahuancane Baja, April 2011

Change	Frequency	Ranking
Soil conservation	8	1st
Irrigation	7	2nd
Use of organic fertilizers	6	3rd
Improved potato seed	5	4th
Use of tractor	3	5th
Crop association (repellents)	3	5th
Production of Alfalfa	2	6th
Crop diversification	1	7th
Forestation	1	7th

Irrigation is not new in Calahuancane Baja or Turrini Alta with a number of households practicing basic endogenous forms of irrigation for generations, which they have described as time and labour intensive. As one survey participant remarked:

> *My grandparents used to irrigate already, but only using soil channels.*[60]

This was an option largely for those with a natural water source on their land, and in the case of Turrini Alta there is a small river running through the community, thus there has always been the potential for irrigation in this community for those with the means to draw the water to their plots. The influence of external actors on the uptake or enhanced use of irrigation in the communities over recent years was clear. An irrigation system for both Calahuancane Baja and Alta had been installed a number of years ago by the municipality. For various reasons, including insufficient water, these fell into disrepair. As a result, only a few households in Calahuancane Baja were irrigating at the outset of the study, either because they had a water source on their land, or they were clandestinely using water from the community drinking water tank, a practice not endorsed by the community given the scarcity of water. In Turrini Alta an NGO intervention a number of years ago reinforced part of a soil irrigation channel that had been built by the community itself. Furthermore, an ongoing government sponsored intervention was constructing a dam further up river to provide sufficient water for both Turrini Alta and Bajo.

Table 5. Focus Group Discussion on actors instigating uptake or enhanced use of irrigation

Focus Groups April 2011	Instigation of irrigation
Male Group Calahuancane Baja	CIPCA
Female Group Turrini Alta	Earthen irrigation channels always existed but a great deal of water was lost. CIPCA and Plan International have carried out repairs and improvement of this irrigation system.
Male Group Turrini Alta	National, departmental and municipal government support and the Japanese Government.

Box 7. CIPCA support for irrigation in Calahuancane Baja and Turrini Alta

In the course of the study, projects were agreed between community members and CIPCA in which support for the adoption or expansion of irrigation was a significant component. The project involved increasing availability of water by increasing water levels in drinking water tanks in Calahuancane Baja to allow households to use this source for irrigation in the short-term without fear of impacting on household water needs, while installing irrigation infrastructure to improve the existing, non-functioning system. In Turrini Alta, CIPCA agreed to reinforce the existing irrigation channel. Beyond infrastructural changes, CIPCA had provided equipment to households, such as hoses and sprinklers, conducted demonstration workshops and brought a number of community members to take part in farmer to farmer exchanges.

At a national level both water availability and irrigation are key political, developmental and adaptation issues. Although Bolivia is endowed with significant natural water sources these are unevenly spread across the country and, as noted in Table 2, an increasing need for irrigation, as well as increased competition for water, is expected across a number of ecological zones. The importance of water is not a new issue in Bolivia; in the 1990s the privatisation of water services in the country provoked mass discontent, culminating in the Cochabamba 'water wars' of 2000. Since then, under the Morales Government, the Right to Water has been inscribed in the national constitution and the government spearheaded the recognition of the Right to Water within the UN. The government has established a ministry dedicated to integrated water resource management, the Ministry for Environment and Water, with a Vice-Ministry for Water Resources and Irrigation.[61] In November 2011 the government publicly affirmed the provision of $300,000 to each municipality to improve access to drinking water, to be followed by investment in water for agriculture.[62] Water was one of the sectors put forward in the National Adaptation Plan of Action (NAPA) and a National Plan for Watershed Management has been developed under the National Development Plan.[63] The latter has five objectives:

1. Reorganising the institutional landscape relating to watersheds as well as technical, procedural and organisational advice. Including:
   a. promote coordination and cooperation processes between the various institutions
   b. work with civil society to guarantee the integrated management of water resources
   c. prevent conflicts arising over limited water resources.
2 Developing and implementing plans, policies, standards and laws in order to improve the sustainable use of natural resources in Bolivia's watersheds
3. Introducing a knowledge management system to institutionalise organisational learning
4. Promoting and systematising the sustainable and integrated management of watersheds
5. Developing and implementing a corresponding programme for raising awareness among the population about the key issues and the project.

Given the importance placed on irrigation by both the government and other institutional actors working in these communities, including CIPCA and Trócaire, this provided a highly relevant entry point for exploring what is supporting or undermining households' capacity to take up or enhance their use of irrigation, and whether or not irrigation is supporting them to become more resilient in the face of a changing climate.

3.3. FINDINGS

Perceptions and impact of climate variability and change

When asked in focus groups about significant shocks or stressors over the past 50 years, significant periods of drought during the 1950s and the 1980s were highlighted. At the same time a number of bouts of flooding and severe hail or frosts were recalled. Overall the perception in both communities was of an increase in temperature and a general decrease in water over the last decade.[64] In the seasonal survey, rainfall and the availability of water for irrigation recurred frequently in responses to questions about crop choices and the prospects for the next harvest.[65]

When community members were asked directly if they had noticed any changes in the weather since they were children, all but one of 20 people interviewed reported changes and indicated some of the impacts these were having on them. Increasing temperatures and a reduction in water levels were highlighted by many. One man observed that September and October are hotter now:

> *When it rains, it [the soil] dries up very quickly. In the past the moisture remained for two, three days, even for a week. That is changing. I mean the soil dries up quickly and one cannot sow quickly enough.* [66]

An increase in sunburn, particularly in the children, was noted. Some community members linked increasing temperatures and changes in the arrival of the frost with the proliferation of outbreaks of disease in crops. As one respondent said:

> *From June to September we used to get frozen periods so we used to turn over the soil so that the worms die with the frosts; but now there is no point. We simply prepare the soil and sow, but the worms attack us.* [67]

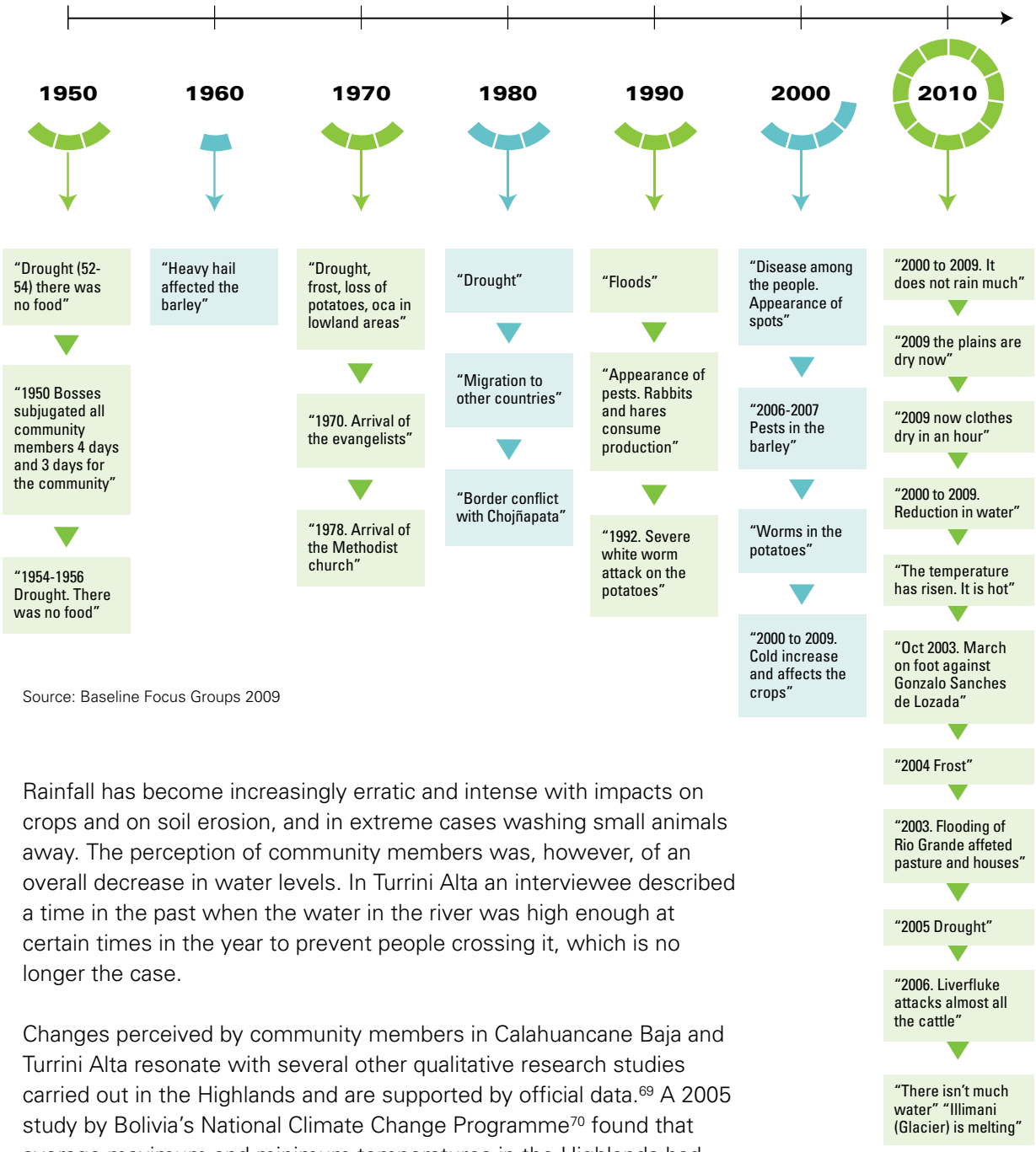
Changes in the temperature and in the arrival of frosts are also perceived as impacting on the types of crops households can produce, with both positive and negative effects. As one respondent reported:

> *In this region you couldn't produce potato imilla only luk'i....quinoa, barley q'achu for cows, but now there is barley for grain, potato k'eni... we couldn't produce all these crops before but now that it is warmer it is possible.* [68]

At the same time it was noted that households are unable to continue a traditional practice of sweetening oca in the sun because the sunshine has become too strong. Furthermore, decreasing predictability of frosts mean that Chuño, a freeze-dried potato that has been important in bolstering food security in rural areas as it lasts for months, is becoming increasingly difficult to produce.

Sheep and Llama are brought down from the hills, Calahuancane Baja.

Figure 5. Histogram of major shocks and stressors of the last 50 years in Calahuancane Baja and Turrini Alta



Source: Baseline Focus Groups 2009

Rainfall has become increasingly erratic and intense with impacts on crops and on soil erosion, and in extreme cases washing small animals away. The perception of community members was, however, of an overall decrease in water levels. In Turrini Alta an interviewee described a time in the past when the water in the river was high enough at certain times in the year to prevent people crossing it, which is no longer the case.

Changes perceived by community members in Calahuancane Baja and Turrini Alta resonate with several other qualitative research studies carried out in the Highlands and are supported by official data.[69] A 2005 study by Bolivia's National Climate Change Programme[70] found that average maximum and minimum temperatures in the Highlands had increased between the 1940s and 2004 by between 1.1 and 1.7˚C. Statistics from Bolivia's Meteorological and Hydrological Office, SENAMHI, indicate a slight decline in the total volume of rainfall in this area, with a more pronounced change in the monthly distribution.[71] National projections for climate change impacts in Bolivia, as set out in Table 2, provide a framework for understanding current variability and change, and for identifying implications for livelihoods and livelihoods support in this and other areas of the country in the future.

Irrigation as a response to current variability and change

Households in the communities that have been able to begin using or increase their use of irrigation over the last few years have been able to mitigate the impacts of the changes they are experiencing. As one community member said:

> *When the rains do not come, you simply replace it with irrigation.* [72]

They are also seeing a variety of positive livelihood outcomes from irrigation, including multiple yields in a year and a greater variety of crops. It is enabling households to plan so as to produce crops when market prices are favourable. Impacts of irrigation described include greater food security and higher incomes as a result of increased yields and better crop and livestock sales. They also noted increased dietary diversity as a result of more vegetable production.

There was also evidence of households being able to pay off debt and invest in their children's education, agricultural inputs and in new business ventures. Some households are using irrigation to produce fodder for their livestock, which is an important means to adapt to mitigate pressure on pasture land in a context of decreasing plot sizes, particularly in a community where livestock is a primary source of income.

Juan José Arciénega of CIPCA standing beside the irrigation channel that had been earmarked for reinforcement, Turrini Alta.

Constraints and barriers

The positive impacts of irrigation in enabling households in each community to adapt to certain aspects of climate variability, and on their food and income security, are clear. Importantly, however, the case study data also highlights the various constraints and barriers faced by households in taking up or enhancing their use of irrigation.

An overriding perception among respondents was that water availability and access is a key limiting factor to households' ability to irrigate. As one respondent noted:

> *Now that it [water] has decreased it does not reach [Turrini] Bajo. We have to take turns if we want to irrigate.* [73]

As a result, social conflicts have arisen between neighbouring communities as well as among community members. Some community members reported getting up at four or five in the morning to irrigate to avoid confrontation. As one respondent reported:

> *There are always arguments among the people. That's why we have to be careful to not use too much water, there isn't enough water to irrigate.* [74]

While irrigation committees existed in both Calahuancane Baja and Turrini Alta in the past, both dissolved after some time. It is unclear whether this was a symptom or a contributing factor in the failure of the existing systems.

Availability of water notwithstanding, the cost of tools and equipment (e.g. hoses and sprinklers) was reported as a barrier to irrigation for some households. The lack of technical know-how was also a factor, as it is needed for the installation, use and maintenance of systems and equipment, as well as to ensure results and to avoid pitfalls. One man said:

> *We started to use irrigation just last year. We did not know how to do it.* [75]

Some community members said that while they and others had been given the necessary materials in the past, there were some people who do not know how to install or use them. Although demonstration workshops are usually provided, it is clear that for various reasons some are not benefitting, either because they were not able to take part in the demonstrations, or because they require more hands-on practice in order to absorb the new information and skills. Furthermore, a number of people reported mistakes that had been made when one doesn't know how to irrigate effectively. Some households over-irrigated, or irrigated during the heat of the day so that water was lost through evaporation, or their irrigation resulted in rotting or the attraction of pests.

The need for external support for many households to be able to take up or enhance their use of irrigation was underlined by the fact that in the course of the research a number of households approached CIPCA saying that they would be willing to do whatever was required in order to receive support for irrigation. It is common practice for external institutional actors to set criteria for their support. These criteria are usually used to incentivise practices aimed at increasing household resilience; for example a household could be required to practice soil conservation in order to have support for irrigation.

While external actors often provide the technical and financial support for interventions, community members are often required to provide basic materials and labour. Such requirements and conditions for access to support and assets are not only laid down by external institutions,

however, but also by community members themselves. In this case, according to rules in the communities, what a household puts into the process (sand, stone and labour) equates directly to the amount of water a household can draw from the irrigation system. If this is not possible, households can pay the equivalent in cash, which can be fairly significant. One person indicated this could equate to 900 BOB (almost €100) or the equivalent of ninety days work. As one female respondent explained:

> *We are spending several days digging and connecting irrigation pipes so that we can win the right to use irrigation.* [76]

Women selling their produce in the market. Irrigation has helped some households increase their production, enabling them to sell the surplus in the market.

Beyond the time and labour involved in the construction of irrigation infrastructure, it is clear that the day-to-day time and labour required for irrigation has been a barrier for some. For example, one man reported:

> *My llamas and sheep consume my time. I do not have much help. I'm thinking about sowing carrots and onions but I don't have time to irrigate, not even one plot.* [77]

Labour shortages have been exacerbated by increasing migration to the towns and cities. Whether a short-term coping strategy in difficult times, or a livelihood choice for some, the consequences for those left behind have been mixed. Whilst migration reduces pressure on local land and water resources, those remaining resident have a reduced household labour force and less people to take up community obligations. Furthermore, there are suggestions that over recent years, traditional social relations of collective work and cooperation in the Highlands such as the *ayni, mink'a* and *waki** are starting to disappear, resulting in reduced social capital and increased livelihoods vulnerability.[78]

A number of other practical reasons why some households would not practice irrigation were pointed out. The case study data shows, for example, that a number of households in the higher wealth category were not irrigating because their land was too far away or on too high a slope for an irrigation system to effectively reach their plots. While the case study sample is not large enough to discern whether it was the most vulnerable households in the community that were the most likely not to be irrigating or irrigating at proportionately less levels, the data highlights a variety of factors, financial and otherwise, that would present significant constraints and even barriers to vulnerable households in accessing external support as well as communal assets for irrigation.

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

* Ayni is a free and reciprocal exchange of labour force between relatives, friends and neighbours in order to facilitate agricultural activities. Mink'a is a form of support amongst families during the sowing and harvest time that can be paid with cash or products. Waki is an associated work between a land owner and other person that possess seeds where both parties participate and benefit equally of the production process

Box 8. Voices from the communities

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.***

3.4. CONCLUSION AND RECOMMENDATIONS

Households in Calahuancane Baja and Turrini Alta are experiencing both direct and indirect effects of changes in precipitation patterns and rising temperatures, such as changes in the crops they can grow, increasing water scarcity and related social tensions. These are adding to and interacting with other livelihood stressors such as natural resource pressure and crop disease/pests.

Households are making changes in their livelihoods strategies in response to these climatic as well as non-climate-related factors. For example, adapting to unpredictable rain is not the only factor influencing community members' decision to take up or enhance their use of irrigation. The case study data indicates a combination of households acting autonomously, the influence of external governmental and non-governmental support in the increased uptake in irrigation, and the promotion of new crop and seed varieties that are irrigation dependent.

Irrigation is allowing many households in Calahuancane Baja and Turrini Alta to maintain and even increase their production despite changes in rainfall patterns, resulting in increased food and income security and allowing some households to invest. At the same time, community members reported that current water availability and irrigation coverage is inadequate to meet the current needs of many households. The need for and potential benefits of increasing water availability and scaling up irrigation in these communities and others like them is clear. The Bolivian government and national and international donors should provide increased, appropriate resources for scaling up efficient and appropriate irrigation systems in rural areas for small scale farmers.

Households in the two communities are adopting or enhancing their use of irrigation in response to their immediate needs. It is clear, however, that they are attuned to the likelihood of increased water stress. Respondents highlighted the benefits of higher yields and better prices obtained with new crops and seed varieties, but noted their dependence on irrigation. Both community members and CIPCA also recognised the potential for irrigation to exacerbate soil erosion, in particular where capacities or infrastructure constraints allow only for flood irrigation. As one female respondent noted:

> *Some neighbours won't allow irrigation channels through their land because they argue that the water takes the soil with it.* [79]

External actors are extremely important in the uptake and implementation of livelihoods adaptation strategies such as irrigation. This came across clearly in Calahuancane Baja and Turrini Alta where governmental and non-governmental actors were particularly influential in promoting irrigation to households, providing financial support, technical expertise, infrastructure and tools, as well as the promotion of particular crops and seed varieties.

In Calahuancane Baja and Turrini Alta, external interventions are addressing the key limiting factor to irrigation as an adaptation strategy for community members – access to water. With their greater access to information, resources and technical expertise, it is critical that external institutions ensure the support they provide both responds to short-term needs and also builds resilience in the longer-term. Current perceptions of water scarcity and national climate projections indicate that interventions to increase access to water in the short-term should take explicit account of uncertain future water availability. Where tensions or trade-offs between short and long-term benefits cannot be avoided (whether acceptance of a certain amount of soil erosion to increase production in the short-term, or the promotion of irrigation dependent crops to enable asset accumulation in the short-term), external institutions should ensure these are taken into

account. They must employ strategies to manage these tensions and support transition to sustainable outcomes. Whilst this has always been important, the implications of increasing livelihoods shocks and stressors as a result of a changing climate make this an even greater imperative. Government and non-governmental actors should invest adequately and appropriately in scaling up integrated watershed management and support the strengthening of soil and water conservation strategies and agro-ecological approaches to reduce water demand and competition.

Avoiding maladaptation in relation to irrigation interventions requires comprehensive assessment of the impacts of interventions on the natural resource base, including the availability of water for neighbouring communities. Furthermore, while in some cases the more efficient irrigation options may be more costly to establish, in the interest of sustainable adaptation and efficient and effective use of scarce adaptation resources, greater upfront costs should be seen as an investment that will be offset by greater resilience returns over the medium and longer-term. Equity considerations, furthermore would suggest that those who have done little to contribute to climate change but are experiencing its impacts should not have to make do with support that may exacerbate their long term vulnerability.

External actors also have an important influence on who is able to access external support and how successfully supported households implement the techniques they have been provided with, via the conditions or requirements laid down for support (albeit as incentives for resilience-building practices), and as a result of the form and extent of capacity building support and accompaniment provided. The variety of constraints and barriers which inhibit or prevent certain households from accessing or benefitting from support offered have been noted; external institutional actors should explore these in a participatory manner with community members and develop appropriate responses, with a particular focus on the most vulnerable households.

Alongside their current strategies, households are planning for the future. When asked whether they thought they would be able to continue to use irrigation if current climate trends continue, community members gave a variety of responses displaying determination, innovation for some, and resignation to fate and faith for others. Finding new water sources and building more water tanks and traditional Andean reservoirs were among household and community plans. Some were determined to avoid migration. For example, one respondent stated:

> *I'm going to stay with ten or twenty people striving for survival. We are not going to the city that easy. With time in La Paz there will be no food but in the countryside at least we will have food.*[80]

Others accepted that they could be forced to follow those who have already left the area as without water there would be 'no life'. Others suggested they would seek to diversify their income by setting up small businesses such as selling lunches. It is important that development actors ensure the design and implementation of adaptation interventions take into account the variety of livelihoods stressors and options within communities, such as migration and business diversification, and build on existing local and traditional knowledge and skills combined with appropriate modern technologies e.g. efficient irrigation systems. Alternative resilience-building strategies will need to be developed where irrigation is neither viable nor a preference, again in particular for the most vulnerable households.

The importance of bolstering internal capacity in the community for sustainable strategies was indicated by evidence of a series of external irrigation-related interventions over recent years with limited reach or sustained impact. Whilst it is unclear whether the failure of committees set up to manage irrigation were more a cause or a symptom of the failure of existing systems, the need for effective management of access to and maintenance of irrigation systems, in order to support fair and durable access and to avoid social conflict, came across clearly. The potential for external actors to support the development of internal capacity was also evident. Beyond hard inputs such as equipment and infrastructure, community members spoke positively of soft support provided by CIPCA such as farmer to farmer exchanges on irrigation practices and community organising. Empowering and enabling communities to effectively organise, including how to navigate, negotiate and manage external irrigation interventions, is critical to ensuring maximum and sustained benefit from support provided, as well as building communities' autonomous resilience in the face of future climatic and non-climate-related risks and uncertainties.

There are significant practical and financial challenges in delivering irrigation at scale and in a manner appropriate to the variety of contexts in communities and individual households across the Highlands and rural Bolivia. For example, currently only 10 per cent of cultivated land in Bolivia is irrigated.[81] From the national policy level to local governmental and non-governmental interventions, there is evidence of similar objectives around coordinated action to increase and improve watershed management and to increase rural communities' access to water for irrigation. However, it appears that investment levels and implementation activities have a way to go to catch up with current needs and to manage potential future scenarios**.** Effective communication and coordination between external governmental and non-governmental institutions supporting adaptation of rural livelihoods through water resource management and irrigation is needed in order to deliver appropriate support at the scale needed, taking into account the responsibilities and added value of each actor. In the face of increasing global and local climate uncertainties, integrated approaches to livelihoods adaptation and joined-up strategies with governmental and non-governmental agencies acting according to their comparative strengths becomes increasingly important.

4

VULNERABLE LIVELIHOODS AND CLIMATE VARIABILITY IN NORTHERN HONDURAS

4.1. INTRODUCTION

The current context in the Aguán valley in northern Honduras is marked by a complex interplay of conflict, climate shocks and limited and insecure livelihood options. Livelihood options for the people in the village of El Coco, where this research took place, have narrowed in recent years, and few have the resources to create their own opportunities. The majority rely on jobs from local plantations or cattle ranches, and remittances. While many households grow fruit trees and keep small numbers of livestock for household consumption, only a small number continue to farm on a full-time basis. In recent decades the region has been characterised by more frequent and intense tropical storms and hurricanes and flooding is becoming an increasingly destructive force in El Coco.

KEY FINDINGS

- Wage labourers and small-scale farmers, though impacted in different ways, are both vulnerable to climate shocks and stressors. Wage labourers incur 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 in 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 the means of production and consumption, but there are higher personal risks in terms of losses of investment.
- 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.

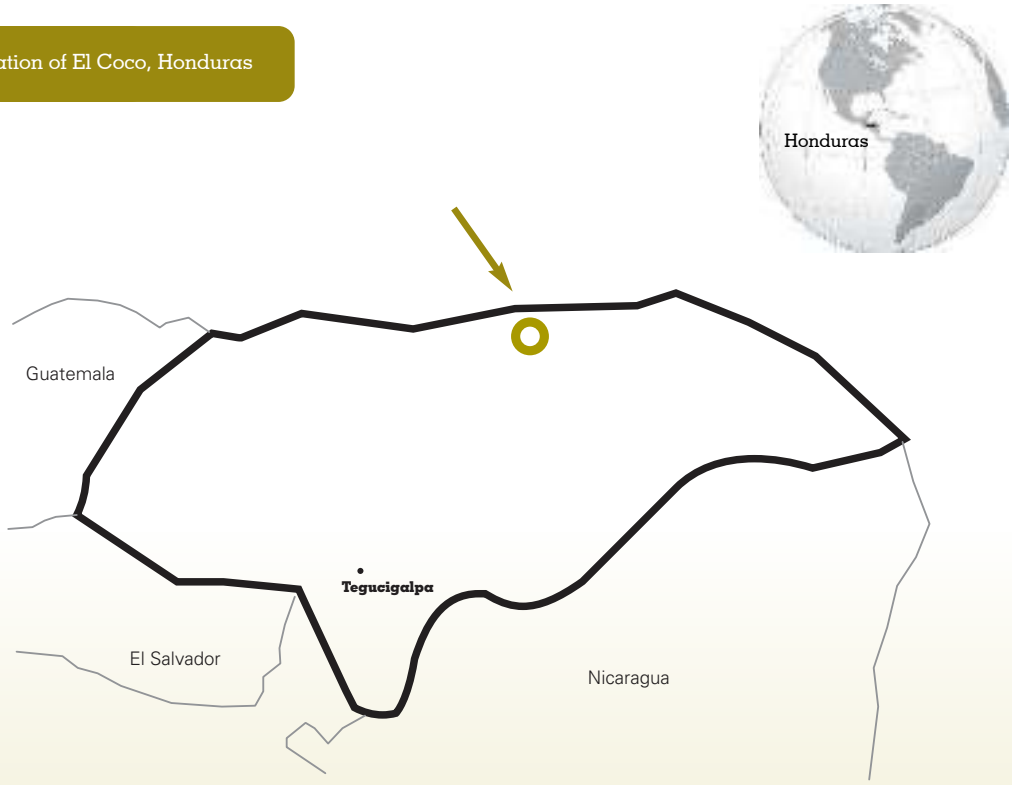
4.2. CASE STUDY CONTEXT AND FOCUS

Honduras is characterised by deep inequalities in income and living conditions. With a Gini Coefficient of 58.6,[82] it is one of the most unequal countries in the world. Poverty is widespread but is most acute in rural areas where 65.1 per cent of the population live in extreme poverty compared to the national average of 47.5 per cent.[83] The climate is tropical with marked dry and wet seasons. It is dry from December until May, with the rainy season beginning in June and lasting until December. Average temperatures range from a high of 30°C to a low of 20.7°C.The average rainfall of the region is 2,643mm. According to Aguilar et al., temperatures in Central America have warmed over the past 40 years, and although their study was not specific to Honduras, it used data from a number of weather stations in Honduras and concluded that 'the region is clearly warming over the last several decades and extremes of temperature are changing accordingly.'[84] Temperature records show annual mean temperatures increasing by almost 1°C between 1951 and 2001 in Honduras and precipitation declining marginally.[85] The Global Climate Risk Index[86] for 1997-2006 ranks Honduras first in the world in terms of countries most affected by extreme weather events, based on human and economic losses.

Climate variability and extreme weather events are part of everyday life on the northern coast of Honduras. Regularly subject to hurricanes and tropical storms, with knock-on river surges leading to flooding, this case study represents a different type of climate vulnerability than the other three detailed in this report. Unlike the situation in the research communities in Bolivia, Kenya and Malawi, the majority of households in El Coco do not rely predominantly on small-scale agriculture for their household consumption and income. Most have shifted from agricultural livelihoods to a reliance on waged employment. In light of this and after initial mappings and consultations with community members, partner staff and the research team, it was decided to explore the issue of the livelihoods mix in the community. 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.

The research took place in El Coco, a small rural town located in the municipality of Trujillo, Department of Colón. El Coco is located within the lower Aguán valley, considered the most fertile valley in Honduras. The Rio Coco flows along the border of the community and 30km to the north is the Caribbean Sea. The population of the municipality of Trujillo is 43,498.[87] According to Humphries, 'the northern coastal plains of Honduras include fertile alluvial soils. This is where the area's urban growth has taken place, alongside the development of large agro-export industries'.[88] African Palm in particular accounts for a large proportion of this development and is now cultivated on 120,000 hectares in the north of Honduras, compared to 40,000 hectares in the 1990s.[89]

Figure 6. Location of El Coco, Honduras



Source: United Nations, Department of Peacekeeping Operations, 2004. Adapted by authors.

In conjunction with African Palm, the economy in northern Honduras relies on banana, citrus fruits, and a significant portion of the land is dedicated to cattle farming. Migration to other cities in Honduras and the United States is a common feature of livelihood strategies in northern Honduras and remittances play an important role in the local and national economy, accounting for approximately 25 per cent of national GDP.[90]

Honduras has been characterised by diverging trends in policy in recent decades which has contributed to the complex situation of land distribution and ownership in the Aguán valley today. A policy of agrarian reform and land redistribution began in 1962 with the Agrarian Reform Law ('Ley de ReformaAgraria') and reached its peak during the mid-1970s when a number of reforms took place and a law allowing for the temporary use of lands was passed, as well the distribution of 120,000 hectares of land to peasant families.[91] Around this time, migration to the less populous, northern coast of Honduras was promoted by the government and, as will be outlined below, the impact of Hurricane Fifi in 1974 also resulted in people (many of whom were cattle farmers) being relocated from the flood-prone lowlands to villages such as El Coco.

These movements acted as pressures upon the land ownership system and from the mid-1970s onwards a trend towards a re-concentration of land into the hands of a small number of large landowners began. The productive potential of the Aguán valley and government policy emphasising an agro-industrial export model contributed to this process. The concentration of land was further compounded by the Law for Modernisation and Development of the Agricultural Sector ('Ley para la Modernización y el Desarrollo del Sector Agricola') in 1992, in which 'large producers were given the opportunity to extend their territories beyond the maximum property limits established by the agrarian reform law',[92] reversing many of the achievements made by the land distribution process in previous decades.

Since the beginning of the twenty-first century conflict and insecurity in the region has increased. Moves towards land reform were again thwarted and the 2009 political coup has seen the re-establishment of political and economic elites, alongside the resurgence of campesino (peasant farmers) groups and other social movements working for land redistribution. At the same time, the Aguán valley has been heavily militarised, in a bid to tackle illegal drug trafficking through the area. Members of campesino groups involved in the land struggle are increasingly subjected to intimidation and detention at the hands of public and private security forces. In the past two years 45 activists involved in the land movement in the Aguán have been murdered.

4.3. FINDINGS

Wage labourers, small-scale farmers and climate vulnerability

Households in El Coco experience extremes in weather on a regular basis and are vulnerable in particular to flooding. Excessive levels of rainfall during tropical storms or hurricanes have significant impacts on the community and often lead to local rivers bursting their banks and flooding surrounding areas. The consequences for households in El Coco are many. A small number of houses, due to their proximity to the river, regularly flood during heavy rains. During Tropical Depression 16 in 2008 for example, 12 homes in the community were damaged, one completely destroyed and 65 graves in the local graveyard were damaged.

El Coco is regularly cut off from other towns and villages for prolonged periods due to roads in the area being flooded. Improvements have been made to the bridge providing access to El Coco since Hurricane Mitch in 1998. However the road connecting El Coco to Tocoa - the most important town in terms of markets and trading - can be submerged by up to three metres of water during heavy rainfall.[94] In a focus group discussion, one participant said that El Coco can be eight days without communication when there are floods. Others discussed a storm in January 2011, which took place outside of the regular tropical storm season (June to November)9[5] that left the community cut off for 15 days. This results in food supplies running low in the local shops and a subsequent increase in prices. Households spoke of having to go hungry or just 'hang in there' during times of flooding when they are unable to access food in the local shops. They said that some, presumably those deemed to have more resources or a secure job, are able to obtain food on credit or can buy from Tocoa prior to the arrival of the storms.[96]

The majority of waged work is outside of the community and flooding or storms can physically prevent people from accessing their employment. Those involved in the sale and distribution of milk from cattle ranches experience similar problems in accessing markets, as one man explained:

> *When the floods come we cannot sell the milk because the roads get flooded and we cannot get to the selling points.* [97]

Demand for labour on palm and citric plantations also diminishes as the crops are damaged by the rain or heavy winds. With nothing to harvest, employers cut back on staff. The impacts of these disruptions on households dependent on waged labour are not only an immediate drop in income; availability of work can be affected long after the flooding has subsided. In an interview with one woman, who estimated her household's income was 80 per cent reliant on waged labour, she said that after one storm they were unable to work for almost two months. This experience was repeatedly relayed by those depending on paid work. In the baseline survey, those who identified flooding as one of the problems their household experienced spoke of the impacts in terms of 'loss of income because milk was not sold' and 'lack of work'.

Only a minority of people in El Coco engage in small-scale farming as their main livelihood strategy. These households are mostly involved in growing basic grains such as maize and beans, small-scale African Palm production, livestock rearing or a combination of these. There is evidence of one or two farmers from the sample who are using agro-ecological practices in their production. Furthermore, even those who rely on farming as their main livelihood strategy have other income sources, such as remittances or small businesses like carpentry as a means of spreading risk in the event that one or other income sources are affected. Farmers are directly affected by climate shocks, for example when harvests are lost during flooding. As noted above, farmers involved in producing for sale are also impacted when access to markets is cut off during and after flooding. Many farmers do not own land themselves and have to rent from large landowners, very often in areas by the river which are at most risk of flooding. One women in a focus group discussion said farming by the river was 'an adventure' due to the risks involved. For some, growing crops is no longer a viable option:

> *We don't grow crops because the risk of them being destroyed by floods is too high.*[99]

One household reported losing land when the river failed to recede to its normal levels after flooding, reducing the land available for production. Others lost livestock during flooding, mostly small livestock such as chickens. One woman said:

> *We were forced to evacuate our home. The river broke its banks and we had to move to higher ground. Most of our animals (chickens and roosters) drowned.*[100]

Whilst increasingly intense storms and floods are the main climate shocks in the area, drought, a slow onset stressor, is also becoming more problematic in El Coco. Whilst drought and subsequent water shortages affect everybody in the community, they present particular challenges for small-scale farmers. According to one respondent:

> *A few years ago the rain would consistently arrive in the month of May and I could sow crops. Now the dry season is longer.*[101]

A view of the Rio Coco, which borders the village of El Coco and can flood the surrounding areas during periods of heavy rain.

Another farmer described how:

> *Excessive droughts in recent years have led to crops being lost and an overall reduction of basic grains in the market place.*[102]

Drought also affects livestock keeping. As one farmer reported:

> *The land was so dry cattle herders were unable to graze cattle on local lands.*[103]

Whilst drought has a direct impact on small-scale farming, like flooding it also has an indirect impact on those relying on wage labour. One palm grower said:

> *When summers are long and dry it reduces palm-oil production. Droughts harm the trees, and when there is less production it means there is less work for us.*[104]

In the context of current and projected temperature increases, local factors impacting on water resource management are important. Excessive deforestation has taken place in the area for the plantation, ranching and logging industries. A number of interviewees spoke of the need to address the water crisis and ensure there is secure access to water for the future. Attempts to resolve the problem have however been unsuccessful, as one man explains:

> *People in the community face serious water problems. Authorities have come and tried to help, but the land-owners threaten the movement's leaders who are trying to ensure access to water.* [105]

While drought and limited water availability reduce palm production and the availability of pasture for grazing cattle, unlike small-scale farmers the owners of plantations and cattle ranches are likely to have the resources to compensate for a lack of water. Nevertheless, incomes derived from these forms of waged labour are insecure and sensitive to any changes, internal or external, that affect production.

Changes in the livelihoods mix

In El Coco, more so than in the other three case studies, the changes that have occurred in the livelihoods mix appear to have less to do with people's choices and more to do with external factors and cultural influences. The overall mix has been changing in El Coco over the past decades in response to a number of factors. The impacts of climate shocks on agriculture has lead many to perceive that farming is no longer a viable livelihood in the area. Lack of access to land has also affected this perception, making farming a strategy beyond the reach of many because of the prohibitive costs of land (both for purchase and rent) and the risks involved.

There has also been a move towards cattle farming which has impacted upon perceptions of small-scale farming in the area. The rise in popularity of cattle rearing can be traced back to the aftermath of Hurricane Fifi in 1974. According to participants in a focus group discussion, after Hurricane Fifi there was a big change in land use in El Coco. People who lived in the lower Aguán valley were flooded during Fifi and were relocated by the government to El Coco. Many of these were cattle farmers and land which was previously used for growing basic grains was now given over for cattle farming, apparently with little consideration given to those living and farming locally.

Despite the negative associations linked to the arrival of the cattle farmers, it would seem that this model of agriculture has gained importance within El Coco over the past 30 years. According to one woman:

> *Nobody wants to grow crops or invest; people just grow pasture for grazing cattle.*[106]

While in the words of an 84 year old retired plantation worker:

> *People find it easier to struggle with animals than to plant crops.*[107]

The move towards cattle farming, and the small-scale production of cash crops such as African Palm, is also partly due to cultural factors. People associate some prestige with being '*ganaderos*' (cattle farmers) or '*palmeros*' (palm farmers) and for many the role of the *campesino* has lost its cultural significance. As it was explained by one commentator:

> *The whole concept of the campesino economy has been lost.*[108]

A sentiment echoed a number of times during interviews was that:

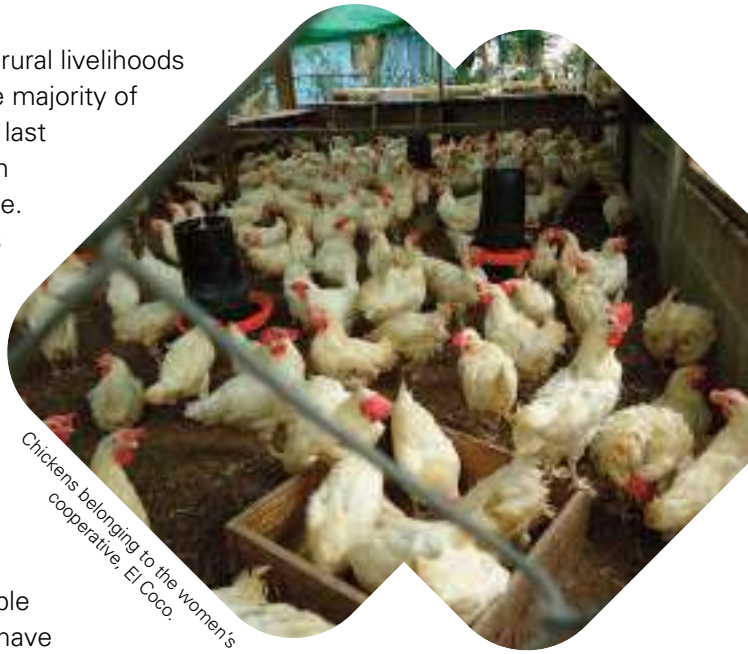
> *The region is full of livestock farmers, nobody wants to work the land and grow crops.*[109]

In conjunction with the shifts within agriculture, the rise in availability of waged work created employment opportunities for people who lacked access to land or the resources to rent it. According to focus group participants, large ranches became an important source of employment in the area during the 1980s and 1990s. African Palm plantations started to appear around the 1980s and gained importance as a source of employment once they came into private ownership during the 1990s. The establishment of plantations and processing plants by large companies introduced regular waged labour as an important, though low paid and insecure, income source for households in El Coco and the wider Aguán valley.

For women, livelihood strategies are particularly limited. They are largely excluded from employment opportunities on plantations and for those who do secure a job, the work is generally the most labour intensive and poorly paid. Outside of waged labour, there are a number of small collectives, or women's groups, involved in poultry rearing and the sale of eggs or bread making. Although focus group participants highlighted an increase in women's groups over the past decade as a result of international support received after Hurricane Mitch, the groups were struggling to survive in the context of increasing grain prices. Despite the lack of sustainable livelihood options for women in El Coco, responses from interviewees pointed to the significance of women's labour during periods of unemployment or crises. Domestic labour, providing laundry services and involvement in women's groups provided essential resources and acted as key coping strategies during times of difficulty.

Preparing for a focus group, El Coco.

However, in a broader sense, the lack of investment in rural livelihoods has resulted in a limited set of livelihood options for the majority of households in El Coco. Although migration is seen as a last resort, the reliance on remittances suggests that it is an important strategy for supplementing household income. The proportion of households relying on remittances as their main source of income was anywhere between six per cent and 28 per cent of the survey sample at different times of the year over the period of this study and, according to data from interviews, approximately four out of the sample of 40 households relied exclusively on remittances. Remittances mostly come from relatives working in the United States or elsewhere in Honduras. According to focus group participants, remittances really only began to be relied upon in the 1990s as people migrated in bigger numbers, and since the 2000s they have increased in importance.[110] The devastation and the ensuing dearth of opportunities caused by Hurricane Mitch in 1998 was identified by focus group participants as a reason why people migrated. The lack of opportunities for work in the area was repeatedly given as the main reason why people migrate.



Chickens belonging to the women's cooperative, El Coco.

While remittances make a relatively significant contribution to many households' income, those in receipt of remittances have no control over this income source. Many spoke of the effects of the global financial crisis in the United States on the remittances they receive:

> *When the USA is in crisis it affects us, people receive less remittances and there is less money in the community.*[111]

> *Financially speaking we have suffered. One of our two sons that live in the USA lost his job and can no longer send us money. Our other son does not have a stable job, he might work three days a week and does not send too much money.*[112]

The uncertainty surrounding the levels and timing of receipt of remittances was referred to frequently in interviews and focus groups.

The shifts outlined above highlight the move to an increasing dependence on external income sources. This situation has stemmed from government policy steering livelihood trends towards a reliance on waged labour by prioritising an agro-industrial and export-orientated model at the expense of small-scale agriculture.[113] The result is a narrow livelihoods mix within which income streams are highly sensitive to national or global shocks, for example the impacts of the global financial crisis on remittances and global commodity prices on the availability of waged labour.

Land as a key factor limiting people's ability to practice diversified livelihoods

Lack of access to land for the majority of the households in this study is a key limiting factor affecting livelihoods options and strategies, and peoples' responses to climate shocks and stressors. The negative impact of flooding on agriculture has been outlined above, but despite the losses to livestock, crops and investment, many people in El Coco clearly stated their desire to have access to land so that they could farm. When asked in a focus group discussion whether they

would prefer to be working their own land or working on the plantations if a storm came tomorrow, there was consensus on the fact that they would prefer to be working their own land. The argument put forward was that if people have land they can go back to work on it after a shock weather event, but they have no option with waged labour; it is out of their hands when, or indeed whether, they go back to work.

The sense given by research participants is that they feel they would be more secure and have more control over their livelihoods if they have land. One man, who has been growing African Palm since 2000 on four hectares of land he bought after giving up work on the citric plantations, said:

> *Now that I have my own plantations I feel more capable of resisting through bad weather.*[114]

Another man, who farms some land and rears pigs, said:

> *I always have food because I have my land.*[115]

Access to land is a problem in the village of El Coco because it is expensive and controlled by a few powerful plantation and cattle ranch owners. Few households in the study are in a position to purchase or even rent land at the current costs. Purchasing land costs approximately $1,500-$2,000 per acre and renting costs $50 per month. As expressed by one woman:

> *The land is owned by wealthy cattle ranchers and palm plantation owners. Even if we could afford to buy the land they do not want to sell it.*[116]

Land held by powerful local actors has been attained through various degrees of land purchase and acquisition – from the voluntary sale of land by campesino co-operatives to the forced sale or aggressive acquisitions due to land being encircled. One focus group participant described how his land was 'caged' as all the land around him was bought by a large landowner leaving him with no option but to sell. In other instances the land was simply taken from small farmers, as in the case of one former farmer from El Coco who previously owned a large tract of land, but the lands were fenced and then taken by big land owners.[117]

A number of these factors were likely at play in the loss of land by many previous land-owners in El Coco. Whatever the reasons in each case, the reality today is that access to land is beyond the reach of the majority of households and without it, livelihoods continue to be fragile and largely outside of people's own control – a key concern that emerged in this study.

Land conflict is also affecting access to waged labour on plantations. As highlighted in focus group discussions and interviews, current land recovery processes by *campesino* groups are resulting in a reduction in the number of jobs available on plantations as business owners restrict operations. One woman said:

> *The conflict between palm plantation owners and local residents has totally disrupted the local economy.*[118]

At the same time, a number of groups from the community have gained access to land in the surrounding hills of El Coco as a result of this movement, which they are now using to grow crops. While the land recovery process is currently impacting upon the community in different ways, it has succeeded in providing opportunities for livelihood diversification to numerous households that were previously unable to access land.

Box 9. Voices from the communities

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.***

Research participants from El Coco, Honduras.

Institutional support and underlying vulnerabilities

While the risks to livelihoods and physical assets from climate shocks and stressors in El Coco are clear, strategies employed to respond to climate events are, for the most part, based on short-term coping rather than longer-term improvements in capacities to respond to climate extremes. When asked what they did in times of flooding to ensure they had enough income or food, most people said they depended on food for work programmes, support from neighbours, while a large number of respondents spoke of reducing their food intake. In the words of one man:

> *Some people find food, others just have to hang in there.*[119]

If households have the ability to store food they will generally rely on this. For one person it was much harder to manage floods in the past. She explained:

> *Before I didn t rent land, so I didn t have basic grains stored.*[120]

A significant number of people also resort to selling or slaughtering their livestock, either for household consumption or sale. Overall household resources, whether agricultural or financial, are rundown during periods of flooding and storms.

Lack of appropriate institutional support is a key factor influencing the strategies people can employ in the short and long-term in response to climate shocks and stressors. Support for livelihoods, either for wage labourers or small-scale farmers, is largely absent in El Coco. Research participants named Fundación Popol Nah Tun, CARE, Action Aid and a local NGO Fundación San Alonso Rodríguez as some of the main providers of support to the community during flooding and storms. Interventions primarily focus on disaster management and response, including the provision of construction materials for repairing damaged houses, housing relocations, construction of drainage channels and food for work programmes. Interventions such as these, which meet immediate needs during an emergency, are critical. However, with the exception of some small-scale agricultural training provided by Fundación Popol Nah Tun, little support goes towards on-going development work within the community.

Local actors, such as NGOs, face significant challenges in trying to address the underlying issues making people vulnerable in the first place. Lack of access to land is an issue many local actors are unable or hesitant to tackle, given the conflict in the area and previous experiences of land titling projects which resulted in small-scale farmers selling their recently titled land to large landowners. Similarly, housing relocation programmes in El Coco have struggled to move people away from at-risk areas beside the river. Relatives or friends of the family that have been relocated will often move into the vacant at-risk house, resulting in a new set of people being at risk and perpetuating the cycle of vulnerability.* The difficulties local actors face in addressing these structural issues is undermining their ability to address vulnerability and support robust and resilient livelihoods.

Despite the existence of a local emergency committee in El Coco, known as a CODEL and established under the national emergencies committee COPECO (Comisión Permanente de Contingencias), according to members no local or national government support has ever been received; this instead is channelled to the town council. Many interviewees were cynical about government support, saying the municipality helps 'when its their time to run a political campaign' and that 'help doesn't get to the ones that are more in need',[121] or that they 'only support their own party members'.[122] Several other institutions that supported local production and community growth in the past are no longer functioning. According to one interviewee a government institution which used to provide loans is no longer doing so and in his opinion cattle ranchers seem to be the only sector of the population with the privilege of accessing credit.

Research respondents were readily able to identify the support they need to improve their circumstances and among the most common types identified were access to credit, access to land and job opportunities/investment in the area. Higher levels of organisation were also frequently cited as necessary to achieving their desired livelihood strategies. According to one man:

> *Our community needs organisation; we need to work in coordination. Access to credit would be very good, it would help us get on with things ourselves and not wait around for donations.*[123]

Another woman was definitive in her assertion that:

> *We need three items to improve our quality of life: consistent supply of water, stable work, and land.*[124]

Tensions, trade-offs and climate resilience

The data indicates that there are inherent weaknesses in the two dominant livelihood strategies-waged employment and small-scale farming; both are vulnerable to extreme weather events and engender some level of trade-offs in practice. People moving out of agriculture to work as wage labourers have the benefits of a regular income without individual investment or risk. However, employment is unstable and as community members reported, contracts are either unavailable or are offered for short periods so that employees can be made redundant and hired again the following month with worse conditions.[125] Waged labour also implies a dependence on external factors which are largely out of the control of local people and, as was seen from the discussion on land above, participants in this research considered the ability to determine when to resume work after a flood or storm as an important factor in their ability to bounce back from climate shocks.

*Programmes now insist on the former houses being destroyed once the new buildings are ready, to ensure people do not move into at-risk housing.

While the short-term benefits of waged labour are that immediate needs can be met by the income earned, it is questionable whether households dependent on waged labour are increasing their food and income security and their overall livelihoods resilience to climatic and non-climatic shocks and stressors in the longer-term.

There are also resilience trade-offs in small-scale agriculture. Though more autonomy over the means of production and consumption are assured, there are higher personal risks in terms of losses of time, finances and other inputs invested if the crops or livestock are affected by flooding or drought. Cash income gained from small scale agriculture can also be jeopardised by such events.

4.4. CONCLUSION AND RECOMMENDATIONS

This case study has highlighted the vulnerabilities experienced by different livelihood groups in El Coco. Households relying on waged labour from plantations and cattle ranches face uncertain employment prospects when the area is affected by storms, floods and, to a lesser extent, drought conditions, while small-scale farmers incur losses in crops, livestock and their investment. Both groups are negatively impacted by extreme weather events but this is one of various factors affecting their vulnerability. Government and non-government actors responding to the challenge of increased climate variability and working to build resilience must consider the context of multiple stressors if climate resilience/adaptation interventions are to be effective. A comprehensive approach that supports disaster preparedness and risk reduction, while providing sustainable and viable livelihood options, must be developed. Support for agriculture provided by external actors must incorporate more drought and flood responsive practices, and should include agro-ecological approaches. Structures for increased water management in the area are also required to ensure secure water access for the future.

Households face significant challenges in finding alternative livelihoods as options are extremely limited in El Coco. Changes have taken place in the livelihoods mix over recent decades, in response to perceptions about viable livelihoods shaped by increased climate risk, limited access to land, population movements, availability of particular types of employment and cultural factors. As a result the activities households in El Coco are more likely to engage in are dependent on external forces to a greater degree than small-scale agriculture. Government and non-government actors must address the lack of opportunities for alternative livelihoods. A broader vision is needed of the local economy and a combination of measures is required to promote non-farm wage employment sources and to stimulate small-scale businesses and petty trade through the provision of business development services. These should include specific strategies for increasing women's employment opportunities.

Failure to redistribute land as laid out in government policy has undermined people's ability to access land, perpetuating fragile livelihoods which are outside of people's control and limiting the extent to which small-scale agriculture and related options can be used to build more secure and resilient livelihoods. Rural development and agricultural policy and the lack of investment in rural livelihoods have also contributed to a dependence on livelihood options which are unreliable and highly sensitive to global economic trends, such as employment in palm plantations and a reliance on remittances from migrants.

The underlying structural causes of vulnerability in El Coco are not being addressed by government policy or institutional support, rendering most households ill-equipped to deal with livelihood shocks and stressors and resulting in a deficit in their ability to cope with the additional impacts of climate-related shocks and stressors. The dominant livelihood strategies of waged labour and farming have inherent limitations and trade-offs, and neither offer adequate resilience to the impacts of climate-related shocks and stressors. Diversification is recognised as one of the criteria for resilience by authors such as Osbahr and Tschakert[126] and in El Coco households who were doing some farming along with other activities, for example carpentry, a small business or indeed wage labour, generally seemed better able to manage climate shocks and stressors, as they could largely meet the food needs of the household from their own production and have some, if limited, savings from the other activities. What ultimately matters for climate resilience and adaptation is the overall livelihoods mix and the extent to which incomes can be derived from a number of sources.

Many of the solutions already exist. Research participants identified access to land, credit, job opportunities and investment in the area as key actions required to reduce vulnerability. Support to livelihoods needs to be based on local knowledge and needs. A shift in government policy and practice in relation to the key limiting factor of access to land is required. The government must fulfil its commitments and implement a programme of equitable land distribution in the area. This should be coupled with a reframing of agriculture and rural development policies and appropriate investment in climate resilient agriculture and diversified rural livelihoods, to ensure people are able to adopt more diversified and resilient livelihood strategies.

5. LIVELIHOODS CRISIS AND CHANGE IN SEMI-ARID KENYA

5.1. INTRODUCTION

The current crisis in East Africa unfolded over the course of the research. The drought was already underway when fieldwork started in Tharaka in Autumn 2009 and data collected testifies to the worsening situation over the two years. In a survey conducted in November 2009, 35 per cent of the sample identified 'lack of food' as the most significant problem facing the household; by December 2010 this had increased to 60 per cent. The rains have been consistently inadequate for supporting agro-pastoralist livelihoods in Tharaka and assets and capacities to deal with drought have been eroded by consecutive harvest failures.

Drought is not new to Kenya. The current crisis is more complex than a lack of rain and should be seen in the context of a myriad of issues, including persistent under-investment in the ASALs (Arid and Semi-Arid Lands) in the country, food price volatility, the loss of traditional coping strategies, as well as interrelated population and natural resource pressure. An existing deficit in people's ability to cope with livelihood shocks and stressors is being exacerbated by changing climatic patterns. Although the current drought cannot be directly attributed to climate change, the vulnerability of the communities in this case study to climatic shocks, and the projected impacts of climate change in East Africa of reduced rainfall and temperature increases, mean enhancing the adaptive capacity of communities in the ASALs in Kenya is an increasingly urgent imperative.

KEY FINDINGS

- Changes in rainfall patterns, in particular a decrease in rainfall volume and reliability, were 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 and due to limits within the strategies.

- 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.
- There are inherent trade-offs in some of the strategies being adopted; although the use of improved seed varieties and livestock breeds have benefits, they are more susceptible to disease and require additional inputs and household investment.
- Extreme climatic conditions combined with a significant existing deficit in adaptive capacity mean many strategies being adopted are having limited results in the current context.

5.2. CASE STUDY CONTEXT AND FOCUS

Fieldwork was conducted in the villages of Kathandeni and Uturini, Tharaka South division, Tharaka district (see map below). Tharaka is located in Kenya's Eastern Province and covers an area of 1569.5km2 to the east of Mount Kenya,[127] where the altitude ranges between 500m and 700m above sea level. Tharaka is part of the ASALs of Kenya, a region which has been marginalised politically and economically since the colonial period. In the decades since independence development policies for this region have focused on the commercialisation of crop and livestock production, tourism and the abolishment of communal land tenure, contributing to the breakdown of livelihood systems and coping strategies that are based on communal resource management.

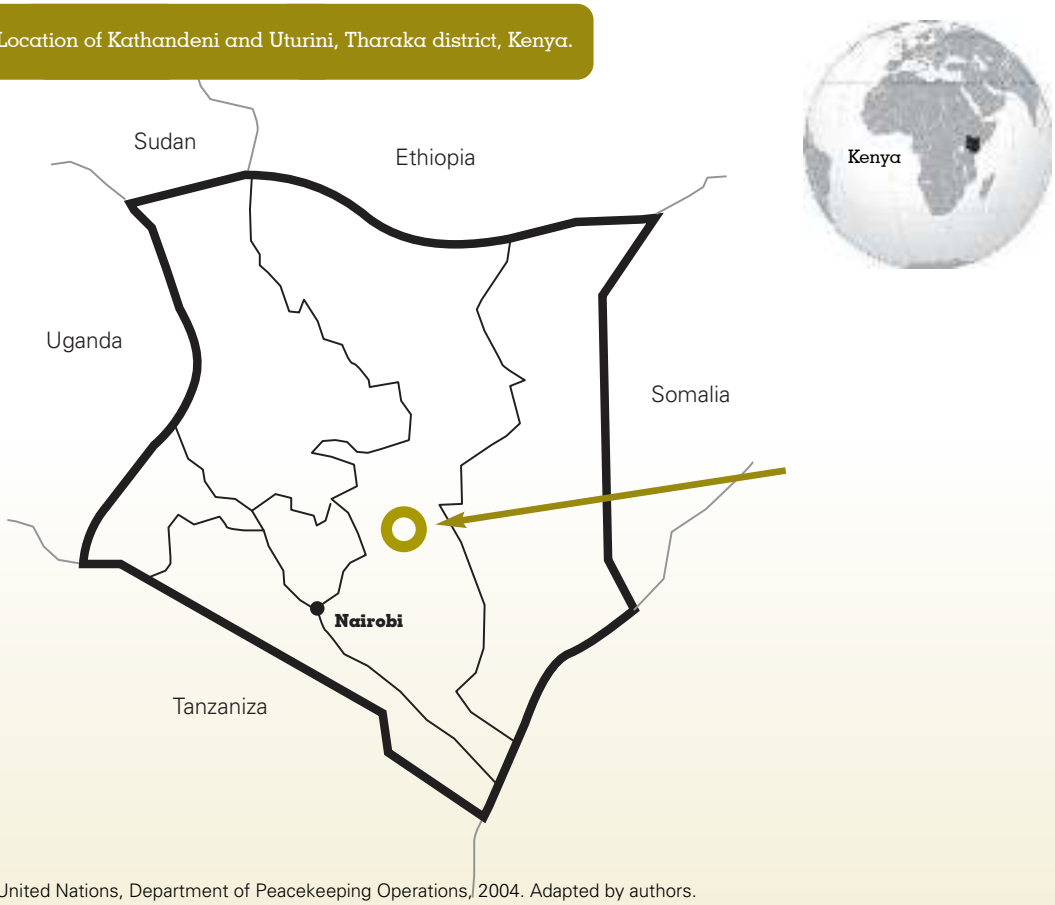
Tharaka district is home to 130,098 people and 27,393 households,[128] with Tharaka South being the smallest of three divisions of the district. The majority of the population are Tharaka people, a sub-group of the Meru ethnic group. The population of Tharaka is largely agro-pastoralist and agriculture (crops and livestock) accounts for 70 per cent of household incomes.[129] Key crops grown in Kathandeni and Uturini are millet, sorghum, green grams and cow peas. Maize is consumed as the main staple but it is mainly purchased as the area is too dry to support maize production and only a minority, 15 per cent of the households in the sample, are producing it. The average land holding size for households in this study is 2.8 acres. The main types of livestock kept are goats, cattle and chickens and holdings are relatively small; according to the baseline survey average holdings are eight goats, two cows and three chickens. Sales of livestock, crops and casual labour are the main sources of income for households while other strategies such as basketry sales and roadside kiosks also contribute to household income. Migration, predominantly of men, is a common coping strategy and during the course of this drought has been the main source of income for many households.

Average temperatures in Tharaka range between 24^{0}C and 37^{0}C.[130] The rainfall pattern is bimodal and average annual rainfall amounts are between 500 to 800mm. The long rains are expected in October to December and the short rains in March to May,[131] although these patterns are seeing increased variation and unpredictability. Research suggests that rainfall amounts are reducing in districts like Tharaka. A study conducted by the Kenya Meteorological Department indicates that there have been more occurrences of rainfall deficiencies since 1998 than enhanced rainfall occurrences over most parts of the ASALs.[132] FEWS Net have found that since the mid-1970s there has been a decline of more than 100mm in the long rains over central Kenya.[133]

In conjunction with decreasing amounts of rainfall, rainfall patterns have become more unpredictable. In research conducted in Tharaka, Smucker and Wisner found that 'the temporal pattern of rainfall has become less predictable and that the March–April rains, in particular, have been extremely unreliable for the past two decades.'[134] Temperature change has also been

documented and although the time periods differ slightly, a number of studies suggest a temperature increase of 1°C since the 1960s.[135]

Figure 7. Location of Kathandeni and Uturini, Tharaka district, Kenya.

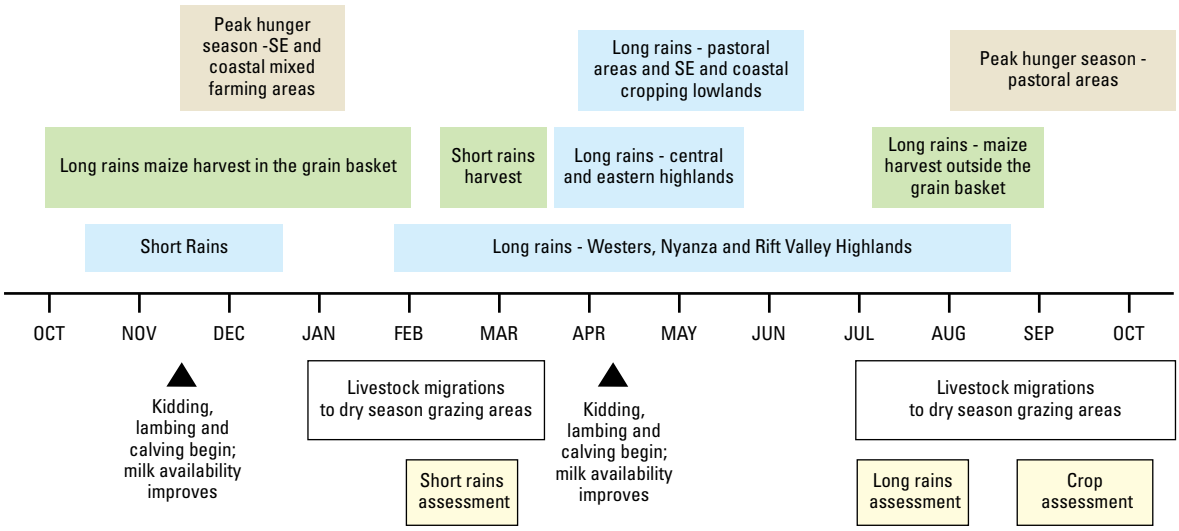


Source: United Nations, Department of Peacekeeping Operations, 2004. Adapted by authors.

Cumulative extreme weather events compound the situation of increasingly erratic and unpredictable rainfall. Although numerous droughts have affected Kenyans over the past 30 years, such as those in 1984, 1992-3, 1999-2001, and 2005-6, the current drought is frequently referred to as the worst the region has experienced in 60 years.[136] Successive seasonal rain failures, resulting in limited crop production and availability of pasture for livestock, have led to the current crisis which is affecting primarily the Eastern and North Eastern provinces of Kenya.

According to the District Strategic Plan 2005-2010,[137] 65 per cent of the population of Tharaka live in absolute poverty, compared to the national average of 52 per cent.[138] The Food Security District Profile from 2006 states that the district's food production is not only low but unsteady and barely meets the population's food requirements.[139] In August 2008, a year before the research started, the IPC Acute Food Insecurity rating classified Tharaka district as 'Borderline Food Insecure'. By August 2009 this had reached 'Crisis' stage; the third of five stages of food insecurity. Although predictions placed Tharaka as moving into the 'Emergency' classification in the final months of 2011[140] – one step below 'Famine/Humanitarian Catastrophe'- this was averted by above average short rains between October and December. However at time of writing food insecurity levels in Tharaka remain critical and are unlikely to improve given the forecast for below-average long rains in March-May 2012.

Figure 8. Seasonal Calendar and Critical Events timeline



Source: FEWS NET http://www.fews.net/pages/timelineview.aspx?gb=ke&tln=en&l=en

In light of the climate and food security context and after consultation with community members, partner staff and the research team, it was clear that changes in the farming systems were the most significant changes being made in livelihood practices in the two communities. The shifting emphasis between crop production and livestock keeping, and within that the incorporation of improved seed varieties and livestock breeds, were considered relevant and important areas to explore to understand how people are seeking to become more resilient in the face of increasing climate variability. Given that the research took place during a period of drought, this case study offered the opportunity to investigate adaptation strategies in the context of extreme conditions.

5.3. FINDINGS

Experiences of changing weather patterns in Kathandeni and Uturini

Changes in weather patterns, particularly changes in reliability of the rains, were reported widely throughout the surveys, focus group discussions and interviews conducted during the fieldwork in Kathandeni and Uturini. When asked about rainfall changes over the past 10-20 years, focus group participants spoke of droughts in 1990 and 1995, and a series of mild to severe drought events between 2000 and 2008/9. Heavy rainfall events were also listed as occurring in 1992/3 and 1997/8 but in general it was reported that poor rain events have become more frequent over the last 20 years.[141] Water and food availability were said to have declined in line with trends in rainfall, and water availability in particular was said to have been decreasing since the 1997/98 El Niño rains. There was also speculation from focus groups that declining incomes were connected to the unreliable rainfall patterns, which were considered to have been declining steadily since 1997.

In focus group discussions the following stresses were identified in relation to the use of natural resources for livelihoods: lack of rains, recurrent dry spells, reduced water masses, predators,

pests and diseases, wind (destruction), massive erosion, formation of hard-pan after erosion, soil infertility and a lack of harvests. Survey responses highlighted drought as a key concern for households in the two villages. In the baseline survey in Autumn 2009, 'drought' was the primary concern for 62.5 per cent of the sample. Combined with other related problems – 'drought and famine' and 'lack of rainfall' – this figure rises to 72.5 per cent. Some of the immediate impacts reported were 'lack of food', 'death of livestock', 'malnutrition' and 'lack of food and income'.

Adapting farming systems – livestock and crops

Data collected from focus group discussions and interviews points to significant changes in the farming systems of these two communities over the past three to four decades, with two broad trends being identified. Firstly there has been a shift in the livelihoods mix between livestock and crops. Livestock holdings have been reducing in number since the 1960s while the importance of crops has been increasing. According to participants in focus group discussions the average household kept 20 cattle and 50 goats in the 1960s; today the average number is reported to be two to three cows and five goats per household.[142] An increasing emphasis on crops appears to have begun in the 1970s, triggered by the 1976 drought, and according to focus group participants mixed farming (livestock and crops) was scaled up in the 1980s as drought became frequent.[143] More recently farmers seem to try to strike a balance between crop production and livestock keeping, prioritising and devoting most energy to whichever strategy is more feasible in the context of a set of given conditions, such as pasture availability, market conditions and weather patterns.

The second, more recent trend highlighted in focus group discussions is the incorporation of improved livestock breeds and crop varieties, largely in an effort to modify or improve the existing practices of livestock keeping and crop production. In the 1980s, breeds of goats and cattle which were not indigenous to the area, such as Galla and Toggenburg goats and Boran cows, were introduced to Kathandeni and Uturini and these breeds offered superior body weight, higher milk production levels and a good market price (approximately three to four times the value of local breeds).[144] Today people in the case study communities keep a mixture of indigenous and non-indigenous breeds of livestock (although the indigenous breeds comprise the majority) or cross-bred livestock, which allows people to avail of the potential benefits of both while managing risk, for example the susceptibility of non-indigenous breeds to disease.

Improved breeds of goats being dipped in order to prevent tick borne diseases.

A simultaneous shift has occurred in the composition of livestock holdings. In the past, cattle were the most highly-prized livestock because of the wealth and status they inferred. Though the beliefs linked to wealth and prestige remain, community members recognised that cattle are not as resistant to drought as goats. It is clear from survey responses and interviews that people are making decisions to switch from cattle to goats because the latter are better able to survive in drought conditions.

In relation to crops, new types such as green grams have been introduced for their higher market value and low rain requirements,[145] while improved varieties of millet (ICMV 221), sorghum (gadam and red varieties), maize (Katumani) and pigeon peas have been introduced for their drought resistance, short maturation cycles, higher production per acre and higher market prices.

Research participants prepare for a focus group.

It was suggested that the shifts between and within crop production and livestock keeping in the communities stem from a number of influences, which overlap and are difficult to disentangle, including changes in the land tenure system, institutional and government support, and declining rainfall.

Indications from focus group discussions and interviews suggest that the division and private ownership of land played a part in the increasing use of improved varieties and breeds, as households had smaller pieces of land to farm and lower numbers of livestock to rely on than was previously the case. As described by one interviewee:

> *Land demarcation stopped us from shifting cultivation so there are decreased nutrients in the same piece of soil and we could not get the advantages of the local varieties as before.* [146]

This resulted in the necessity to adopt a more intensive approach to crop production and livestock keeping. Beyond that, community members alluded to the higher yielding properties of improved crop varieties, and the higher milk production and market prices attained from improved livestock breeds, which acted as strong incentives for their adoption.

Government policy and external actors have been key in promoting and providing support for these measures. Reductions in livestock and an increased emphasis on crop production was facilitated by government policy during the 1970s and 1980s, which made crops a more feasible option for households in areas like Tharaka. Gitau et al. explain that as a result of drought-related food shortages in the 1979-1981 period, there was an 'increased emphasis on the development of drought resistance crops for ASALs including sorghum, millet, potatoes, beans, legumes and oil seeds'.[147] Support from the government through the provision of seeds was identified by a number of interviewees as one of the main reasons they were able to adopt improved varieties. One woman said:

> *The government extension officers advised us about these [improved seeds] and the government gave us seeds to test in the area.*[148]

Similar developments occurred in relation to livestock and focus group participants cited government policy and support for non-indigenous livestock breeds as key reasons influencing the adoption of non-indigenous breeds. As mentioned in a focus group discussion:

> *The government gave out certain breeds of goats like the Toggenburg.*[149]

External actors, such as NGOs and church organisations were also widely attributed with helping people in Kathandeni and Uturini adopt improved seeds and livestock breeds and, according to focus group participants, this was mainly to improve food production in the context of declining precipitation.

Box 10. Voices from the communities

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.

Constraints and barriers

Financial constraints

While research participants identified the many merits of improved crop varieties and livestock breeds, households face significant barriers in adopting and making use of these strategies. The adoption of improved crop varieties and livestock breeds is not widespread. The baseline survey revealed that almost 90 per cent of households in the sample were using local variety seeds for crop production and estimates from interviewees suggest that about 40 per cent of the community have not adopted improved livestock varieties. Improved seeds and livestock breeds are more expensive than local options, making them inaccessible for the majority of the households in our study without the support of external actors such as government and NGOs.

Improved seeds can be ten times the cost of local varieties and as they are more susceptible to diseases they require additional inputs such as pesticides, resulting in further costs. Similarly, improved livestock breeds are two to three times the cost of local breeds and, according to focus group participants, they require more management, for example dipping and vaccines, which increases the costs associated with keeping them. The implications of this for certain groups was highlighted by one respondent who stated:

> *The poor and most vulnerable have not been able to make these changes because they have no funds to buy seeds….single mothers and widows can't because it is expensive.*[150]

Limited availability of inputs

Even more problematic than the financial constraints is the limited availability of improved seeds. When asked about the resources needed to adopt improved seeds, participants in a focus group discussion highlighted the problem, stating that 'seeds are very scarce'.[151] It was reported that availability of improved seeds is low due to the fact that there are so few companies in Kenya with a mandate for seed production. Although the seed industry was liberalised in 1996, 'thus reducing the monopoly that the Kenya Seed Company has enjoyed for a long time'[152] others point to the prominence of the Kenya Seed Company in the market as an indicator 'of increased price co-ordination which suggests the existence of oligopolistic tendencies in the sector'[153] which may go some way to explaining the difficulty people experience in trying to access seeds.

In conjunction with these difficulties, the drought and subsequent food crisis is resulting in a shortage of seeds being reproduced in the area. As a consequence, accessing seeds that are appropriate for the local growing conditions is a challenge and most of the seed currently being purchased and planted in Kathandeni and Uturini is coming from areas outside Tharaka. One farmer, who was hopeful of getting seed from a similar agro-ecological zone, outlined the risks:

> *I think the seed will be good as it is in the same zone, and I don't have any alternative anyway. It's just trial and error.*[154]

This statement highlights the uncertainties and risks farmers face even if they can access seeds, and the need for appropriate training and information.

Limited training and information

Although access to the physical inputs is the first step to farmers adopting improved livestock and seed varieties, accessing quality information and training is key if farmers are to reduce the risks involved in adopting improved inputs. As outlined above, improved seeds and breeds come at a

high price and their adoption can incur losses of investment, as one farmer who is growing a range of improved variety crops explained:

> *There is a big loss margin because of the expenses to buy and maintain them.*[155]

Providing appropriate information and training on what strategies work is essential and focus group participants outlined the need for agricultural advice on appropriate seeds for the area if they are to adopt improved seed varieties. Indeed education in a general sense appears to be a factor influencing the take-up of improved seed varieties and livestock breeds. In discussions about people in the community who were adopting strategies such as the use of improved seed, one interviewee explained:

> *It is mostly only the educated, teachers, administrators who are making these changes. The common man can't afford to, and does not have the knowledge to do so.*[156]

This sentiment is endorsed by research from Ayieko and Tschirley who say 'some education increases adoption' of purchased (i.e. hybrid and improved) seed.[157]

Limitations of strategies

Although overcoming the barriers outlined thus far would increase the use and further take-up of improved livestock breeds and seed varieties, the limits inherent within these strategies must be acknowledged. Improved seed varieties in particular are proving to have limited ability to withstand the drought conditions being experienced in Kathandeni and Uturini over the past number of seasons. One farmer, who is growing mostly from improved seeds, said:

> *If I hadn't changed from traditional to improved varieties I wouldn't harvest or sell anything with little rainfall. But I haven't harvested anything for the last two seasons… They don't grow if the rains are poor.*[158]

She explained that she made the changes to her crops in the context of normal rainfall amounts but as a result of reduced rainfall the harvests are insufficient. This situation was repeated by the numerous household who have adopted seed varieties that were supposed to be suitable even with low levels of rainfall but which are not withstanding the drought conditions currently prevailing in the area. The extent of the drought over the past few seasons has been exceptional, and perhaps could not be expected to facilitate the cultivation of any crops. As one farmer explained:

> *We have had no harvest from the crops. We planted but nothing germinated; the crops dried at the time of germination as there was so little rain.*[159]

In light of this, the appropriateness of strategies currently promoted should be interrogated given current climate variability and projections for the longer-term.

The picture is less clear-cut with livestock. There is some evidence that improved breeds of goats are retaining their body weight and market price better than local breeds. One respondent reported:

> *The prices of livestock are low but the goat prices have remained ok.*[160]

This could, however, be linked to matters of supply and demand given the widespread losses of livestock that have occurred as a result of drought.

Land – a key limiting factor affecting strategies and diversified livelihoods

An overarching factor which influences many aspects of the communities' livelihoods and the changes to livelihoods that have occurred over recent decades is access to land. Previously land tenure was communal and agriculture was based around free-range grazing of livestock and shifting crop cultivation. Access to and use of natural resources was also communally managed. It was reported that land division began in the 1980s, led by both a national trend for land titling on the part of the government, and a fear about future ownership on the part of the clan, in the context of population growth and pressure on the availability of land.[161] This resulted in a process of land division, conducted by the clan. Individual plots of land were registered and recorded by village elders and copied to the Land Office, however our data indicates that few households in these communities, if any, hold title deeds.

Population pressures have also contributed to the decline in available land. Census figures indicate an average annual growth rate of 3.1 per cent from 1969–79 and 4.0 per cent from 1979–89 in Tharaka district. As can be seen in the table below, growth continued during the 1990s and 2000s, leading to higher population densities and growing pressure on the productive capabilities of the land use system and the natural resource base.

Table 6. Population of Tharaka District, 1969–2009

Year	Population
1969	37,031
1979	50,277
1989	74,929
1999	100,992
2009	130, 098

Source: Based on Smucker, T.A. & B. Wisner. 2008. Changing household responses to drought in Tharaka, Kenya: vulnerability, persistence and challenge. Overseas Development Institute. Blackwell Publishing, Oxford. Adapted by authors (2011)

The division and private ownership of land has had a significant impact on the approach to crop production. The ability to shift cultivation from one area to the next each season, and to plant crops wherever the conditions seemed most favourable, has been lost with the demarcation of land. As a result, households grow crops continuously on a small plot of land, without the possibility of leaving land fallow. The intensive use of the same small piece of land has resulted in more degraded and infertile soils and the land is now more unproductive than in the past. As one female farmer explained:

> *The disadvantage [of land demarcation] is that there is decreased production. The activities are intensive in one small piece of land, so it becomes degraded.*[162]

The result is lower harvests, and combined with unpredictable and inadequate rainfall, repeated crop failures.

Changes in land tenure also contributed to reductions in livestock numbers held as large livestock holdings became increasingly untenable. People no longer had the possibility of free-range grazing and the inability to keep large numbers of livestock on small plots of land led to a reduction in the size of livestock holdings. Research participants also stated that reductions in livestock holdings were linked to the decrease in available pasture because of reduced rainfall and because access to common pasture was no longer a possibility.

Women from Kathandeni and Uturini gather in the community hall for a focus group discussion.

The reduction in livestock numbers created a need for more efficient and productive livestock, and improved breeds of goats and cattle gained popularity. As this farmer explains:

> *The grazing zone reduced, land was demarcated so I reduced the big flock of local variety that I had to a few improved ones.*[163]

Increases in livestock and crop disease were reported by focus group participants as resulting from land division. As land was divided up and people had only small enclosed plots of land to grow crops and keep livestock on, disease outbreaks increased and are blamed on the close proximity that livestock, crops and humans were living in. However, there was an acknowledgement that new breeds of livestock come with new diseases and that improved variety crops can be more susceptible to disease, so land division is only in part responsible for the trend of increasing disease.

Beyond agriculture, a range of livelihood options that were available to agro-pastoralists in the past have diminished considerably as a result of the private ownership of land. Focus group participants reported a reduction in alternative income strategies, such as bee-keeping, hunting and to a certain extent basket-making, as many areas where these resources are available are now inaccessible to them. When land was communally owned, gaining access to areas for hunting or for picking Doum palm for weaving was not a problem, but focus groups participants and interviewees explained that they cannot access these areas anymore and in some cases have to pay for the Doum palm they used to pick freely, making basket weaving less profitable. However, other factors are also at play. Participants suggested that with the current food crisis, more people are turning to small income-generating activities such as basket-making, thereby increasing the competition for already scarce natural resources. Others reported that the reduction in rainfall has resulted in less flowers growing, therefore reducing honey production and its viability as an alternative livelihood strategy.[164] In this case the viability of alternative income generating activities as a mechanism to cope with drought is being undermined by the incidence of drought.

The strategies promoted in Kathandeni and Uturini, i.e. the increasing reliance on crops and the use of improved livestock breeds and seed varieties, are constrained by limited land access. The intensification of crop production as a result of small land holdings is undermining the fertility and productivity of the land, while the susceptibility of improved breeds and seed varieties to disease is exacerbated by limited space brought about by the demarcation and privatisation of land holdings. The possibility of employing a wide range of livelihood strategies, as was common in the past and as is crucial for future climate resilience, is undermined by the lack of access to land and natural resources that were available on communally held land in the past.

Tensions and trade-offs in strategies

The strategies highlighted in this case study are being promoted and adopted because of the benefits they offer users. It is worth acknowledging however that the extent of their use is limited due to resource constraints. The incorporation of improved livestock breeds, predominantly goats, was identified by focus group participants as a positive change because of the higher meat and milk production achieved, as well as the higher market price. However, improved breeds are not without their difficulties. The inability of certain breeds to tolerate harsh conditions, such as those found in Tharaka, and their lower resistance to disease – especially heart water - are among the shortcomings identified by research participants. As explained in one focus group:

> *Although less suited to the low climatic conditions, the people saw the new breeds as a way of increasing food production in the context of declining precipitation. They however retained the indigenous breeds in case of droughts.*[165]

While this makes them a less attractive option in some ways, the possibilities of getting a return on the investment are higher than with indigenous breeds, as this woman outlined:

> *For selling one of these improved goats we get 3000Ksh so with this we can purchase food, pay the school fees and hire a piece of land for the livestock…The sale of a small East African goat only gets a small price so I would not be able to buy food or clothes.*[166]

Trade-offs and tensions are also inherent in the strategies around crop production. As outlined above, improved seed varieties attain a higher market price than local varieties but they are more difficult to access due to limited availability and because of higher costs associated with their purchase and maintenance. In the context of decreasing soil fertility and unreliable weather patterns, improved seeds are also proving unproductive. Investing in improved seed varieties therefore poses high risks to farmers and highlights the tension within this strategy, which was intended to increase food production, incomes and resilience, but which in reality exposes farmers to increased vulnerability based on the uncertainties involved.

The current food crisis highlights the tensions and limitations of the strategies currently being pursued in Kathandeni and Uturini. There is little evidence to suggest households adopting these strategies are any better-off. Drought resistant seeds are not producing in drought conditions. Furthermore, although improved livestock breeds were retaining their market price and body weight better than local breeds, with few safety nets in place aimed at household retention of livestock assets, most had already significantly depleted their livestock holdings and would therefore not benefit from the good prices being offered in the market. Given recurrent drought conditions in the area and future climate projections, the tensions and limitations in these strategies must be acknowledged and appropriate action taken to ensure appropriate support for increasing the resilience of households in these communities.

5.4. CONCLUSION AND RECOMMENDATIONS

The current crisis in Kenya is the result of a low level of adaptive capacity to deal with livelihoods shocks and stressors, exacerbated by cumulative stressors which have eroded people's livelihood strategies, assets and resource base further. The introduction and adoption of new breeds of livestock and new seed varieties in Kathandeni and Uturini has taken place in response to factors such as changes in the land tenure system, government policy and external support and declining rainfall patterns. Interventions by government and non-government actors must recognise how livelihood systems and changes to these are shaped by multiple stressors and how climate

variability interacts with these as an additional stressor. Responses must therefore be comprehensive and address climate variability as one of multiple stressors.

The take-up of existing strategies is constrained by key factors. The relatively high costs involved in the adoption of improved seeds and livestock compared to local varieties, and the financial constraints facing many households are limiting the widespread take-up of these strategies. Accessing improved seeds is also a challenge, despite the Ministry of Agriculture's emphasis on the 'promotion of traditional high value drought resistant crops'[167] as a strategy to cope with the impacts of climate change. The research indicates that farmers lack the appropriate training and information on the strategies best suited to the local environment, without which the risks associated with adopting new strategies are great. Government and non-government actors designing and implementing interventions must recognise the barriers households and communities face in adopting improved inputs. More localised research is needed on seed varieties and breeds that are appropriate to local growing conditions. Training and information sharing must be prioritised in the roll-out of strategies. There is also scope for the development of community seed banks and seed production at a local level. In a broader sense, the high input model being promoted, based around improved inputs which are inaccessible to many, should be questioned and consideration should be given to a low input, low cost agricultural model.

Land, and the reduction in availability over the years as a result of private ownership and population growth, is an overarching factor affecting the viability of strategies around livestock, crop production and the ability to use natural resources, and which is in turn inhibiting people's ability to practice diversified livelihoods. The possibility of employing a wide range of livelihood strategies, as was common in the past and as is crucial for future climate resilience, is undermined by the lack of access to land and natural resources that were available on communally held land in the past. There is a need therefore to strengthen institutional frameworks that support equitable and secure access to and management of resources to support livelihoods. There is also a need for government policy, across the sectors, to take imperatives presented by climate change into account and to recognise the impact of policy and practice on households' adaptation capacity, in particular in the ASALs where land policy, among other factors, has undermined the capacity of agro-pastoralists in Tharaka to cope with drought conditions.

There are a variety of reasons why strategies being adopted are having limited results in the current context and for the medium-long-term. Although the use of improved seed varieties and livestock breeds have benefits, there are inherent tensions or trade-offs in each strategy. Despite greater body weights and higher milk and meat production, improved livestock are more susceptible to disease than local breeds. Improved seed varieties offer higher yields, but they require pesticides which is undermining the fertility of already degraded soils. In addition, it is worth noting that even those strategies designed and adopted to guard against drought, such as the use of improved seed varieties with drought resistant properties, are in more extreme conditions still not sufficiently well adapted. Government and non-government actors must recognise these trade-offs and short-comings and adapt the strategies they promote accordingly, as well as ensuring safety nets are in place to deal with the breakdown of strategies in extreme circumstances.

Consecutive seasons of drought have left the communities of Kathandeni and Uturini extremely vulnerability to its impacts. It is clear that current livelihood strategies are not sufficiently well adapted to current climate shocks and stressors. Ongoing and increased levels of support from government and non-government actors is needed to address vulnerability in order to prevent livelihoods from descending into crisis in the first place, while emergency responses must incorporate interventions that build resilience, recognising the constraints households face and the trade-offs and tensions inherent in strategies.

6

DROUGHT AND DIVERSIFICATION IN MALAWI

6.1. INTRODUCTION

Food security remains a key challenge in Malawi. Recent food crises in 2001-3 and 2005-6 have contributed to a significant drive to tackle national food insecurity, and policy interventions implemented over the past number of years have addressed this with some success. Given Malawi's 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 the food insecurity challenge is to be tackled over the long-term. Temperatures in Malawi are increasing and Balaka district, where the research took place, has experienced prolonged dry spells for the past three years. This study looked at how farmers are diversifying their agriculture in the face of these challenges, the constraints they face in doing so, and whether strategies being adopted are contributing to an increase in household resilience.

KEY FINDINGS

- 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 high 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, while adopting improved varieties requires additional financial investment in inputs (fertiliser and pesticides) for pre- and post-harvest management.
- Lack of access to these resources or to external institutional support which could enable access to them (e.g. through NGOs or the Farm Input Subsidy Programme) limit 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 undermine its potential effectiveness as a food security and adaptation measure.

6.2. CASE STUDY CONTEXT AND FOCUS

Malawi, ranked 171st out of 187 countries in the Human Development Index, is faced by immense development challenges. As high as 72 percent of the population face poverty and deprivation (according to the Multidimensional Poverty Index)[168] and almost one million adults and children in Malawi are living with HIV, giving it an adult prevalence rate of 12 per cent and placing it among the worst affected countries in the world.[169] Malawi's National Adaptation Programme of Action (NAPA) states that more than 90 per cent of the population are engaged in subsistence rain-fed agriculture, 60 per cent of whom are food insecure throughout the year.[170] Unreliableweather patterns in recent years have compounded the situation. Mean annual temperatures in Malawi have increased by 0.9°C since 1960,[171] while the incidence of droughts and floods has increased in frequency and intensity over recent decades.[172]

Food security is a fiercely political issue in Malawi, where it is commonlyconceived of in terms of adequate production and supply of maize. The vast majority of farmers grow maize but due to insufficient production levels 80 per cent of smallholder farmers are net buyers of maize[173] and its availability is a central concern for the Malawian government. In the first years of its implementation the Farm Input Subsidy Programme (FISP, previously named the Agricultural Input Subsidy Programme) focused on providing fertilisers and seeds for maize production. However, given the observed and projected climate scenarios for Malawi as well as the sensitivity of maize to drought, measures were needed to make agriculture more resilient to climate variability. Significant investment and attention from donors and policy-makers has been focused on achieving this and government policy, for example the Agricultural Sector Wide Approach (ASWAp), increasingly reflects the importance of diversification for achieving food security as a climate adaptation strategy. The FISP has been modified to a limited extent to now include a voucher for legumes since 2007/8.[174]

Ongoing fuel shortages and limited foreign exchange in Malawi, as well as a sharp reduction in budgetary support from international donors, raise questions as to the food security situation in the country in the near future. National agricultural production is heavily reliant on the provision of input subsidies through the FISP, and with indications that only a quarter of planned fertiliser had been delivered by late 2011, FEWS Net is predicting the 2012 crop harvest to be poor 'irrespective of seasonal rainfall performance, good farm managerial skills, and improved seed varieties'.[175]

The fieldwork took place in the neighbouring villages of Chiholomba and Chimdikiti, located in Balaka district, Southern Malawi. Balaka district covers an area of 2,193km² and is on the eastern edge of the Rift Valley. It has a varied topography, ranging in elevation from 350 to 800m. Temperatures range between 14°C (minimum) and 32°C (maximum) and average annual rainfall in Balaka is 800mm.[176] The villages are located close to Lake Malawi and the Shire River. Balaka district is home to 317,324 people.[177] Approximately 50 per cent of the population in the area

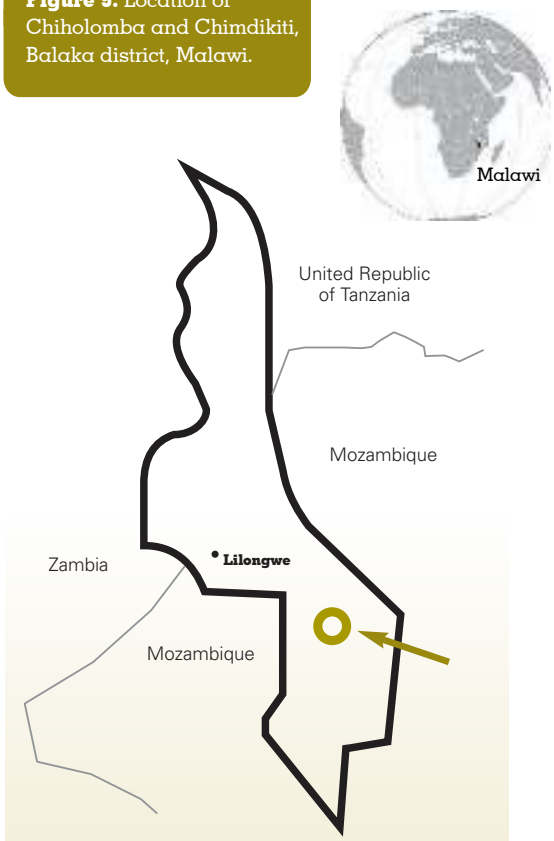
Village scene, Malawi.

belong to the Yao tribe,[178] while the remaining 50 per cent consists of Ngoni, Lomwe, Mang'anja and Chewa. The main religions are Christianity and Islam, representing 67.3 per cent and 31.5 per cent of the population of Balaka respectively.[179] Balaka is primarily inhabited by Yao speaking people and it follows a matrilineal kinship and lineage system, where residency is typically matrilocal,[180] i.e. husbands move to their wife's home upon marriage.

Balaka district is located in what the Welfare Monitoring Survey[181] classifies as the poorest part of Malawi, the rural southern region. According to Mangisoni et al. (2011) Balaka is affected by frequent dry spells and droughts.[182] The population of Balaka have experienced more food insecurity than most other parts of the country, partly due to the location of the district in a rain shadow area and the erosion of the area's productive asset base due to prolonged dry spells over the past three years.[183]

The area was selected as the case study location due to its vulnerability. Having consulted secondary literature, local staff and community members, diversification came across as a pertinent issue and an important factor in how households in Chiholomba and Chimdikiti have been adapting their agricultural practices over recent years. As such it became the main focus of this case study. The key concern was to establish the drivers behind diversification, what factors or support are enabling farmers to diversify and what are the constraints limiting their ability to diversify. This was also a pertinent issue to research given that government policy has increasingly emphasised crop diversification in recent years as a strategy for climate change adaptation.[184] Of particular interest was whether and how the FISP, a tool designed to increase food security, was encouraging diversification in practice and could be considered to be contributing to climate resilience.

Figure 9. Location of Chiholomba and Chimdikiti, Balaka district, Malawi.



Source: United Nations, Department of Peacekeeping Operations, 2004. Adapted by authors.

6.3. FINDINGS

Livelihoods and climate vulnerability

For households in Chiholomba and Chimdikiti the primary source of income was crop sales, which accounted for 32 per cent of the sample's main income source during the pre-harvest period in October and almost half – 46 per cent - during the harvest/post-harvest period in April. Maize is grown by all households in our sample, with groundnuts and pigeon peas the next most common crops, grown by 74 per cent and 67 per cent of households respectively. Other important crops include cotton, cow peas and sorghum. Chickens and goats are the main form of livestock but only 52 per cent of the sample keep livestock. Casual agricultural labour ('*ganyu*') is another important source of income for households, and firewood sales and small businesses (such as selling baked goods or operating bicycle taxis) are the main off-farm income sources for households in Chiholomba and Chimdikiti, with firewood consistently accounting for 10-20 per cent of households' primary income source, contributing most during the planting season.

Changes in weather patterns were reported as having the biggest impact on crop production and food insecurity. According to one male participant in a focus group discussion:

> *The main source of lack of produce or good harvest is the change in the rainfall pattern.*[185]

As Table 7 shows, food insecurity is an on-going problem in the two study villages.

Table 7. Percentage of Households experiencing food shortages in previous 4-6 months

Follow-up Survey 1 April 2010 (end of the hunger period)	Follow-up Survey 2 Aug 2010 (after harvest)	Follow-up Survey 3 Dec 2010 (second month of hunger period)
66.7%	29.7%	37.8%

Changes in weather patterns were reported by many community members in Chiholomba and Chimdikiti. Participants highlighted in particular an overall decrease in rainfall since the 1970s and increasingly unpredictable rainfall patterns. According to one interviewee:

> *Erratic rains and inadequate rainfall is more common these years than years back.*[186]

When asked about the main shocks that had occurred over the past 20 years both drought and flooding featured strongly in the responses. According to focus group participants drought, prolonged dry spells or erratic rains occurred in 2000, 2001 and 2008, while flooding occurred in 2004-5 and 2009.

Adaptation through crop diversification

Data from households and focus group discussions suggest that farmers in Chiholomba and Chimdikiti are both diversifying the range of crops they plant and using improved seeds with external inputs.

According to the baseline survey conducted in September 2009, over two thirds of households in the sample were growing three crops or more, including maize, groundnuts, pigeon peas, sorghum, cow peas and cotton. Focus group participants reported that maize, peas and groundnuts were the most common crops grown in the past but in the last five years many have started adopting sorghum, cotton, vegetables, sugarcane, banana, cassava and sweet potatoes.[187]

The motivations for farmers to include a wider range of crops are varied but changing rainfall patterns and the desire to reduce the risk of food insecurity are central. One interviewee said:

> *We diversified, as we like to have options in case of crop failure; we still have something for food and income if this happens.*[188]

Female participants in a focus group discussion explained that, by diversifying:

> *Households have food in times of hardships especially when drought occurs, other crops survive and provide food for households.*[189]

The potential to earn an income from the sale of crops grown is another motivation for farmers to diversify crop production. Cotton is grown purely for sale while sorghum, cassava, sugarcane and

vegetables are seen as both cash and food crops. If production surpasses the food security needs of the household the sale of the surplus provides much needed financial resources for the purchase of essential household items. While maize is still seen as the main crop grown for, and considered as providing, food security at the household level, other crops are increasingly gaining recognition for the benefits they offer, whether for household consumption or for sale.

Adaptation through improved seeds and external inputs

The use of improved seed varieties is seen as an important part of responding to the challenges of reduced rainfall and food insecurity, although the data suggests it is not as widely practiced as crop diversification in these communities. While focus group participants estimated that 30 per cent of farmers in their village had adopted 'modern farming methods'[190] (i.e. improved seeds), the baseline survey of a sample of community members shows that 45.9 per cent of crops grown were local varieties but almost the same amount (42.5 per cent) were improved varieties. Farmers are adopting improved varieties across a range of crop types, including maize (hybrid MH18), groundnuts (CG7), pigeon peas, sorghum, cassava, sweet potato and cotton.*

Box 11. Characteristics of MH18 and CG7

MH18 is an early-maturing hybrid maize seed and CG7 is an early-maturing groundnut seed. Both are valued for their resilience under drought conditions and in soils of poor fertility.

Farmers reported high yields and early maturity as two desirable traits offered by improved variety seeds in the context of unpredictable rainfall patterns. One farmer, who introduced improved varieties of maize, groundnuts, rice, cassava and sweet potato, did so for a number of reasons:

> *Because they are high yielding and early maturing. The rains tapered off during the growing of local varieties…they take 3-4 months to grow and the rains are not there.*[191]

Another farmer reported harvesting 20 bags of maize since introducing an improved variety, compared to previous harvests of five or seven bags, while yet another said that:

> *By using improved maize we have seen very good results. It is very high yielding, we harvested 40 bags.*[192]

In conjunction with this, the likelihood of higher yields from the use of improved variety seeds is also important for the potential to sell on excess produce. Some respondents grow improved maize specifically for sale and prefer to keep the production from local variety seeds for household consumption due to its reported superior taste and properties. As one woman explained:

> *Hybrids are high yielding, so we get more bags of maize but you need a lot more flour to make nsima thick from the hybrids. And there is a better taste from the local seed. We try to grow hybrid maize for income generation… it is a great loss to sell the local maize.*[193]

*Within the sample cow peas, pumpkin, finger millet and millet were grown exclusively from local varieties

The availability of external institutional support is a key influence on whether households practice crop diversification and use improved seeds. NGOs are the main actors promoting crop diversification, through the provision of seeds and technical assistance. The government are primarily promoting the use of improved variety seeds by distributing improved maize, cotton, tobacco, and to a limited extent legume, seeds through the Farm Input Subsidy Scheme. The data suggests that accessing new crop varieties would not be possible for many households without the support of NGOs, while accessing the government subsidy is central to households' ability to access improved seed varieties as they lack the financial resources to purchase these seeds. However other resources are equally as important for the successful adoption of new crop or improved seed varieties.

One farmer's harvest of maize.

Resources required for strategies to be adopted

Labour availability

The availability of labour is a pre-requisite for crop production in any instance, but especially so in Chiholomba and Chimdikiti where one of the strategies being promoted to achieve food security and increased climate resilience, i.e. crop diversification, comes with perceived additional labour demands. While crop diversification may involve increasing the area of land under cultivation, which has clear labour implications, in the case of Chiholomba and Chimdikiti it was reported that managing several crops, irrespective of the size of land, is more labour intensive than single crop production.* One male farmer, aged 40 and in good health, said:

> *Diversification is labour intensive. The planting is ok but weeding demands a lot of labour and it has to be done quickly and at the right time, so we need cash or maize to get external labour in to help.*[194]

However, households face significant labour constraints, both as a direct result of illness and as a result of care-giving to family or household members. Survey responses show 'health problems' or 'illness' were the main problems consistently affecting between 20 per cent and almost 60 per cent of households, peaking between August and December – a key time in demand for labour as planting for the main season takes place between October and December.

Table 8. Percentage of households' listing 'illness' or 'health problems' as the main problem affecting the household

Baseline Survey Sept 2009	Follow-up Survey 1 April 2010	Follow-up Survey 2 Aug 2010	Follow-up Survey 3 Dec 2010
21.1%	45.2%	58.6%	58.1%

*This point is commonly contested by the donor and NGO community, but respondents in this research reported additional labour demands from crop diversification. It was beyond the scope of this research to investigate the nuances of this issue in sufficient detail and further research is therefore recommended.

In general those who are sick or have sick family members spend less time in their fields and have lower yields as a result. Some of the impacts of ill-health given in survey responses were 'not able to work hard in the fields', 'spent more time caring for sick than in the fields' and 'delayed farm preparations'.

In conjunction with reduced labour availability as a result of illness or care-giving, labour shortages are also created by food and income insecurity, which forces many households to seek casual labour or '*Ganyu*' outside of their own farm. Although it provides income for households to purchase food during the hunger gap period (November to April), it has a detrimental effect on the productivity of their own farms, as there is limited time for weeding which undermines production in the longer-term and increases the likelihood of food insecurity. One female focus group participant explained:

> *If we have seeds we can plant but most of our time is spent on 'ganyu' to get food so there is no time to spend in our own fields.*[195]

In this context, the additional labour requirements associated with crop diversification would appear to be a significant constraint to adopting this strategy.

Access to inputs

As outlined above, there are strong food and income security motivations for adopting improved seed varieties. The cost of seeds would however inhibit many households from accessing these seeds were it not for support from NGOs and the government. Improved seed varieties also require additional inputs such as fertiliser and pesticides, which local seeds do not, as highlighted by one interviewee:

> *My observations are that people use hybrid maize for sale, as you can only keep it if you are using pesticides. Local variety maize can be kept in a granary for as long as you desire.*[196]

Chemical inputs are unattainable financially for many households in Chiholomba and Chimdikiti. One woman reported that pesticides are cheap:

> *It is MK100 per bottle, which will do three bags of maize so I can usually manage to get this.*[197]

However another man said:

> *We're not growing large amounts of MH18 [hybrid maize] as it requires pesticides and we cannot afford these.*[198]

In a focus group discussion looking at the main barriers to adapting farming strategies, a female group identified 'lack of fertiliser' as the number one reason preventing increased use of improved seeds, as they felt that without fertiliser there is crop failure, while a male group identified 'lack of start-up capital to buy seed and inputs' as the primary barrier.[199] For households with very limited resources, the possibility of adopting improved seeds is constrained by the additional inputs required by this strategy, making it an option only for those households with some level of resources. The FISP is designed to address this very problem - difficulties in accessing agricultural inputs such as seeds and fertiliser.

Access to technical training and knowledge

Though the lack of physical and financial resources are significant constraints to diversifying, technical information and training are also fundamental in order to reduce the risk of losses, as highlighted by this farmer who had a very good harvest of maize:

> *All 40 bags have been weeviled so the maize has turned to dust. We had no access to technical information; hybrids are easily attacked by weevils but this is the first year growing these varieties so we lacked the information.*[200]

'Lack of knowledge, ignorance about diversification' was identified by male participants in a focus group discussion as one of the top three reasons why people are not diversifying their production. Support from government extension workers was reported as limited and infrequent and focus group participants suggested that in the village there should be:

> *More than one club [agricultural group with external support] to allow more people to participate and get the knowledge. Knowledge is just circulating among the very same few people.*[201]

Given that the provision of seeds is a strategy employed by the government and some NGOs, this raises important questions regarding targeting and coordination. Without appropriate and adequate training and technical support, the investments made by farmers to incorporate improved seed varieties will be lost; farmers with the least resources, who have the least ability to take a risk, will not diversify and will continue to rely on strategies that, according to most research participants, are under-performing in the current weather conditions.

Limited land access

Finally, the issue of land was identified by focus group participants as a key factor affecting crop diversification. Although increasing the number of crops grown does not necessarily require additional land (as crops can be intercropped) there was a perception among many research participants in Chiholomba and Chimdikiti that land acted as a constraint to crop diversification. It was stated that 'diversification needs a lot of land' and in one focus group 'lack of farming land' was identified as the second most important barrier to diversifying.[202] Population pressures are likely part of the reason as the villages have experienced significant population growth in the past decades due to the arrival of migrants from other parts of the country. According to focus group participants 'land farming sizes are very small because of overpopulation' and 'all the arable land has been used for cultivation'.[203] New or recent arrivals are likely to have the least land to farm as there is little left to be allocated and although the median land holding size of the sample households is two acres, the variations within this range from half an acre to 11 acres. The increasing competition for land and assumptions around the need for additional land for growing additional crops is contributing to a perception that land is a barrier to diversification.

Institutional support – opportunity or barrier to diversification

The previous section outlined the resources required for crop diversification and the use of improved seeds and while some households have these and other financial resources which allow them to diversify independently, for most households in these two communities, access to institutional support is the main vehicle for adopting these strategies. This section will deal with the two main institutions supporting crop diversification and the use of improved seeds; non-governmental organisations and the government through the FISP.

Farm Input Subsidy Programme

The FISP is a government-run scheme which subsidises fertiliser and seed for approximately 50 per cent of farmers in Malawi.[204] The programme's core objective is to achieve food security and increase incomes for resource-poor smallholder farmers through increased food and cash crop production by the use of improved agricultural inputs.[205] While research suggests that the subsidy programme has been successful in improving national food security,[206] problems with its implementation were reported by participants in this study and have been documented in other research.[207] During focus group discussions problems were outlined with the scale, targeting and timing of the subsidies. For example, in Chiholomba it was reported that only 44 coupons were distributed in 2010 for a village of almost 300 households. Many participants also felt that the targeting was unfair, stating that 'the problem is that those who are rich are the ones who get the support due to their popularity' and that the officials 'overlook the poorest… they think that the poor will not be able to produce even if they get fertilizer'.[208] In relation to timing, the coupons were said to be distributed too late in the season to be put to use.

The key concern, however, in terms of institutional and policy support for diversification, is the disconnect between the rhetoric promoting the FISP as 'a vehicle for crop diversification'[209] and its continued emphasis on maize. Focus group participants explained there were difficulties in accessing seeds for other crops so effectively there was only support for maize. One woman explained:

> *The coupon is supposed to allow you access to MH18 [hybrid maize], pigeon peas, groundnuts and cow peas but these are not available here. You have to go to Balaka if you want these and the cost of travelling there is equal to the cost of buying the seeds here without the coupon.*[210]

Men take part in a focus group discussion in Chiholomba looking at the main shocks and stressors affecting the village over the past number of years.

Donor support for the funding of the programme was based on the fact that it would promote crops other than maize.[211] The continued emphasis on maize through subsidies, and problems utilising the subsidy for other crops, limits small farmers ability to diversify and if anything reinforces the preference for maize, therefore undermining the incorporation of more resilient crops.

Support from non-governmental organisations

The question of the targeting of institutional support was raised a number of times throughout the fieldwork. While this is clearly an issue in the implementation of the FISP, support from NGOs also appears to fail to reach some of the most vulnerable people in these communities. Data suggests that older people in particular are practicing very limited, if any, diversification of crops or use of improved seeds and part of the reason given for this is that they are not targeted by NGOs and extension workers for agricultural training. One older woman said that because she was illiterate, she could not be included in the training schemes while another said because of her age, access to credit was not possible and she therefore could not join an agricultural support group.

Another possible reason is that NGOs promoting diversification seek to work with active farmers and, as outlined above, crop diversification comes with additional labour demands, resulting in older people being excluded as a target group for these interventions. While there may be some basis for not wanting to impose further labour demands on older people, it appears that those who are not diversifying are experiencing extreme difficulties in achieving food and income security and therefore require a more tailored response to sufficiently provide for older or vulnerable groups. While Chinsinga et al. state that 'there is consensus on the desirability of crop diversification as an adaptation strategy',[212] the evidence from this study suggests that it is not a strategy available to all groups, and that institutional supports are contributing to the creation rather than the elimination of the conditions which lead to the exclusion of certain groups.

Tensions and trade-offs for adaptation and resilience

Improved seed varieties offer higher yields, contributing to household food security and the possibility of increasing income. Drought tolerant properties also make them more attractive given the experience of unpredictable rainfall patterns. However the risks of the harvest being attacked by pests (weevils) is greater than with local seed varieties, and fertilisers and pesticides are required for the pre- and post-harvest management of such crops. The chemical inputs required by these seeds have environmental implications. Focus group participants highlighted this issue saying 'reliance on fertiliser has contributed to soil infertility' and added that fertiliser supports only the plants while the application of manure supports the soil.[213] It may also lock farmers into a particular pathway, leading them into a dependence on inputs which many may not be able to afford without the government subsidy. Combined with population growth and limits to new land available for cultivation, this intensification strategy – despite the short-term benefits if it is accessed and implemented properly – is questionable in the context of building resilience in the longer-term.

Box 12. Voices from the communities

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.***

6.4.CONCLUSION AND RECOMMENDATIONS

Households in Chiholomba and Chimdikiti are experiencing declining rainfall levels and more erratic patterns of rainfall, as well as regular incidences of drought and flooding. They are adapting their farming to deal with these and other non-climatic stressors by diversifying the range of crops grown and incorporating improved seed varieties. However, there are significant barriers to adopting these strategies. Households have limited labour, which is important for crop diversification, and financial constraints, impacting upon the adoption of improved seed varieties which require additional chemical inputs for pre- and post-harvest management. Technical training and support is limited, adding to the risks associated with the adoption of strategies. Land availability is also perceived as a barrier to crop diversification. It is also clear that institutional support is failing to target some of the most vulnerable households. While those who can access the necessary resources and external support to adopt strategies are seeing increased food security, greater dietary diversity and increased incomes, those who cannot remain food insecure and are unlikely to move out of this situation without underlying structural factors being addressed. Government and non-government actors must recognise the barriers faced by households in adopting strategies and ensure that the promotion of crop diversification and the use of improved varieties are accompanied by appropriate technical support and knowledge transfer. Government and non-government actors must also develop more tailored responses to ensure that different categories of people, especially the most vulnerable, are included in and are able to benefit from interventions.

Inconsistencies between government policy and practice were highlighted by the limited support available for crops other than maize through the FISP. The government should seek to address this incoherence by ensuring that subsidies for crops other than maize are available in practice. Support should also be appropriately targeted to reach those who have the greatest difficulties in accessing agricultural inputs.

There are clear tensions and trade-offs with the use of improved seeds. While they offer higher yields, the need for chemical inputs could undermine the productivity of the land in the longer-term and may leave households in Chiholomba and Chimdikiti more vulnerable to climatic shocks and stressors in the future. It may also create a dependence on inputs which can only be afforded with external support. Actors promoting the use of improved seed varieties must recognise and factor into planning these trade-offs and their implications on longer-term resilience. Soil and water conservation practices should be scaled up and organic manure production should be promoted to address the challenges of soil fertility and to reduce the dependence on chemical fertiliser.

Diversification of crop varieties also presents tensions. While it reduces vulnerability to crop failure and food insecurity by spreading the risk across a number of crops in the Malawian context, given the labour shortages, it is faced with significant challenges. If it is to be employed as a tool for climate adaptation and food security, crop diversification needs to be appropriately supported, recognising and addressing the constraints around labour or, as Eriksen et al.[214] assert in their Principles for Sustainable Adaptation, to 'recognize the context for vulnerability, including multiple stressors'. Investment and further research into the most appropriate and least labour intensive models of diversification are required.

7

CONCLUSIONS AND RECOMMENDATIONS

This research investigated how people in four case study locations are experiencing and responding to climate shocks and stressors, what factors are supporting or undermining their capacity to respond, and whether or not actions taken move people on a path towards becoming more resilient in the face of a changing climate. The report presented the findings from Bolivia, Honduras, Kenya and Malawi, which although very different in geographical, social, political and institutional contexts, offered common features of how households and communities are adapting their livelihoods. The study focused predominantly on the resilience of agriculture and agriculture-based livelihoods systems.

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

1. Household responses to observed 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 studies. 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 resources constraints, market forces, institutional incentives and increased climate variability. Responses are driven by multiple stressors and not any single factor. In Kenya, for example, improved seed varieties have been adopted for their greater drought tolerance and potential to produce more 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. 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 are also vulnerable to climatic factors, such as casual agricultural labour.

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 climatic changes are increasing pressure on resources and aggravating vulnerability. In Kenya and Malawi these processes are limiting the options for alternative livelihood strategies while in Bolivia competition for water resources are creating heightened tensions. 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 governmental policy, is key in influencing livelihood strategies and adaptation options. The evidence shows that some of these strategies contributed to increased food and income security. Households in the study communities are cognisant of both the benefits and trade-offs of strategies being promoted with regard to their future resilience. For example 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 that 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 fail; in Honduras, waged labour appears as risky as farming to climatic and other shocks, despite climatic risk associated with farming being a factor in why some households moved out of farming. Across all four case studies, whatever changes households are making, it remains the diversity and flexibility in households' livelihoods strategies that determines resilience.

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

Many options for increasing resilience exist and there is significant scope for building on those strategies where households are seeing positive outcomes such as crop diversification in Malawi or small-scale irrigation in Bolivia. However it was also clear in these case studies that whether governmental or non-governmental, support does not reach all households and households face constraints in adopting strategies supported. External support was often seen to be limited in its scope and coverage, poorly targeted and inappropriate for particular households. In Malawi 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, skills and education as affecting their ability to take up new strategies or to implement them effectively.

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 requiring 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 move of many households in El Coco out of small scale agriculture to become more dependent agricultural wage 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.

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, is not 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 agriculture 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 agriculture and rural development, placing the rights and resilience of the most vulnerable communities at the centre. This 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 for the creation of non-farm income sources is also critical for diversified livelihoods and increased resilience to multiple livelihoods shocks and stressors.

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 in 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-terms 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 around locking households into pathways which 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 livelihoods 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 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 vulnerable to the additional stressors presented by increased climate variability are those households whose ability to cope with existing livelihoods shocks and stressors is in deficit. Trócaire believes a rights-based approach is needed to ensure policies and support for adaptation focus on the most vulnerable and empower them to secure their rights, while enhancing the government's ability 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 both 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.

Children from Malawi

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TRÓCAIRE
Working for a Just World

Head Office: Maynooth, Co. Kildare, Tel. +353 1 6293333
Dublin Office: 12 Cathedral Street, Dublin 1, Tel. +353 1 8743875
Cork Office: 9 Cook Street, Cork, Tel. +353 21 4275622
Northern Ireland Office: 50 King Street, Belfast. BT1 6AD, Tel. +44 28 90808030
Derry Office: Carnhill Resource Centre, Derry, BT48 8DA, Tel: +44 28 7135 7288

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