

Lived experiences of an integrated adaptation project: lessons for adaptation programming in Tanzania

By

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Declaration of Authorship

The candidate confirms that the work submitted is her own, except where work which has formed part of jointly authored publications has been included. The contribution of the candidate and the other authors to this work has been explicitly indicated below. The candidate confirms that appropriate credit has been given within the thesis where reference has been made to work of others.

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The conceptual underpinnings and research design were agreed by all authors. The framework and methodological design were led by the candidate. The candidate performed the data collection and full analysis and created all figures and tables. Secondary data was also used collected by the project partners. The text and findings were written up by the candidate, with contribution from S.M Sallu and M.Di Gregorio. Editorial text editing and revisions were undertaken by all authors, led by the candidate.

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Abstract

The implementation of adaptation projects is often confined by project boundaries and limited by time and funding, leading to a focus on technical solutions. However, vulnerability extends beyond these constraints, necessitating new forms of research and learning, such as examining lived experiences of adaptation projects. Embedded in a research-practitioner collaboration, this thesis incorporates elements of reflexive learning to investigate the lived experiences, implications, and lessons learned for adaptation programming from a collaborative integrated project in rural Tanzania. Employing an interdisciplinary mixed-methods approach involving 291 households survey and ethnographic data from 60 narrative interviews, 31 semi-structured interviews and participant observation, the thesis combines traditional objective evaluation approaches with subjective accounts to generate learning for adaptation programming.

Findings are presented in three empirical chapters. The first results chapter assesses vulnerability and resilience in the context of project implementation. Through research-practitioner collaborative learning, an innovative framework and methodology is developed, which deepens monitoring and evaluation processes by revealing how projects influence different dimensions of livelihood resilience. A second analytical chapter explores the lived experiences of the adaptation project in a biodiversity hotspot, highlighting how historical legacies seeping into project design and implementation inhibit learning and reinforce 'repackaging' of conservation as adaptation. The final analytical chapter employs public policy theory to show that technologically and politically inappropriate projects cannot be institutionalised in policy unless local knowledge and experience are considered.

The examination of lived experiences of projects redefines adaptation as a reflective learning process within individuals and institutions. The thesis observed a varied understanding of vulnerability, with more compassionate perspectives emerging at the individual level rather than the institutional level. This implies that the root causes contributing to these issues might be situated at higher programmatic levels, such as donors. Furthermore, the thesis highlights that the design and execution of projects are indeed bound to specific spatial and temporal frames. Although these constraints

may be easier to control, they typically do not align with the lived experiences of local communities, leading to maladaptive outcomes.

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List of Acronyms

ASSAR	Adaptation at Scale in Semi-Arid Regions
BA	Before-After
BACI	Before-After-Control-Impact
BH	Biodiversity hotspot
CbA	Community-based adaptation
CBD	United Nations Convention on Biological Diversity
COSTECH	Tanzania Commission for Science and Technology
COWSO	Community Owned Water Supply Organisations
CSA	Climate smart agriculture
DiD	Difference-in-differences
EbA	Ecosystem-based adaptation
EU	European Union
EUM	East Usambara Mountains
FG	Focus groups
GCCA+	Global Climate Change Alliance's
GGA	Global Goal on Adaptation
HHs	Households
INGO	International non-governmental organizations
IPCC	Intergovernmental Panel on Climate Change
IUCN	International Union for Conservation of Nature
LDCs	Least Developed Countries
M&E	Monitoring and Evaluation
MSF	Multiple Streams Framework
NAPA	National Adaptation Programme of Action
NCCRS	National Climate Change Response Strategy
NGO	Non-governmental organisations
NP HHs	Non-participant households
O&OD	Opportunities and Obstacles to Development framework
ONGAWA	Engineering for Human Development (Sp. Ingenieria para el Desarrollo Humano)
P HHs	Participant households
QUAL	Qualitative

QUAN	Quantitative
REDD+	Reducing Emissions from Deforestation and Forest Degradation
SIDS	Small Island Developing States
TASAF	Tanzania Social Action Fund
TFCG	Tanzania Forest Conservation Group
UN	United Nations
UNEP	United Nations Environment Program
UNFCCC	United Nations Framework Convention on Climate Change
USD	United States Dollar
WB	World Bank
WUA	Water Users Associations
WWF	World Wild Fund for Nature

Chapter 1 - Introduction

1.1 Why study lived experiences of adaptation projects?

Adaptation is defined as ‘the process of adjustment to actual or expected climate and its effects, in order to moderate harm or exploit beneficial opportunities’ (IPCC, 2023: 2). The implementation of adaptation often occurs through ‘projects,’ a practice referred to as the ‘projectisation’ of adaptation in the climate adaptation literature (Eriksen et al., 2021; Mikulewicz and Taylor, 2020). Adaptation projects are proliferating, especially in the developing world, and this trend is expected to continue as funding for adaptation increases. For instance, public finance allocated for adaptation witnessed a 35% surge between 2015 and 2018, reaching an annual average of \$30 billion (Buchner et al., 2019). Although this falls short of the \$100 billion pledged for adaptation in the Paris Agreement (UNEP, 2018), the current funding level has already facilitated the execution of thousands of adaptation projects globally (Mills-Novoa, 2023).

However, this approach to implementing adaptation through projects has significant drawbacks. Adaptation projects, characterised by well-defined boundaries, limited time frames and funding, and frequently framed to ‘reduce vulnerability’ and ‘increase resilience,’ tend to view adaptation as a technical problem requiring technical solutions. Consequently, anything that happens beyond these technical boundaries often remains overlooked (Nightingale et al., 2020). Yet vulnerability is inherently contextual, shaped by complex socio-political and economic relationships (Adger, 1999; Kelly and Adger, 2000; Dilling et al., 2015). A lack of understanding of the vulnerability context and focusing solely on technical adjustments may lead to negative externalities and maladaptation (Eriksen et al., 2021; Schipper, 2020).

Furthermore, adaptation is an ongoing process of continual adjustment (IPCC, 2023), making it impossible to define any form of adaptation success within the confines of a project’s boundaries (Mills-Novoa, 2023). If successful adaptation is to be achieved, it will not occur within a single programme or project cycle (Dilling et al., 2019). However, existing project evaluation methods and tools are often constrained

within such boundaries, predominantly focusing on whether the project plan was fulfilled rather than assessing the overall soundness of the plan from the outset.

These limitations highlight the importance of a new approach to studying adaptation projects. By engaging with the lived experiences of these projects and understanding the processes by which adaptation is attempted, we can gain deeper insights into the real-world impacts and complexities of adaptation efforts. This approach can help uncover the broader socio-political and economic contexts that shape vulnerability and inform more effective and holistic adaptation strategies. Therefore, studying the lived experiences of adaptation projects is crucial for advancing our understanding and practice of climate adaptation.

This thesis addresses these considerations by embarking on a learning journey to study the lived experiences, implications, and lessons learned from a collaborative, integrated adaptation project in rural Tanzania in real-time. Using an interdisciplinary mixed-methods approach, which includes survey data and ethnographic immersive fieldwork, the thesis aims to combine traditional 'objective' evaluation methods with 'subjective' accounts (Jones, 2019)¹. This approach highlights the diversity of voices, differential meanings, and varying goals of the project stakeholders to generate valuable insights for adaptation programming. The thesis delves deeply into the processes of the adaptation project to unpack the stakeholders' lived experiences, the project's implications, and the lessons derived from this learning journey. By processes, I do not refer to the mechanics of planning and implementation or its programmatic details, but rather the substantive actions that contribute to vulnerability reduction and building resilience (Eriksen et al., 2021; Forsyth, 2018; Taylor et al., 2022). Learning about the project adaptation processes and implications through the lens of those who experienced it, is the purpose of this

¹ In this thesis, I adopt Jones's (2019) classification of assessment methods into 'objective' and 'subjective' categories. It's important to clarify that I refrain from passing judgment on the actual 'objectivity' of methods such as index-based assessments or other quantitative frameworks, as opposed to personal accounts and narratives that are considered more subjective. Additionally, I do not intend to assign any hierarchical value suggesting one method is more 'scientific' than the other. Rather, my focus is on highlighting the contrast between these approaches and advocating for the recognition of subjective evaluations as valuable contributors to our understanding of vulnerability and resilience and insightful forms of producing knowledge about the lived experiences of adaptation projects. Further explanation on this is available on page 22-23.

thesis. This PhD therefore embodies aspects of reflexive learning, developed inductively during a research-practitioner collaboration that is an integral part of this study. By integrating both objective evaluations and subjective narratives, this research aims to provide a more comprehensive understanding of adaptation efforts and inform more effective and holistic adaptation strategies.

1.2 Academic-practitioner collaboration in Tanzania

During this PhD, an opportunity arose to engage in such real-world learning through an academic-practitioner collaboration. The collaboration refers to a consortium consisting of two non-governmental organisations (NGOs), academics and a local district council of Muheza in Tanzania that was created to implement an integrated adaptation project called 'Integrated Approaches for Climate Change Adaptation in the East Usambara Mountains'. It was a 4-year adaptation project funded by the European Union's Global Climate Change Alliance. The project was implemented by ONGAWA, a Spanish NGO specialising in water engineering, the Tanzania Forest Conservation Group (TFCG), a Tanzanian forest conservation NGO, together with local government staff from Muheza District Council. The adaptation project is referred to in this thesis as integrated because it was a multi-intervention project consisting of many activities focused on building livelihood resilience and reducing vulnerability in the region (ONGAWA, 2013). As the University of Leeds was the research associate on the project, the opportunity arose to contribute to the project monitoring and evaluation (M&E) processes and follow the project in real-time, at intervals, to explore the lived experiences, implications and lessons learned for adaptation programming from this integrated project implemented in rural Tanzania.

Tanzania provides an excellent country case in which to explore the lived experiences of adaptation projects in their real-life contexts for a variety of reasons. Firstly, Tanzania is a developing country with a long history of presence of development aid agencies and actors, particularly notable in the field of natural resource management. Environmental programmes in Tanzania have been primarily managed and funded by foreign agencies, predominantly international non-governmental organisations (INGOs), in collaboration with international development

agencies and the Tanzanian government (Levine, 2002). Consequently, Tanzania's adaptation projects often involve the same set of actors and organisations that have been involved in broad variety of community-based natural resource management projects over the past three decades, exhibiting a varied track record of results (Brockington and Wilkie, 2015).

Secondly, Tanzania's adaptation strategies tend to portray climate change as primarily an environmental issue. For instance, the National Climate Change Response Strategy 2021-2026 (NCCRS) and the National Adaptation Programme of Action (NAPA) recognise that recurrent droughts and/or prolonged heavy rainfall in various parts of Tanzania threaten the country's food production, leading to hunger and water scarcity (URT, 2007; URT, 2021). Although not comprehensively covering all economic sectors, vulnerability in the reviewed sectors is mainly presented as determined by biophysical hazards. For example, vulnerability in the agriculture sector lies in unpredictable rainfall, in forestry due to deforestation and desertification, in the water sector because of decreased/increased runoff in rivers, encroachment to streams and water pollution, and in land use due to soil erosion and degradation, among others. Critical voices have previously highlighted the overly simplified representation of climate change adaptation issues in government documents that may create disconnect between international and national discourses and local realities (Smucker et al., 2015). Similar, concerns were also reported in the advent of climate change mitigation projects in Tanzania such as REDD+ (Beymer-Farris and Bassett, 2013; Massarella et al., 2018).

Thirdly, similar to many other developing countries, Tanzania grapples with policies and strategies awaiting translation into actionable plans (Shemdoe, 2013). There is significant uncertainty about how the implementation of adaptation measures will unfold on the ground. Despite the high expectation for local governments to play a pivotal role in delivering adaptation strategies and mainstreaming adaptation into local development plans, they often lack guidance, executive power, or funding to do so (Shemdoe et al., 2015; Pilato et al., 2018). In the absence of central government guidance, the prevalent tendency is to rely on donor-funded projects. However, these projects frequently suffer from sustainability issues, with engagement diminishing soon after the funding concludes.

These three aspects make Tanzania a compelling case for exploring lived experiences of adaptation projects, within a developing country, with the view to harness lessons learned during the research-practitioner collaboration to support future projects design and implementation and broader adaptation programming beyond this case.

1.3 Research aim and objectives

The overarching aim of this research is to explore the lived experiences, implications and lessons learned for adaptation programming from a collaborative integrated adaptation project in rural Tanzania.

The following three research questions emerged inductively from the ethnographic fieldwork that followed the project in real-time. These research questions correspond with three empirical chapters of this thesis. When consolidated, the insights gathered from individual research questions collectively contribute to achieving this study aim.

RQ1: How can projects achieve their objectives of reducing vulnerability and strengthening resilience and how can their differentiated impacts on both be assessed?

RQ2: How do specific local contexts influence project adaptation processes, design and implementation?

RQ3: How does participation impact adaptation mainstreaming into policy at local levels?

1.4 Thesis and chapter structure

Chapter 2 explores the broader literatures on adaptation, vulnerability and resilience that informed the arguments presented in this thesis. The literature review first presents different interpretations of adaptation in adaptation policy and practice that

influence how projects are framed, planned for and executed. Then it explores the main actors, narratives and modes of adaptation projects. It progresses to discuss instances when adaptation leads to maladaptation and the possible drivers of that identified in the literature and relevant to this thesis.

Chapter 3 outlines the approach I have taken to research design and methodology. I first present the research approach, which is influenced by the research-practitioner collaboration. Then, drawing on mixed methods research design theory, I situate my research in the research-practitioner collaboration using a framework of Embedded Design (Creswell and Plano Clark, 2011). I then introduce the case study of the integrated adaptation project in the East Usambara Mountains before providing details on my data collection strategies and data analysis, which includes information on methods used, sampling strategies and ethical considerations. Finally, I present some challenges I encountered during my fieldwork.

Chapters 4, 5, 6 are the main analytical chapters of this thesis. I have written these three chapters as standalone pieces of research, in a format of academic papers. This thesis was adapted from a paper-based thesis into a traditional monograph at a very late stage of this research. However, I have made every effort to ensure these individual chapters work together as building blocks that develop the thesis story and the arguments I put forward. They follow the structure of academic papers, beginning with an introduction section that frames the research problem and identifies the gap. Each analytical chapter uses a different conceptual lens and so this is unpacked through a literature review. The specific methods taken in each chapter are also outlined, along with case study information where required. This is followed by results and discussion. A short conclusion then brings the main themes together.

Chapter 4 on *evaluating the impacts of adaptation interventions on vulnerability and livelihood resilience* focuses on research question one. I ask how development practitioners can best achieve their objectives and understand their programmatic contributions to reducing vulnerability and building livelihood resilience. I use a conceptual framework of livelihood resilience proposed by Speranza et al. (2014) and combine it with an innovative methodology grounded in BACI design (Before-After-Control-Impact) to develop an evaluative framework that allows to assess

empirically adaptation projects' contributions to households' capacities (buffer capacity), and the societal processes (self-organisation and capacity for learning) that are the component parts of livelihood resilience. I then apply the framework to evaluate the impacts of the integrated adaptation project on vulnerability and livelihood resilience.

Chapter 5, on the *narratives of climate change adaptation in global biodiversity hotspots*, focuses primarily on research question two, and unpacks the links between climate adaptation narratives produced by the adaptation project stakeholders and the specific biodiversity hotspot context. Using environment and development narrative theory (Roe, 1991) and ethnographic description, I explore how historical legacies seep into the project design and implementation, perpetuating historical injustices along the way. Across the results and discussion, I look at the implications of such 'repackaging' of conservation as adaptation on local (mal)adaptation prospects.

Chapter 6, *unpacking bottom-up adaptation mainstreaming and local participation in policy processes*, looks predominantly at research question three. It uses a public policy theory of Kingdon (1995) to study the role of local communities in adaptation mainstreaming processes into district planning during the adaptation project implementation. By expanding Kingdon's theory to include bottom-up processes in policymaking, I unpack local communities' inclusion/exclusion in problem, policy and politics streams and the implications for opening 'windows of opportunity' for effective policy mainstreaming. In discussion and conclusions, I reflect of what it would mean in practice to engage with the reconceptualised framework of Kingdon.

Chapter 7 and 8 bring the findings from chapters 4, 5, and 6 together and show how they collectively contribute to achieving this thesis aim. In Chapter 7 I do that by identifying 5 core themes and through them I critically explore the lived experiences, implications and lessons learned for adaptation programming from the integrated adaptation project. In chapter 8 I lay down this thesis contributions in a more comprehensive way than I do below in this introductory chapter. I also present 5 lessons for development practice engaged in adaptation programming derived from this research.

1.5 Main Contributions

This thesis created methodological, theoretical, empirical and practical contributions.

The *methodological* contribution of this thesis is presented in chapter 4. This chapter contributes to the adaptation monitoring and evaluation literature. Through the research-practitioner collaboration I developed a comprehensive monitoring and evaluation framework based on a robust BACI (Before-After-Control-Impact) study design. Moreover, I showed how to operationalise the framework using a statistical modelling called difference-in-differences method. This methodological advancement facilitates a more profound understanding of the dimensions of livelihood resilience affected by projects and the specific ways in which these impacts manifest. This methodological insight is particularly valuable for practitioners and evaluators engaged in the design and assessment of projects aimed at enhancing livelihood resilience (and vulnerability to a lesser extend).

This thesis also created a *theoretical* contribution that adds to the literature on adaptation governance and mainstreaming. The novel elements introduced in the theoretical framework presented in chapter 6, drawn from Kingdon (1995), offer a foundation for potentially redefining the significance of bottom-up processes and the involvement of local communities in the formulation of adaptation policies at local level. This chapter engages in critical discussions regarding projects' and policy sustainability, underscoring the constraints inherent in the mainstreaming processes when solutions are not guided by local knowledge from the outset.

Empirical contribution of this thesis is built from chapter 5. This chapter contributes to both adaptation and conservation projects literature, particularly in biodiversity hotspot's locations. Although the literature on biodiversity hotspots is beginning to address adaptation, it frequently neglects the aspect of human vulnerability. Thus, the inclusion of the lived experiences from a climate adaptation project within a biodiversity hotspot introduces a diverse case study to this scholarly literature, offering a noteworthy empirical contribution.

Each empirical chapter in this thesis makes a tangible *practical* contribution. Chapter 4 specifically adds value by developing a monitoring and evaluation framework applicable to the international community, including donors and development practitioners. This framework is instrumental for those engaged in the implementation and evaluation of adaptation and resilience projects. In Chapter 5, the focus on human adaptation efforts in biodiversity hotspots brings attention to the risk of perpetuating historical injustices in the design and implementation of adaptation projects in these regions. This insight highlights the potential for maladaptation, presenting another practical contribution. Furthermore, Chapter 6 engages in critical discussions on adaptation projects and policies sustainability. It underscores the limitations of mainstreaming processes when not guided by participatory processes and local knowledge from the outset. This emphasis on the importance of incorporating local insights, contributes practically to the design of projects.

Together, five broader lessons for development practitioners are derived from this thesis, which are presented in chapter 8, and summarised here:

1. **Vulnerability:** Prioritise understanding and addressing the vulnerability of local livelihoods, considering the complex interplay of environmental, social, political, and historical factors.
2. **Participatory Design:** Implement adaptation projects through participatory processes, allowing communities to discuss potential trade-offs and ensuring their involvement in planning to prevent maladaptive outcomes.
3. **Equitable Burden Sharing:** Ensure local communities do not unfairly bear the burden of climate policies by providing visible and sustainable short-term benefits alongside long-term environmental management goals.
4. **Reflective Approach:** Consider both intended and unintended outcomes of adaptation projects by recognising and addressing structural inequalities and socio-political factors in order to enhance project accountability and effectiveness.

5. **Link Ecology and Livelihoods:** In biodiversity hotspots, integrate ecological and livelihood resilience through addressing historical conservation legacies and climate change vulnerability simultaneously to support local communities sustainably.

Chapter 2 - Literature review

2.1 Introduction

This thesis aims to explore the lived experiences, implications and lessons learned for adaptation programming from a collaborative integrated adaptation project in rural Tanzania. The motivation behind this aim stems from the recognised need for more immersive qualitative research supporting adaptation projects and engaging with the lived experiences of projects on the ground rather than solely looking at project outcomes. This aim was also motivated by the research-practitioner collaboration to generate learning for adaptation projects' design and implementation and adaptation programming more broadly.

This chapter introduces the main literatures and theories that form the basis for the arguments presented in this thesis. I first introduce different approaches to adaptation that have influenced the adaptation policy and practice. Subsequently, I summarise the dominant 'regime' of doing adaptation, including the actors, narratives and framings, and different modes of adaptation interventions – top-down vs bottom-up. This review then progresses to discuss maladaptation and its drivers, relevant to this thesis.

2.2 Different interpretations of adaptation

In 1992, the global community recognised climate change as a significant environmental issue, primarily addressing it through the reduction of greenhouse gas emissions. The United Nations Framework Convention on Climate Change (UNFCCC) was established to facilitate this approach. However, challenges in reaching binding agreements on emission levels and the realisation that mitigation alone may not suffice prompted a shift towards exploring alternatives. Emerging evidence suggested that adaptation strategies were necessary alongside mitigation efforts. This shift in perspective led to a broader political agenda advocating for approaches that not only mitigate environmental changes but also enable adaptation (Huq et al., 2004).

Since then, the adaptation discourse has been operating at several different and seemingly contested levels. Adaptation moved from being conceptualised as the 'adjustment' to climate stimuli through to the vulnerability and resilience discourse, and the transformation discourse. The interpretation of these discourses remain nevertheless ambiguous within and between the climate change and development arenas, where most climate adaptation projects are situated (Ayers and Dodman, 2010; Arnall et al., 2014; Eriksen et al., 2015; Pelling et al., 2015).

The ambiguity arising from various interpretations of adaptation also influences projects' design and implementation on the ground. To understand the challenges, several aspects merit attention. Drawing from my literature review, I summarise these aspects below, organised under three broad categories: 1) understanding adaptation, 2) doing adaptation, and 3) maladaptation.

2.3 Understanding adaptation

According to Smit et al. (2000) differences in interpretations of adaptation revolve around questions like 'adapting to what?' — encompassing climate change, change and variability, or just climate — and 'who or what adapts?' — which could pertain to individuals, social or economic sectors, practices and processes, or system structures. He also asked, 'how does adaptation occur?' — hinting that adaptation refers to both the process of adaptation and to the resulting outcome or condition.

Bassett and Fogelman (2013) identified three distinct interpretations of the adaptation concept in the climate change literature: 'adjustment', 'reformist', and 'transformative adaptation'. Each of the three approaches implies different strategies for reducing vulnerability. Although the paper is a decade old, I find it very relevant, especially in showcasing the evolution of the adaptation discourse over time.

The 'adjustment' approach regards climate impacts as the primary cause of vulnerability, focusing on responses to climate change rather than underlying social factors contributing to vulnerability. This perspective was largely influenced by the natural hazards scholars (e.g. Burton et al., 1993) and featured in early Intergovernmental Panel on Climate Change (IPCC) assessment reports, which

defined adaptation as 'adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities' (IPCC, 2007a: 870). Vulnerability, in this context, refers to 'the degree to which a system is susceptible to and unable to cope with adverse effects of climate change including climate variability and extremes' (IPCC, 2007a: 869). Thus, 'adaptation to what' has been interpreted here as adaptation specifically to climate change, without considering underlying drivers of vulnerability, often stemming from development needs (Ayers and Forsyth, 2009a). Bassett and Fogelman (2013) found that the adjustment approach was by far the most influential and was presented by 70 per cent of authors in leading global change journals reviewed at that time. Consequently, this outlook has created a policy context characterised by mainly scientific, technical, and environmental perspectives, where adaptation is primarily centred around technology and measures like building seawalls, early-warning systems, drought resistant seeds, irrigation schemes or planning trees.

In contrast, other approaches emerged that have considered vulnerability to be highly context-dependent, advocating for more significant systemic changes, sustainable development and societal transformation as the most effective ways to reduce vulnerability and enhance adaptive capacity (Schipper, 2007; Pelling et al., 2015; Watts and Bohle, 1993). The goal of vulnerability analysis here is 'to identify the active processes of vulnerability production and then to identify which are amenable to redress' (Ribot, 2010: 61). These processes can vary from economic disparities to inadequate representation in decision making, insufficient rights, and unjust historical processes leading to current vulnerabilities. This understanding, identified by Bassett and Fogelman, (2013) as 'reformist' or 'transformative adaptation', emphasises overcoming social structural barriers to vulnerability reduction.

Few et al. (2017) suggests that two approaches exist to conceptualising adaptation as transformation in the literature. The first approach is referred to as 'transformational adaptation' and argues that 'incremental' or 'adjustment' adaptation that seeks to modify existing human-environment relations will be insufficient for society to manage the consequences of climate change (Dilling et al., 2015; Pelling

et al., 2015). According to this approach, more fundamental changes are necessary in how people utilise resources, where and how people live, and what systemic limitations are imposed on peoples' agency. The second approach, called 'transformative adaptation' holds that adaptation requires challenging the relations of power and the socio-political constraints that create vulnerability in the first place. The focus here is on social justice and the vulnerability of more marginalised groups with least secure access to resources (Eriksen et al., 2015b; O'Brien, 2012). This approach is also aligned with a critique of the 'development as usual' adaptation paradigm (Eriksen et al., 2015a), asking whether adaptation measures are merely incremental adjustments or whether they should influence current development pathways towards more transformational paradigm shift (e.g. Nagoda, 2015). The literature from which the arguments presented in this thesis are drawn is more aligned with the latter approach to adaptation.

The third and final approach to adaptation identified in the literature, not discussed by Bassett and Fogelman (2013), is understanding adaptation in the context of resilience. Since the beginning of the century the approaches of 'adjustment' to climate change gradually moved away from the concept of vulnerability to privilege the concept of resilience instead (Weichselgartner and Kelman, 2015). Resilience has its origin in ecology and has mostly been discussed in terms of the capacity of ecological or bounded socio-ecological systems to respond to and adapt to adverse conditions (Holling, 1973; Folke and Gunderson, 2010; Folke, 2006). This ecological context was subsequently important for transplanting the concept to climate change discourses. The 2007 IPCC assessment report defined resilience as: 'the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of functioning, the capacity for self-organisation and the capacity to adapt to stress and change' (IPCC, 2007a: 880).

Adaptation could also be seen as part of resilience, where resilience capacity is described as a combination of: (i) shock absorbing and coping; (ii) evolving and adapting; and (iii) transforming (Béné et al., 2014). The term 'resilience' remains extremely nebulous and malleable, making its incorporation into differing paradigms possible, such as into the adaptation and development discourse (Gaillard, 2010; Brown, 2014). For its advocates, it allows for complexity and adaptability in

development processes and outcomes and conveys more strongly the ‘human capacity to act message’ that in vulnerability definitions is perhaps less pronounced (Obrist et al., 2010, Frankenberger et al., 2014).

These differing interpretations are integral to the diverse perspectives on adaptation and vulnerability found in contemporary development aid efforts and academic studies on adaptation, and influence how adaptation is seen as a ‘problem’ and ‘for whom’ (Morchain, 2018; Sovacool et al., 2015b). Particularly noticeable in these distinctive approaches is that adaptation, as much as an outcome, is also a process (Adger et al., 2005; Adger and Vincent, 2005). This process does not happen in a socio-political vacuum but is situated within and affected by dynamic social, historical, governance and development contexts (Taylor, 2015). Moreover, this process is positioned in a broader international network of adaptation and development actors, policies and discourses that influence how adaptation projects are framed, planned for and executed.

2.4 Doing adaptation

As discussed above adaptation constitutes a dynamic socio-political process that may lead to maladaptive or transformative outcomes. To understand how the adaptation process unfolds in practice and what are the lived experiences and implications of that process for communities and other stakeholders, it is essential to discuss first who are the main actors influencing adaptation, how adaptation is framed and justified; and how solutions are operationalised. This section aims to unpack the so called ‘adaptation regime’ by first exploring the various actors and institutions involved, then discussing the concepts of framings and narratives, and finally examining the two primary approaches to operationalising adaptation: the top-down and bottom-up approach.

2.4.1 Actors and institutions

Adaptation planning involves a multitude of diverse actors, which leads to varied interpretations of the meaning and purpose of adaptation. The backgrounds, specialisations, and capacities of actors engaged in adaptation inform their

understanding of vulnerability. Some scholars have introduced the term 'adaptation regime' (Doelle et al., 2014), while others have suggested the concept of the 'field' (Falzon, 2021a) to describe how interactions among diverse actors shape adaptation. These actors include scientists, donors, international organisations, policymakers, and other 'experts' within variety of private and public institutions. For instance, Chaudhury et al., (2016) describe the arrangement of actors in adaptation as a meta-organisation comprising governments, INGOs, the private sector, local communities, and others operating based on organisational rules and structures.

A crucial meta-entity in the adaptation regime is the established governance and management structure of the UNFCCC, supporting low and middle-income countries in adapting to climate change (Persson, 2019). The UNFCCC and IPCC reports consistently exert significant influence on research and the implementation of climate change adaptation projects and policies at various levels (Pelling, 2011). Additionally, bilateral and multilateral institutions, including development banks and various United Nations (UN) agencies, along with finance institutions and funds such as the Adaptation Fund, Green Climate Fund and the Global Environmental Facility, are integral components of this structure (Klepp and Chavez-Rodriguez, 2018a).

Donors, actors in international organisations, INGOs, and some national experts wield particular power in shaping adaptation priorities and practices. These are often non-local actors with their own interests and priorities, which may directly conflict with the culture and values of local communities (Adger et al., 2013; Adger, 2016). Numerous studies have documented how Western scientific knowledge has predominantly shaped the adaptation agenda, side-lining the profile of local knowledge (Eriksen et al., 2015; Nightingale, 2017; Nightingale et al., 2020). This diverts attention away from the needs and priorities of local people (Makondo, 2018). When planning and funding occur within international institutions and among expert actors, local stakeholders without access to these distant offices are systematically excluded from decision-making (Falzon, 2021a). By contrast, governance structures that invite the adaptation agenda to be set by diverse actors and a multitude of knowledge have higher potential to promote transformative adaptation actions (Few et al., 2017).

2.4.2 Framings and narratives

Framings and narratives play a crucial role in perpetuating the dominance of the outsider and 'expert' driven perspective on adaptation. Framings are defined as 'particular contextual assumptions, methods, forms of interpretation, and values that different groups might bring to a problem, shaping how it is bound and understood' (Leach et al., 2010: 5). Often, these framings incorporate what Leach and Mearns (1996) refer to as 'received wisdom', where assumptions become so pervasive that they acquire the status of common knowledge. Given the multitude of diverse actors involved in adaptation decision-making, it is likely that various interpretations of the meaning and purpose of adaptation coexist, making the establishment of a common framing a complex task (McEvoy et al., 2013).

The influence of the 'experts' predisposes the framing of adaptation problems within a 'climate science first' perspective, diminishing the impact that both, local knowledge, and social science research on vulnerability, can have on comprehensive adaptation responses. This is evident, for instance, in how the influential literature, such as the IPCC assessment reports, has overwhelmingly relied on peer-reviewed natural science publications at the expense of other sources, such as grey literature (e.g., project reports or publications by multilateral organisations) or local and indigenous knowledge (Morchain, 2018). Only recently has the IPCC demonstrated greater commitment to incorporating social science and local knowledge and addressing social justice concerns (IPCC, 2023).

In the realm of adaptation politics, framings may play a significant role in influencing policymaking. These policy-influencing activities, orchestrated by the so-called policy entrepreneurs, gain particular importance in the context of externally funded adaptation projects seeking to secure government ownership and support for adaptation mainstreaming (Tanner et al., 2019), as discussed in Chapter 6.

Additionally, framings frequently serve as the foundation for influential environment and development narratives (Leach et al., 2010a). These narratives typically follow a structure that first outlines a problem and its potential consequences before proposing solutions (Roe, 1991). Roe argues that such narratives are resistant to change, even when negative evidence challenges the knowledge base supporting

them (Roe, 1994). Adaptation narratives represent the latest addition to the global environment and development narratives that underpin most international policy prescriptions, as well as assessments and value judgments regarding what is considered effective, successful or ‘good’ adaptation practice (Adger et al., 2001; Dilling et al., 2019).

2.4.3 Top-down vs bottom-up

Within the UNFCCC framework, there have been pledges to mobilise USD 100 billion annually starting from 2020, aiming to support climate action in developing countries (IPCC, 2014; Eriksen et al., 2015a). This commitment creates an opportunity for significant financing for adaptation projects targeting vulnerable communities. However, there is uncertainty regarding which adaptation approaches and measures are the most effective, cost-efficient and socially just. Development scholars and observers have criticised conventional top-down development approaches, noting their bureaucratic, costly, and short-lived nature (Chambers, 1997; Mansuri and Rao, 2013). Likewise, top-down adaptation efforts have been accused of falling short in providing sufficient support to those most vulnerable to climate change (Ayers and Forsyth, 2009b). Critics observed that a top-down adaptation is informed by the ‘adjustment’ approach that tends to prioritise hard infrastructure projects (e.g. coastal protection) and technological responses to specific climate impacts (e.g. drought resistant seeds). It largely ignores the social and political drivers of vulnerability, neglecting initiatives that possibly would enhance the adaptive capacity and resilience of vulnerable groups (Jones et al., 2019; Polack, 2008; Reid, 2016).

Since the 1990s, there has been a shift away from top-down developmental approaches towards more participatory, bottom-up, and community-driven methodologies (Chambers, 1997; Mansuri and Rao, 2013). Similarly, contemporary discussions on adaptation increasingly acknowledge the significance of bottom-up approaches, with a focus on improving the long-term well-being of vulnerable groups through the promotion of community-based and locally-led actions (Mfitumukiza et al., 2020; Westoby et al., 2021). Proponents of this approach argue that considering vulnerability to climate change impacts in the realm of climate science alone proves insufficient without also understanding the broader context of livelihoods and well-

being. As people's lives, livelihoods, and development pathways are shaped by responses to various hazards and opportunities, the two cannot be separated when thinking about adaptation at the local level (Ayers, 2010). Thus, it is essential to understand and frame adaptation in all its complexity: as a development and livelihood issue grounded in social concerns, supported by the scientific understanding of climate phenomena and their impacts, and not the other way around (Morchain, 2018). Top-down adaptation planning often neglects the intricacies and specificities of local contexts, thereby perpetuating common mistakes known in the development field.

2.5 Maladaptation

Recent literature that assessed the state of adaptation programming points out to widespread adaptation failures (Eriksen et al., 2021, Taylor et al., 2022). It appears that vulnerable communities not only face the impacts of climate change and its biophysical manifestations but they are also vulnerable when confronted with the adaptation actors, discourses, and approaches outlined above (Marino and Ribot, 2012). Development practitioners and adaptation planners aim for positive project outcomes, yet achieving effective and equitable adaptation without negative externalities has proven challenging (IPCC, 2023). Scholarship provides numerous examples where programmes designed to facilitate adaptation were inadequate, deficient, or even led to increased vulnerabilities (Antwi-Agyei et al., 2018; Magnan et al., 2016; Nagoda and Nightingale, 2017; Shinn, 2016; Work et al., 2019). As such it is crucial to delve into lived experiences of adaptation projects to understand the potential for maladaptation and its underlying drivers.

In this section, I discuss several problematic areas of adaptation programming identified by previous studies, which may lead to maladaptation (Eriksen et al., 2021; Schipper, 2020; Taylor et al., 2022). I use the term maladaptation to refer to an intentional action taken to avoid or reduce vulnerability and/or build resilience to climate change, which instead 'impacts adversely on, or increase the vulnerability of other systems, sectors or social groups' (Barnett and O'Neill, 2010: 211). I include resilience-building actions in this definition based on literature demonstrating similar patterns of negative outcomes of resilience-building projects and the general

argument that many vulnerability reduction and resilience building interventions are indistinguishable when implemented on the ground (Mikulewicz, 2019). Unpacking lived experiences and implications of adaptation projects can expand our understanding of the potential for maladaptation and support working out ways of preventing it.

Maladaptation can manifest in at least three ways: by 1) reinforcing existing vulnerability, 2) redistributing or shifting it elsewhere, and/or 3) creating new sources of vulnerability (Eriksen et al., 2021; Schipper, 2020).

The most prevalent form of maladaptation is *reinforcing existing vulnerability*, which occurs when an adaptation measure directed at a group of people makes them more vulnerable to climate change than they were before (ibid.). Projects that reinforce existing vulnerabilities may promote activities benefiting disproportionately local elites and better-off members of the community while neglecting the vulnerabilities of more marginalised groups (Artur and Hilhorst, 2011; Nagoda, 2015; Owusu-Daaku, 2018). Thomas and Warner (2019) provide an extreme example of reinforcing vulnerability, where people's vulnerability is explicitly used as an excuse to exclude them from projects.

Shifting vulnerability occurs when adaptation measures redistribute vulnerability, causing others who were not beneficiaries of an adaptation strategy to become intentionally or unintentionally more vulnerable than they were before. Interventions may redistribute vulnerability across populations by transferring risks and exposures between groups rather than alleviating them. An example of shifting vulnerability is an intervention regulating access to water and other resources through policies that restrict upstream users for the benefit of downstream users (Beckman, 2011).

Finally, *creating new sources of vulnerability* occurs when projects unintentionally generate new problems. This highlights the idea that maladaptation may increase vulnerability not only to climate change but also to other threats, or create negative externalities difficult to predict (Schipper, 2020). For example, certain interventions can elevate workloads, economic costs, and risks for farmers through the use of inappropriately adapted technologies, as noted by some scholars studying

conservation and climate-smart agriculture (Smith et al., 2021; Taylor, 2018; Whitfield et al., 2015). Initiatives that fail to consider long-term projected climate impacts, or connected climate events, and exclusively focus on one type of climatic event, may also create new sources of vulnerability in the long run (Nissan et al., 2021; Raymond et al., 2020).

Similarly, Sovacool et al. (2015) in their analysis from a political-economic perspective, identified four processes reflecting competing interests occurring in adaptation initiatives that are likely to result in inequitable outcomes. These processes are enclosure, exclusion, encroachment, and entrenchment. Each of these processes, in a unique way, serves to widen the economic gap between the rich and the poor, limit access to resources or decision-making processes, damage the environment, and/or aggravate political, socio-economic, or cultural inequalities.

Drawing from Eriksen et al. (2021), Taylor et al. (2022), Schipper (2020) and Sovacool et al. (2015), below I expand on drivers of maladaptation of particular relevance to this thesis that may significantly influence the lived experiences and outcomes of adaptation projects. The identified drivers are: (i) inappropriate evaluation frameworks and methodologies, (ii) insufficient understanding of the vulnerability context, and (iii) inequitable participation in the design and implementation of projects and policies. Next, I discuss them in greater detail in the context of adaptation programmes aiming to reduce vulnerability and enhance resilience.

2.5.1 Inappropriate evaluation frameworks and methodologies

Scholars have identified inappropriate evaluation tools, frameworks, and methodologies as significant contributors to unsatisfactory outcomes in adaptation programming, including instances of maladaptation. One notable issue is the inadequacy of current monitoring and evaluation (M&E) frameworks in thoroughly assessing the underlying causes of vulnerability and the contextual factors influencing human well-being and livelihood resilience (Eriksen et al., 2021; Speranza et al., 2014). The assessments of impacts, vulnerability, and resilience have played a crucial role in identifying potential risks and the responses to

challenges faced by individuals, communities, or systems (Cutter et al., 2008; Pandey and Jha, 2012). Yet, the majority of adaptation evaluation frameworks have focused on quantifying outputs and conducting cost-benefit analyses to facilitate assessments of economic feasibility and effectiveness for donors and policymakers. Vulnerability assessments, for instance, typically involve a systematic analysis of various quantitative indicators to gauge the susceptibility of a particular entity to adverse events (Hahn et al., 2009; Islam et al., 2014). However, such assessments may overlook the broader contextual accounts and social dynamics influencing vulnerability and resilience, which are essential for understanding climatic risks and adaptation strategies. For that reason, the use of standardised frameworks and index-based methods needed to be carefully re-considered due to the limitations associated with a one-size-fits-all approach. As assessment metrics become more generalised, their sensitivity to context-specific dynamics diminishes, despite the critical role these dynamics play in shaping adaptation outcomes. Consequently, efforts to identify common indicators for adaptation proved extremely challenging due to the localised nature of adaptation as well as the criticisms of index-based approaches, which are often deemed inappropriate for effective science-policy communication (Hinkel, 2011).

Jones (2019) explored this dichotomy in assessment approaches in the context of resilience and categorised the assessment methods into boarder 'objective' and 'subjective' methods of evaluation. The authors consider 'objective' methods as those involving measurements independent of subjective judgment. This includes externally defined characterisations of resilience and measurements conducted through external observation or questions that require minimal judgment from those being assessed. In contrast, alternative subjective assessments invite participants to actively contribute to the evaluation processes. They can define the core concepts themselves, participate in decisions on how they will be measured or contribute valuable insights regarding their own vulnerability and resilience during qualitative interviews (Mills-Novoa, 2023). Advocates contend that subjective evaluations question the fundamental assumptions, generalisations, and approximations employed in externally prescribed frameworks. They also draw attention to notions of equity and justice in adaptation and resilience assessments due to the sensitivity to

ontologically and epistemologically different forms of knowing (Ensor et al., 2021); Nightingale, 2016).

Another approach to focus adaptation assessments on the participants themselves has been to integrate livelihood-oriented frameworks into studies of adaptation and resilience. Many scholars, such as Lemos et al., (2013) and Carr, (2019), have advocated for the utility of sustainable livelihoods approaches in adaptation and resilience research. Carr (2014: 110), for instance, argues that ‘livelihoods approaches remain the only broad framework of analysis that allows for the holistic investigations necessary to address issues of vulnerability and resilience at the heart of contemporary development discourse and practice’. In resilience studies, rooted in ecological sciences, the incorporation of a livelihood perspective was welcomed to counter criticism about the inappropriate integration of ecosystem resilience into social realms (Cote & Nightingale, 2012; Béné et al., 2014; Brown, 2014). This criticism was based on the socio-ecological resilience literature defining people's livelihoods and interests primarily in relation to the environment, neglecting social processes and the diverse motivations and capacities entangled in social heterogeneity and power (Fabinyi et al., 2014). Tanner et al. (2015: 23) defined livelihood resilience as ‘the capacity of all people across generations to sustain and improve their livelihood opportunities and well-being despite environmental, economic, social, and political disturbances’. Subsequently, many studies have adopted livelihood resilience as their analytical lens, arguing that integrating a livelihood perspective with resilience thinking redirects resilience from a science- and environment-oriented approach to a people-centred perspective that emphasises human agency, empowerment, and rights, which are necessary for achieving adaptive and resilient livelihood systems (Quandt et al., 2017; Sina et al., 2019; Speranza et al., 2014).

In summary, while current evaluation frameworks have provided valuable insights into adaptation challenges, they often fall short in capturing the complex interplay of contextual factors and social dynamics that influence vulnerability and resilience. Addressing these limitations will require a more nuanced and context-sensitive approach to adaptation evaluation, one that accounts for the diverse needs and lived experiences of communities and individuals facing climate-related risks. Especially,

in light of the Global Goal on Adaptation (GGA), which centres on 'enhancing adaptive capacity, strengthening resilience, and reducing vulnerability to climate change' (UNFCCC, 2021: 5), it becomes imperative to advance our understanding of vulnerability and resilience assessments in a way that derive valuable lessons for future interventions (Beauchamp and Józefiak, 2023). Assisting adaptation projects in understanding the differentiated approaches to M&E, and their own contributions to reducing vulnerability and building resilience, is vital for learning within ongoing projects and informing the design of future initiatives that are equitable and relevant to local realities.

2.5.2 Insufficient understanding of the vulnerability context

In the preceding sections, I discussed that early research and practice on climate change adaptation primarily focused on exposure to biophysical impacts, and offered little analysis of the social drivers of climate change vulnerability or the uneven distribution of risk (Bassett and Fogelman, 2013; Thomas et al., 2019). This resonates with what Kelly and Adger, (2000) emphasised some years ago that *adaptation should be facilitated* by reducing vulnerability, which is not the same as saying that *adaptation is reducing* vulnerability. Yet, despite numerous empirical and theoretical insights indicating that effective adaptation should address the 'root causes' of people's inability to sustain their livelihoods and manage risks, the second reversed view has remained prominent in the adaptation discourse. Consequently, many interventions claim to be 'reducing vulnerability' while, in reality, they focus on 'adjusting' to biophysical impacts (Eriksen et al., 2021).

Vulnerability, rather than being an unchanging state or an innate ability, is a multidimensional process influenced by historical, social, political, and economic factors operating at various scales from local to international (Ribot, 1995). Therefore, a prerequisite for understanding vulnerability, and the contexts in which projects are implemented, involves exploring not only who is vulnerable and possesses the capacities to adapt but also understanding why people are vulnerable and why adaptive capacities vary (Thomas et al., 2019). This necessitates asking more fundamental questions, such as why vulnerability exists, rather than merely

demonstrating how it manifests itself (Mikulewicz, 2018). If adaptation projects fail to address the root causes of vulnerability and only focus on the surface-level impacts of climate change, discrepancies in the different understandings become problematic.

Research indicates several ways in which poorly planned adaptation transforms into maladaptation. This often involves insufficient understanding of the context. Studies, rooted in the examination of development and *mal*development, emphasise that neglecting crucial factors like inequality, interconnected development pathways, power dynamics or institutional structures in designing adaptation measures can lead to failure and exacerbating vulnerability drivers (Schipper, 2020, emphasis in original). For instance, scholars have observed that resources are a valid determinant of vulnerability (Thomas et al., 2019). However, the mere availability of resources in a particular location does not guarantee that people have access to them or can utilise them to reduce their vulnerability (Sen, 1981). Often, access to resources involves complex social relationships and power asymmetries at various scales that many vulnerable members of society struggle to navigate (Artur and Hilhorst, 2011; Nygren, 1998).

Therefore, discussions about maladaptation, and the role of adaptation projects in these processes should carefully consider the specific context into which projects are implemented. It is a frequent occurrence for projects to disregard local perspectives on climate risks and historical specificities ingrained in the landscape (Taylor, 2015). As discussed in section 4.2, narratives of adaptation, similar to other environmental and development narratives (Leach and Mearns, 1996; Roe, 1991), frequently emerge from dominant knowledge production rooted in global forums and distant offices. These narratives being removed from local contexts, carry the risk of excluding the perspectives of local people. This issue becomes particularly evident when the adaptation narratives, enshrined in adaptation programmes, propagate conceptions of adaptation that echo old paradigms capable of perpetuating historical injustices, for instance exclusionary conservation policies. These narratives then influence the design and implementation of adaptation projects.

Injustices in adaptation are socially and historically constructed, and interventions can either perpetuate or address these issues. For instance, Lala's et al. (2023) study on social justice aspects of agricultural transformation in the Kilombero Valley, Tanzania, revealed that local narratives of transformation were incompatible with national and commercial policies and plans. The latter were rooted in historical legacies of injustice going back to colonial period. Similarly, Taylor argued that the failure of many adaptation policies can be traced back to the suppression of historical specificities and local social and ecological dynamics (Taylor, 2015: 54). This often leads to a lack of innovative approaches to address the effects of climate change, resulting in a repetition of the same narratives and patterns of action, now labelled as adaptation (Barnes et al., 2013). Local actors also conform to national and international political guidelines to secure funding for their projects.

For that reason, scholars have increasingly called for equity and justice to be an essential part of adaptation action that is transformative (Juhola et al., 2022; Taylor et al. 2022; Colloff et al., 2017). Over the years, many academics have stressed the importance of fair and ethical adaptation policies and projects (Paavola and Adger, 2006; Shackleton et al., 2015), as well as the need for more radical changes to promote social justice (Eriksen et al., 2015a; Manuel-Navarrete and Pelling, 2015; Pelling et al., 2015). They argued that failing to make these changes sets the stage for adaptation interventions that benefit some while leaving others behind, contributing to an unequal adaptation process that results in 'winners and losers' (Adger, 2003; Adger et al., 2006; Thomas and Twyman, 2005). The IPCC report also has acknowledged the importance of equity and justice, with a more prominent emphasis in the newest IPCC Working Group II report compared to its predecessors (IPCC, 2023).

Eriksen et al., (2021) argue that challenges in understanding vulnerability stem from the relatively new status of adaptation as a field. Consequently, there exists insufficient knowledge and capacity at various levels of project planning and implementation, involving different actors. For example, the scale specificity of climate impacts poses challenges for governments, especially at lower tiers such as regional and district levels, and non-governmental organisations, as they often lack dedicated expertise (Ojwang et al., 2017). Moreover, the project-based, short-term

nature of funding and the broader 'projectisation' of adaptation interventions exacerbate this issue, with local authorities relying on projects to provide expertise that they often lack. Additionally, there is a general political commitment to funding specific technological and infrastructure interventions, such as climate-smart agriculture or tree planting, without the necessary evidence of their positive impact on reducing vulnerability. For instance, Tanzania has designated Climate Smart Agriculture Guidelines at the national level (URT, 2017) as well as has made high commitments to plant thousands of trees each rainy season. These commitments persist despite the lack of evidence and the uncertain adaptation outcomes of the proposed solutions (Bhatasara and Nyamwanza, 2018).

In summary, despite theoretical insights emphasising the importance of addressing root causes of vulnerability, many adaptation interventions still prioritise adjusting to biophysical impacts rather than reducing vulnerability. Poorly planned adaptation can lead to maladaptation, exacerbated by insufficient contextual understanding and neglect of social dynamics and power structures. Dominant adaptation narratives frequently overlook local perspectives, perpetuating historical injustices, resulting in deficient project design and implementation. Therefore, special consideration must be given to the vulnerability contexts into which projects are implemented. Understanding historical and contextual specificities is a priority to inform adaptation actions that prioritise equity and justice, aiming to avoid exacerbating inequalities and creating 'winners and losers' in the adaptation process.

2.5.3 Inadequate participation in design and implementation of projects and policies

Scholars have investigated the issue of insufficient participation in adaptation policy and practice by local stakeholders and marginalised groups, examining its potential impact on maladaptation (Falzon, 2021; Nagoda and Nightingale, 2017). Achieving inclusive and representative participation is crucial for informing policies and interventions about how different causes of vulnerability affect individuals and groups differently. When the voices of the most marginalised groups are not adequately represented in adaptation planning, there is a risk that policies and projects may overlook their unique experiences. This lack of inclusion can result in insufficient

support for these groups, as the implemented measures may not fully consider their specific needs and challenges. This is likely to exacerbate their position of vulnerability and marginalisation further (Polack, 2008). At the same time, it is unwise to assume that participatory processes universally work or consistently lead to improved project outcomes (Leventon et al., 2022; Omukuti, 2020; Preston et al., 2015).

Research indicates that, in reality, ‘participatory processes’ are sometimes used by projects and institutions to justify pre-established agendas and interventions, instead of allowing citizens to shape development according to their values and priorities (Leach et al., 2005). In this process marginalised groups in society may remain unheard and their existing inequalities reinforced (Nagoda and Nightingale, 2017). In most situations, participatory processes are not designed to meaningfully incorporate local knowledge, upholding fixed and outside-driven adaptation framings (Mikulewicz, 2018). As mentioned earlier in this chapter, the current system of knowledge production, on which most adaptation efforts rely, tends to favour Western science over local knowledge. This preference limits the contributions that local people can make to adaptation planning and decision-making processes (Falzon, 2021a). Such framings often appear objective but, by narrowing climate impacts to biophysical changes, they prioritise top-down technological responses, neglecting sustained efforts to make adaptation locally relevant (Tompkins and Adger, 2004). Not only does this create a lack of ownership of adaptation interventions but also prevents effective bottom-up feedback mechanisms to the higher policy levels, a vital element of successful adaptation mainstreaming (Lebel et al., 2012; Ouma et al., 2018).

Unequal power distributions within a community, between local populations and external organisations, and within and between organisations and governments also hinders inclusive participation and effective adaptation (Mikulewicz, 2018). Power dynamics influence decision-making processes and their outcomes (Eriksen et al., 2015b; Daly and Dilling, 2019). Often, those who are better-off, more educated, and of higher social status, not only dominate participatory activities but also significantly influence project outcomes, unfairly capturing most benefits (Nadiruzzaman et al., 2014; Mikulewicz, 2019). Despite the crucial role of power in shaping the

vulnerability context and the rights to participate (Polack, 2008), interventions often overlook this aspect. They prefer to be perceived as external agencies involved in value-neutral technology transfers rather than actively engaging in transforming power relations in order to safeguard more effective and equitable adaptation (Nagoda and Nightingale, 2017; Taylor et al., 2022).

In summary, the literature suggests that inadequate participation in the design and implementation of adaptation projects and policies poses risks of maladaptation. Inclusive and representative participation is vital for understanding how different drivers of vulnerability affect individuals and groups differently, ensuring that policies and interventions address their unique experiences. However, research suggests that participatory processes are sometimes used to legitimise pre-established agendas, while marginalising certain groups and reinforcing existing inequalities. Additionally, unequal power distributions within and between communities and external organisations hinder inclusive participation and effective adaptation, as elites with more power often dominate decision-making processes and unfairly capture most benefits. It's crucial for adaptation efforts to recognise and address these power dynamics, actively engaging in transforming power relations to promote more effective and equitable adaptation outcomes. This requires more meaningful incorporation of local knowledge into adaptation policy processes, bottom-up feedback mechanisms, and efforts to make adaptation locally relevant, ultimately fostering ownership and sustainability in adaptation interventions and mainstreaming efforts.

Chapter 3 - Research design and methodology

3.1 Introduction

The research aim is to explore the lived experiences, implications and lessons learned for adaptation programming from a collaborative integrated adaptation project in rural Tanzania. This PhD research formed part of a collaborative partnership between academics, development practitioners (NGOs), and local authorities (local district council) to carry out academic research that will support the implementation of the EU-funded GCCA's 'Integrated Approaches for Climate Change Adaptation in the East Usambara Mountains' programme in Tanzania. The broader aim of the research-practitioner collaboration was to create a learning environment into how development practitioners can best support local communities in their efforts to adapt to climatic changes. The partnership provided a unique opportunity to integrate research component into the planning, implementation and evaluation phases of the programme. This PhD research followed the implementation of the on-the-ground project activities in real time, at intervals, over a 3-year period (2016-2019), anticipating that learning processes would evolve alongside the research-implementation route. This chapter presents an overview of the PhD research design and methodology. I discuss the research design and how it was positioned in relation to the broader research-practitioner collaboration and the implementation of the integrated adaptation project.

3.2 Research approach

This research was embedded within a broader research collaboration that had a practical aim to support development partners concerned with 'what works' on the ground. In that sense, the initial engagement of this research with the integrated adaptation project can be seen as a pragmatic approach (Kelly and Cordeiro, 2020). Pragmatism emphasises knowledge claims arising from actions, situations, and consequences rather than antecedent conditions. In this perspective, the problem takes precedence over specific methods, and researchers employ various approaches to understand it (Rossman and Wilson, 1985). My initial pragmatic approach was influenced by the collaborative partners, assigning me the role of

supporting the monitoring and evaluation processes (M&E) of the ongoing integrated adaptation project.

Over time, however, this pragmatic approach, somewhat imposed by the collaborative nature of the project, evolved into more critical scholarly approaches rooted in social constructivism (Denzin and Lincoln, 2000). I chose to situate the research within social constructivism approach as, within this paradigm, the focus is on 'understanding the complex world of lived experience from the point of view of those who live it' (Schwandt, 1994: 221), which aligned with the research aim. In this perspective, individuals and social groups seek to comprehend their world, developing subjective meanings of their experiences directed toward specific objects or things. These meanings are diverse and multiple, leading the researcher to explore the complexity of views rather than narrowing meanings into a few categories and ideas. Social constructivism posits that these subjective meanings are often negotiated socially and historically, formed through interactions with others and shaped by social and historical realities operating in individuals' lives (Lincoln and Guba, 1985). Thus, constructivist researchers prioritise understanding the 'processes' rather than the 'outcomes' of situations or interactions among groups and individuals. Additionally, they emphasise examining the specific context in which people live and work to gain insight into the historical and social settings influencing participants (Creswell, 2003).

Hence, the approach of this thesis can be characterised as both pragmatic and social constructivist. This duality is evident across my empirical chapters 4 (more pragmatic), and 5 and 6 (more social constructivist). Such dual perspective also lends itself to a mixed-method research design, drawing from both quantitative and qualitative methodologies.

3.3 Mixed-method research design

The literature on mixed-method design is extensive and it is not my aim to recall all the typologies and classifications that exist in this literature (Morse and Niehaus, 2009; Creswell, 2003). However, in the context of my research, several aspects of mixed-method design theory need explanation here in order to situate my study and

its outcomes in the research-practice collaborative context that this PhD was part of. This context influenced how the study was designed, what data was collected, how the data was analysed and how it was interpreted.

Literature recalls four main decisions that go into selecting appropriate mixed-method strategy of inquiry: i) timing - the order in which the data are used in the study, ii) weighting – the relative weight of the quantitative and qualitative approaches iii) integration - the approach to mixing the two data sets, iv) theoretical perspective – the overall theoretical perspective that drives the entire design (see Table 1). Below I will briefly explain the categories before moving to detailed explanation of the strategy applied in this PhD research (Creswell, 2003; Creswell and Plano Clark, 2011).

Table 1: Decision choices for determining mixed methods strategy of inquiry. Adapted from Creswell (2003); Creswell and Plano Clark (2011).

Timing	Weighting	Integration	Theoretical perspective
No Sequence Concurrent	Equal	At Data Collection	Explicit
Sequential – Qualitative first	Qualitative	At Data Analysis	
Sequential – Quantitative first	Quantitative	At Data Interpretation	Implicit
		With some Combination	

3.3.1 Timing

The timing, also referred to in the mixed-methods design literature as ‘implementation’ or ‘sequence’, refers to the temporal relationship between the quantitative and qualitative components of the study (Creswell and Plano Clark, 2011). Although timing is often discussed in relations to the time the data sets are collected, most important is the order in which the researcher uses the data within a study (Morgan, 1998). That is when the data are analysed and interpreted. Literature distinguishes between concurrent or sequential ways of engaging with the data. Concurrent timing occurs when the researcher implements both quantitative and qualitative methods during a single phase of the research study and most likely

analyse and interpret them at approximately the same time. Sequential timing occurs when one type of data is collected and analysed before the other type. In this type either the qualitative or the quantitative can come first (Creswell, 2003).

3.3.2 Weighting

A second factor that goes into the choice of a strategy is whether greater priority or weighting is given to the quantitative or qualitative approach in answering the study research questions. This has been referred to as the 'priority decision' (Morgan, 1998) because the researcher needs to decide whether to give equal weight to both methods or one method will have a greater importance than the other. Morse (1991) suggests that theoretical drive (discussed below) or general worldview, determine the study weighting. Other factors might be what the researcher wants to emphasise in the study or subjective interests of the researcher.

3.3.3 Integration

Another procedural factor to consider in mixed-method design is how the quantitative and qualitative data will be mixed. Integration of the two types of data might happen at several stages in the research process: the data collection, data analysis and data interpretation stage. Morse and Niehaus (2009) identify two possible points of integration: the results point of integration and the analytical point of integration. Most commonly integration takes place at the results point. The analytical point of integration, on the other hand, involves a stage when the qualitative component becomes quantified.

3.3.4 Theoretical perspective

A final factor to consider is whether a larger theoretical perspective guides the study design. Morse and Niehaus (2009) call it the 'theoretical drive'. The theoretical drive can be focused on exploration and description – then the theoretical drive is called inductive and qualitative. In contrast, the study's main drive can be testing and prediction. Then it is called deductive and quantitative. In the case of mixed-methods, the component that corresponds to the theoretical drive is called the 'core'

component and the other component is called 'supplemental' component. The core component is normally written in the capital and supplemental component is written in lowercase letters (Schoonenboom and Johnson, 2017).

3.3.5 Strategy employed in this PhD research project

This research was part of a broader research-practitioner collaboration. Using the language of the mixed-methods literature the collaboration research design can be described as mixed-method design known as the Embedded Design (Creswell and Plano Clark, 2011). This design is particularly prevalent when there is a need to integrate a qualitative component within a larger quantitative framework, for instance, it is often seen in experimental and quasi-experimental designs. In such designs, qualitative data might be used to qualitatively examine the process of the intervention alongside its quantitative outcomes. My PhD research can be seen as part of a broader M&E framework of the integrated adaptation project as presented in Figure 1. The objective was to enrich the depth of the project evaluation and explore the lived experiences and implications of the intervention through qualitative analysis as well as stimulate reflexivity and learning during the project implementation.

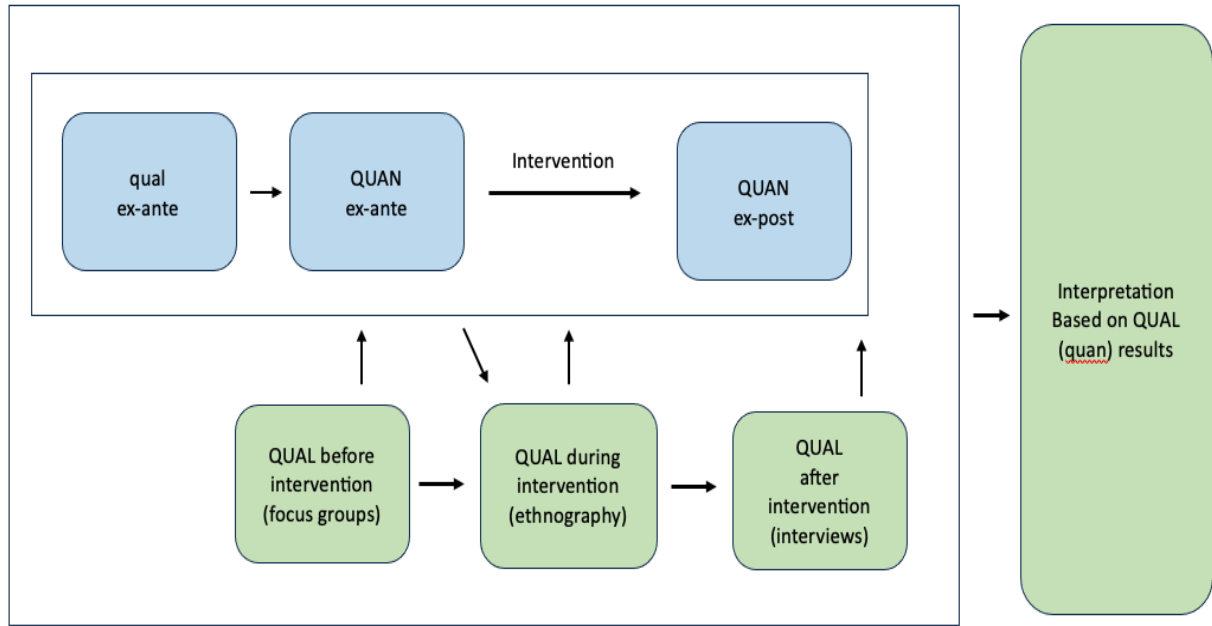


Figure 1: Embedded design showcasing the research-practice collaboration.

The blue clouds signify data collected by the project partners (NGOs) and the green clouds show data collected/analysed by myself during my PhD. QUAL(qual) and QUAN(quan) refers to qualitative and quantitative data, respectively. Capital/lowercase letters signify the ‘core’ or ‘supplemental’ component of the research and correspond to the study’s theoretical drive. For instance, the theoretical drive of the project partners was quantitative, hence QUAN. Conversely, the theoretical drive of my PhD research was qualitative, hence QUAL.

3.3.5.1 Research timing

The timing of my PhD research was sequential and followed the initial collection of ex-ante qualitative and quantitative data by the implementing partners (NGOs) at the project's inception in 2016. During the same year, I conducted the first phase of qualitative data collection (focused groups), aligning it with the timing of the quantitative survey (ex-ante) administered by the project facilitators.

Subsequently, I analysed the quantitative ex-ante data using ‘objective’ methods such as indicator-based vulnerability analysis, which informed various decisions both before and during the primary fieldwork phase—the second phase (2018). This analysis played an important role in decisions such as selecting study villages for subsequent qualitative data collection and determining participants in the qualitative data collection (sampling strategy).

Further qualitative data was gathered after the completion of the implementation of the integrated adaptation project, specifically during the withdrawal stage and the handover to the villages and the local government—the third phase (2019). This multi-phased approach allowed for a comprehensive exploration of the project's lived experiences and implications across different stages. More on the data collection process can be found in section 3.5 below.

3.3.5.2 Research weighting

The *weighting* of this research was more towards the qualitative approach. Qualitative approach was chosen for a number of reasons. Firstly, qualitative approach better aligns with the research aim, which is to explore lived experiences implications, and lessons learned from the collaborative integrated adaptation project. Quantitative, numerical data could not achieve that aim because of its reductionist nature (Creswell, 2003). Secondly, qualitative approach lends itself to actor-oriented, social constructivist paradigm that underpin the research. Thirdly, through qualitative approach the research aimed to elucidate diversity of voices, differential meanings, and different goals of the project stakeholders to 'bring the story of the project alive' (Bernard, 1995). The aim was to achieve depth of accounts rather than striving for statistical representatives. This weighting was also a result of my personal interests to do ethnographic, immersive, emergent and interpretive research rather than prefigured one, with upfront theories (Bernard, 1995). More on this can be found in the data collection section below (section 3.5).

3.3.5.3 Research integration

There were several points of integration and mixing during this research. First, as I already mentioned, was at the design stage of this research, where quantitative analysis informed subsequent qualitative study design. Second at the interpretation and analysis stage where both quantitative and qualitative data sets were merged to strengthen the interpretation of the results (chapter 4).

3.3.5.4 Theoretical drive

The research's dominant theoretical drive was qualitative and inductive approach, hence the QUAL data is the core component, and the quan data is the supplemental component in this thesis. As discussed in section 3.2, I have situated this research within the social constructivist paradigm and, to a lesser extent, within the pragmatism paradigm.

3.4 Case study of the integrated adaptation project

The goal of this PhD research was to elicit the lived experiences, implications and lessons learned for adaptation programming from the collaborative integrated adaptation project. This aim aligns well with case study research that is used when an in-depth description and analysis of a certain programme, activity, a process or phenomenon is needed (Stake, 1995). The nature of adaptation is highly contextual and understanding of how an adaptation project play out in specific context was another motivation behind my choice of case study research. Case study also assumes a naturalistic methodology, where the researcher spends time immersed in the phenomenon under study without attempts to manipulate it (Golafshani, 2015). The research-practitioner collaboration provided a perfect opportunity to immerse myself into the project for a prolonged period of time to study its lived experiences, implications, and lessons in its real life context (Stake, 1995).

Some early views of case studies, especially single cases, has been critical for not being generalisable and therefore not contributing to scientific theory (Campbell, 1975). However, Flyvbjerg (2006) contests this view, arguing that case studies are able to produce robust social science theory due to the depth of understanding they generate. My aim was to generate such depth of understanding of lived experiences, implications and lessons learned for adaptation programming from the integrated adaptation project implemented in the East Usambara Mountains in Tanzania.

3.4.1 The Global Climate Change Alliance's (GCCA+) integrated adaptation project in the East Usambara Mountains

The case study context is the implementation of the 'Integrated Approaches for Climate Change Adaptation in the East Usambara Mountains' project. The East Usambara Mountains are special in many ways and provide an interesting case study for integrated adaptation project due to its long colonial and conservation history, which I explore in chapter 5 of this thesis. The mountains are also a global biodiversity hotspot under the Eastern Arc Mountains of Tanzania, which are part of the Eastern Afromontane hotspot since 2004 (Marchese, 2015). The East Usambara Mountains are located in Tanga Region, Muheza District, in Amani Division. Two Wards within the Amani Division were selected to receive the integrated adaptation project: Zirai and Misalai (for map of the location see chapter 5). The fact that the East Usambara Mountains receive relatively high annual rainfall (see chapter 4 Figure 4 for more on that) could be misleading in that the mountains are naturally 'climate proof'. However, it is a region of high climate variability, high poverty, significant limits to land due to the protected areas (Reyes et al., 2005; Hamilton and Bensted-Smith, 1989) and a long history of crop failures (Porter, 2006).

The first people in the Usambara Mountains, which are divided into the West and the East Usambaras, were the Wasambaa who are known as the mountain farmers (*shamba* in the Swahili language means 'garden' or 'farm') (Feierman, 1974). In the 1940s and 1950s, the region experienced significant in-migration due to the expansion of colonial timber industries and tea-producing estates, which led to increased population densities and greater ethnic diversity in the Usambara Mountains (Kajembe et al., 2003; Conte, 2004). Contrary to the West Usambara, where irrigation is common, most farmers in the East Usambara rely on natural rain to produce crops for subsistence and cash. In the East Usambaras, there are three seasons with varied rainfall: the long rains of *masika* (March-May), gentle rains of *mchoro* (June-July) (present only in some locations), and short rains of *vuli* (October-December) (Kijazi and Reason 2009). All seasons are filled with agricultural activities when maize, beans, cassava, bananas, sugar cane, yams, tea, vegetables and spices are planted. Wage labour in tea estates, small businesses and livestock

rearing for meat or milk may also supplement the Usambara family budget (own data).

Recent shifts in rainfall patterns have created challenges for the mountain farmers. On one hand, there is a rise in drought episodes, and on the other, there is an increase in extreme rainfall events, both of which hinder crop production. Concurrently, climate projections for the region are uncertain. While there is an expectation of a decrease in consecutive rainy days, the likelihood of extreme rainfall events remains high, as indicated by Chapman et al. (2020) and Conway et al. (2017). This climatic uncertainty significantly affects the incomes and overall livelihoods of residents in the East Usambara.

The establishment of the project 'Integrated Approaches for Climate Change Adaptation in the East Usambara Mountains' was initially linked to this heightened awareness of the necessity to develop sustainable adaptation solutions for the region. The project was launched in 2015. It was a 4-year project led by the Spanish NGO, ONGAWA, specialising in water engineering. Collaborating with ONGAWA was a domestic NGO, Tanzania Forest Conservation Group (TFCG), and the Muheza District Council. The collaboration also involved two Universities that were the research associates on the project: the University of Leeds and the Sokoine University of Agriculture in Dodoma. The research-practitioner collaboration sought the opportunity to facilitate direct engagement of practitioners and policymakers with academics and through this to stimulate learning and reflexivity during the implementation of the project and for future projects design.

It is also important to mention that the project was funded by the European Union (EU), specifically the Global Climate Change Alliance Initiative. Here a few words on the Alliance might be helpful.

The Alliance was launched in September 2007. The GCCA aimed to foster collaboration and political dialogue on climate change policy between the EU, Least Developed Countries (LDCs), and Small Island Developing States (SIDS) (European Commission, 2011). Tanzania emerged as an early recipient of financial support for climate change adaptation through the initiative (Kennes, 2019). The GCCA

interventions in Tanzania unfolded in two phases: phase 1 (2010-2013) and phase 2 (2014-2019) (GCCA+, 2018a). In the initial phase, several 'eco-villages' were established in three vulnerable ecological zones—coastal, drylands, and highlands. The concept of 'eco-village' emphasised a holistic and integrated approach, incorporating social, cultural, economic, and ecological dimensions to achieve greater sustainability and resilience (GCCA+, 2017: 2). In the second phase, known as GCCA+ (2015-2020), the initiative also extended its goals to include supporting the mainstreaming of climate change into poverty reduction and development efforts. This expansion aimed to help developing countries fulfil their commitments under the 2015 Paris Agreement, the 2030 Agenda for Sustainable Development, and the new European Consensus on Development (GCCA+, 2018b).

The integrated adaptation project had an overarching goal to demonstrate effective and efficient strategies supporting poor, rural households in Tanzania in adapting to the adverse effects of climate change while alleviating poverty. The specific objective focused on supporting eight village communities situated near high biodiversity forests in the East Usambara Mountains (a map presenting the villages – names were anonymised – is presented in chapter 5). The aim was to increase and diversify incomes, enhance livelihood resilience, and reduce vulnerability to climate change.

The project officially had a gendered focus. It considered women vulnerable to climate change and recognised their crucial role in the adaptation process, such as their key roles in farming and establishing networks. To support women's participation, the project conducted workshops discussing gender roles, equity, and discrimination. Considerable effort was also made to re-negotiate women's participation when some men became unhappy with their wives participating. However, this effort became meaningless when environmental laws affecting women's water user rights were reinforced (see Chapter 5).

The project directives also aimed to be inclusive by encouraging poorer households to participate. A list of participation criteria was passed on to the village and activity group leaders, including the goal of 50% men, 50% women, and 50% participants from poor and vulnerable backgrounds.

The project implemented a wide range of multi-intervention activities; hence it was an integrated adaptation project. I had the opportunity to witness the implementation of some of them, but not all. Some of the activities were implemented early in the project in 2016 prior to my PhD, others were implemented in 2017 before my fieldwork. A summary of the main activities undertaken by the project, as documented by ONGAWA (2013) is presented below. A detailed list can also be found in Chapter 4, Table 1.

The main activity of the project was the construction of an improved water supply system and integrated water resource management. A variety of technical solutions such as small gravity schemes were introduced in the villages to provide access to communal piped water. Due to the mountain topography not all villages, or sub-villages, were eligible for these schemes. The project also formed and trained Community Owned Water Supply Organisations (COWSO) and Water Users Associations (WUA) that were responsible for rural water management – maintenance, funds management, conflict management etc. As part of the integrated water resource management the project also established no-planting river buffer zones that fall about 10m from the riverbanks.

Second main activity was the setup of farmer field schools, known in Tanzania as the *shamba darasa*. These groups were used to provide training to farmers on climate smart agriculture (CSA). The training concerned soil and water conservation technologies, such as contour ploughing, construction of terraces across farm, and no tillage. Additionally, farmers were encouraged to take on drought resilient crops and variety of agroforestry techniques. Training was conducted using voluntarily provided land of lead farmers in the groups. Also, attached to these activities was training on dairy cattle husbandry and business skills. The project also attempted linking farmers with Tanga Fresh Milk enterprise for reliable milk market.

The project was also concerned with community-based forestry and implementation of forest-based enterprises - eco-tourism, beekeeping and butterfly farming. Five villages out of eight have previously established Village Land Forest Reserves and one Community Forest Reserve. The remaining three share a border with Nilo Nature Reserve therefore they jointly manage areas of adjacent forests. Five communities got support with development of the forest management plans, good

governance training in natural resource management, patrol equipment such as rain clothes and bicycles. Part of the forest governance intervention was also establishment and promotion of energy saving cook-stoves. Improved stoves were thought to reduce amount of firewood that is being collected.

Finally, the project established the so-called economic groups with the view to search for reliable spice markets (main cash crops in the East Usambara Mountains).

Together the activities aimed to enhance livelihood resilience and reduce poverty and vulnerability to climate change-related impacts (ONGAWA, 2013: 6).

3.5 Data collection

The data utilised in this thesis is comprehensively listed in Table 2, with additional insights from secondary data discussed in section 3.5.2. Analytical chapters (4, 5 and 6) draw on specific subsections of this data, selected and analysed to address each chapter's distinct research objectives/questions. For instance, chapter 4 uses both quantitative household survey and qualitative data, and chapter 5 engages with historical documents in addition to interview and ethnographic materials. Also, each empirical chapter is equipped with its methodology section, derived from the draft paper format of these chapters, which supports this methods chapter in explaining how the data was collected and analysed.

Table 2: Data used in this research

Method	Data collected
Focus groups (followed by semi-structured interviews)	Village actors in Misalai and Zirai Wards (November 2016) • 8 Focus groups in villages: women, man, youth • 8 interviews with village leaders District and Ward actors (December 2016) • 8 interviews with Muheza District Council staff • 2 interviews with Ward Executive Officers • 1 interview with Ward Councillor
Ethnographic data	Observations at project implementation • 2 planning meetings at district (November 2017, August 2018)

	• 3 internal project planning meetings (between February and August 2018) • 10 project activity groups (CSA, butterfly farming, economic group, River and Forest Committee, good governance and microfinance training) Hand over meetings • 3 hand-over meetings at villages (March - April 2019) • 1 hand-over meeting at district (April 2019) Field notes • Informal conversations at local shops, dispensary, at functions, weddings, funerals, local women groups etc. • Reflections and ongoing theory development
Narrative interviews	Village actors in Misalai and Zirai Wards (February – August 2018) • 60 interviews with villagers – across all sub-villages and including a range of different actor groups from better-off to poor farmers, different genders, and both participant and non-participant households. • 8 interviews with village leaders • 3 interviews with village executive officers (VEOs) • 3 interviews with other leaders (church, head teachers) District and Ward actors • 9 interviews with Muheza District Council staff • 2 Interviews with Ward Executive Officers • 2 interviews with Ward Councillors • 3 Interviews with district extension staff Project facilitators • 7 interviews with NGO staff • 3 interviews with hired consultants to deliver project activities
Documents	Contemporary documents • Project documents including call reports, interim reports, annual reports • Reports, reviews and webinars produced by the EU and the GCCA • District documents such as District Development Plans Historical documents/literature • Reports, strategies and reviews from past projects implemented in the East Usambara Mountains • Published literature (articles, books) on Usambara Mountains environmental history

Household survey	Household survey data (secondary data - collected for monitoring and evaluation by the NGOs) • Pre-intervention household surveys (October 2016) • Post-intervention household surveys (September 2019)
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Below I present an overview of the holistic data collection process that unfolded in three separate phases. I incorporate relevant information on research methods used, sampling strategies and ethical considerations. Prior to data collection, all necessary permissions were obtained, including ethics approval from University of Leeds (AREA 17-049), approval for fieldwork from the Tanzania Commission for Science and Technology (COSTECH) (2018-80-NA-2017-340 and 2019-100-NA-2017-46), as well as district, ward, and village-level approvals. Clearance from the Immigration Department was also secured before initiating data collection.

3.5.1 Three phases of data collection

My data collection was divided into three separate phases to match the integrated adaptation project implementation milestones and to effectively accommodate in-country Swahili language training.

3.5.1.1 Phase one

The initial phase spanned from November to December 2016, during which I, along with other University of Leeds researchers (Dr Susannah Sallu), conducted eight focus groups (FG) in each of the intervention villages in Misalai and Zirai Wards. We collected data from communities living in the villages participating in the integrated adaptation project, village leaders and Ward and District Officers to supplement the quantitative data (household surveys) collected by the NGOs and develop a more robust baseline understanding of the vulnerability context in which the project is being implemented. The focus groups (FGs) were comprehensive and included 4 broad themes: A) seasonality and livelihood dynamics, B) past and present climatic events, C) impacts of climate shocks and stresses, D) coping and adaptive capacity, and E) future development ambitions. Detailed report from the analysis of the FGs was written up by Dr Sallu, myself and another student and was shared with the practitioners to support the project implementation (Sallu et al., 2018). In this thesis, I

only drew from selected subsections of this data, particularly related to coping strategies employed by the communities in drought (chapter 4 and 5). A total of 93 villagers, 49 men and 44 women, including 28 youth aged between 17 and 31, participated in the FG activities. Additionally, we conducted interviews with village leaders and District and Ward officers. These interviews were semi-structured and related to issues of how the villages were affected by weather and climatic events, how the villages (and Muheza District) are coping and adapting to these events, as well as their perceptions on drivers and impacts of climate change. In my thesis, I draw on these interviews, particularly in chapters 5 and 6. This phase was also very important to meet the project partners and visit the villages, participating and affected by the integrated adaptation project, in which I subsequently spent 7 months during my next phase of this PhD fieldwork.

3.5.1.2 Phase two

Phase two of this research fell between October 2017 and August 2018. During this phase I first participated in 4 months intensive Swahili language training at Mkwawa University in Iringa before heading to the villages for another 7 months of remote fieldwork during the ‘fever’ of the integrated adaptation project implementation. This was the most intensive period of data collection, but also a very unique life experience and a personal development experience that I was privileged to be part of.

During this time, I drew heavily on ethnography as a research strategy and a data collection philosophy. I did not conduct an ethnography in the traditional sense, however, as I did not focus on describing and interpreting one culture-sharing group (Bernard, 2006). Instead, the focus was on collecting data and observing various actors engaged in adaptation programming across different governance levels, from project activities to policymaking. Through the Swahili training I obtained sufficient fluency and independence in my whereabouts that allowed me to engage with a wide range of actors (formally and informally) and to try and understand different processes at play, thus increasing the credibility of the research (Lincoln and Guba, 1985). For instance, I had formal and informal conversations with Muheza District officers and participated in the District Council planning meetings, where I was able

to see politically charged exchanges between different actors involved in adaptation. I also observed and participated in many of the project activity groups such as *mashamba darasa* [farmers field schools] and training provided to the economic and butterfly farmer groups. This expanded my understanding of community life, and the participants' experiences of the project. Other features of ethnography in my research included taking an unstructured narrative approach to data collection, working as an interpretive 'bricoleur' and drawing on different tools, methods and techniques as and when required (Denzin and Lincoln, 2000). I also kept a field diary in which I was meticulously putting observations, scribbling 'jottings' and writing reflections that helped me in developing ideas for the individual chapters of this thesis (Bernard, 2006).

While I was able to communicate in Swahili, hiring a local research assistant, who was experienced in working in the region, was important for various reasons. Firstly, I was still a white, European person, a *mzungu* [white person in Swahili language], which for many means an 'outsider'. The research assistant was very skilled in navigating cultural differences and power dynamics that might arise from it (I expand on the subject later when discussing positionality). Secondly, I didn't want any misunderstandings in communication while in the villages, therefore the presence of a fluent Swahili speaker was a necessity. Moreover, on a few occasions the language of the interview was the local vernacular Kisambaa, which the research assistant spoke fluently as well. The research assistant stayed with me from Monday to Friday and was going home to his village for the weekends. This also gave me the opportunity to be on my own immersed in the community life, going about my daily life (such as washing and cooking), in the same way the villagers did, which definitely contributed to leveling the power dynamics field and made me a bit more an everyday person.

Cooper and Pratten (2015) argue that where the goal is to understand lived experiences, individual narratives should play a central role in ethnography. People make sense and meaning out of their experiences by reconstructing it in narrative form. As such, more conversational narrative interviews can enable a depth of understanding that surpasses that of normal semi-structured interviewing (Gee, 1985). This approach to interviewing is also increasingly recommended in the

climate adaptation literature (Paschen and Ison, 2014). I drew on this form of interviewing for several reasons. Firstly, my aim was for participants to speak about their experience of the project and to understand how they make sense of this experience. My role was therefore one of a facilitator to guide the participants through the interviewing process. Because I was living in the villages in which I carried the interviews that made it a lot easier, especially with time when villagers got used to my presence, our paths crossed several times before and there was even a likelihood we shared the same dining table prior to the interview. This brings me to the second reason why I wanted to use narrative interviews as my main interviewing technique. They allow to build a better rapport with the interviewees, and establishing trust and empathy can encourage participants to share more personal and nuanced aspects of their experiences. And finally, I liked the flexibility during narrative interviews, allowing the conversation to flow naturally and adjusting the line of questioning based on the participant's responses. This flexibility helps capture unexpected insights (Gee, 1985). This does not mean, however, that I went to the interviews unprepared or unbothered about what data I was collecting. To the contrary, it took quite a lot of practice to get to conduct a 'good' unstructured interview. Also, it needs to be mentioned that this style of interviewing did not work for all participants. Some participants were less confident to speak about their experience, often because they were not used to being asked their opinions. This can be a challenge to the use of such narrative interviews in the contexts of rural Tanzania. In these cases, I had more structured questions prepared for guidance. More structured or semi-structured format of interviewing was also used when I was concerned with a particular standing that the participants have in the community and the role they were in, such as a teacher or agricultural officer. For instance, in interviews with District officers, or extension agricultural staff, or NGOs I often used a guiding interview protocol for practical reasons: I did not want to miss asking important questions relevant to this research. This is an example of how the flexibility in the pragmatic paradigm is helpful in adjusting different methods and tools, depending on the research needs (Creswell, 2003).

Some explanation about sampling strategy employed by this research should be provided here. I used non-probability sampling techniques to identify interviewees: purposive sampling and snowball sampling (Newing et al., 2011). As I mentioned

before, prior to my fieldwork I conducted quantitative vulnerability analysis based on the baseline household survey collected by the NGOs (Gaworek-Michalczenia and Sallu, 2017). This analysis guided my initial selection of villages for subsequent qualitative data collection and also assisted in determining participants in the qualitative data collection. I wanted to ensure that I included many different perspectives from a broad range of different actor groups such as better-off and poor families, different genders, and both participant and non-participant households in the adaptation project. This initial analysis gave me this opportunity. The survey included information on income and assets, which I additionally triangulated with 'wealth ranking' exercise that was performed by the NGOs at the start of the project. That produced a list of better-off and poorer households that I could follow with interviews. However, after field visits, it became apparent that the assigned 'wealth rank' did not always match the reality. Especially if the households were classified as poor and it was apparent that they are not. Thus, a list of families and individuals receiving TASAF (Tanzania Social Action Fund) funding was requested from the Muheza District authorities to cross-check the data. TASAF is a governmental scheme in Tanzania that support the poorest families with a small amount of money biannually. Therefore, when I am referring in this thesis to better-off or poorer families the classification comes from these triangulated sources (chapter 5 and 6).

I also used snowball sampling. This involved identification of further participants through conversations with other participants. By combining these sampling techniques, and by interacting with the villagers on a daily basis, I was able to ensure that I did not just speak to the 'model' villagers that the leaders would casually put forward in similar circumstances (for instance when we were conducting focus groups earlier in the research process). I was also able to identify and interview more marginalised actors, including those who were against the government, or the NGOs (see chapter 5 for more on this).

Strict ethics were followed with each participant interviewed, in line with the University of Leeds Research Ethics Policy and the ESRC Research Ethics Frameworks. The ethics form was submitted and approved by the department ethics committee prior to commencement of data collection. Important considerations included only working with participants over the age of 18 and ensuring interviews

were conducted in comfortable manner and places. I was aware that I am coming from a different cultural background than the people I was interacting with. Because of my race and education (a white educated person is commonly perceived in Tanzania as having high social status) some participants of this study might have felt inferior or pressured to participate in my research against they will. As such I was dedicated to an on-going reflection throughout the research process and carefully considered the power relations that I was creating (Sultana, 2007). The rights and dignity of the research participants were my priority, including the right to withdraw from the study at any time. Time was taken at the start of each interview to explain who I was and to describe my research, encouraging participants to ask questions before getting informed consent to progress. The option to participate was presented to all potential interviewees through an introductory discussion based on a project information sheet and a written consent form (that was translated into Swahili language). Due to a high level of illiteracy among the respondents, I quickly realised that it was difficult to seek written consent from some participants in this study. Moreover, even if literacy was not an issue, many people in Tanzania are reluctant to sign forms as it is associated with 'officialdom' and might be considered as threatening. In this situation, a verbal explanation of the research aims and implications was provided, and a verbal agreement was sought, which was also recorded on an audio recorder at the start of the interview in most cases.

I adhered to confidentiality agreements outlined in Appendix IV by assuring all participants of the privacy of their information. When granted permission, I recorded interviews to facilitate accurate transcription and translation. Participants were given the choice to consent or decline to be recorded. To preserve confidentiality, I strictly followed a protocol for information storage, employing an encrypted folder, code names for individuals, and code numbers for villages to prevent indirect identification of participants. I continued conducting narrative interviews in the project villages until I felt I had reached 'theoretical saturation' in relation to narrative threads, themes, perspectives and framings (Fusch and Ness, 2015).

3.5.1.2 Phase three

My third phase of data collection fell in March-April 2019. I returned to the East Usambara particularly to observe the withdrawing process of the integrated adaptation project. By April 2019 the project had implemented all activities and was conducting a series of handing over meetings at village and district level. This phase of the fieldwork was important to developing my ideas about community participation and how it affects sustainability issues in adaptation programming that I report in chapter 6. I also wanted to follow up on the project's last component related to mainstreaming adaptation measures into district planning. During this phase I collected ethnographic data from the hand over meetings. I also conducted several interviews with District and Ward actors (see Table 2) to gather their perspectives related to the implementation and performance of the adaptation project, and indirectly the possibilities for adaptation mainstreaming.

3.5.2 Secondary data

This thesis also uses secondary data produced by the collaborative partners and other reports that were found on the internet from past projects implemented in the East Usambara Mountains. This secondary data was incorporated into the primary data set at various stages of the research process. For instance, the household survey collected by NGOs became the core component of my research chapter 4. The origins of my engagement with the survey can be seen in the initial expectation from the project that the research-practitioner collaboration will provide the opportunity to co-design a robust M&E plan that monitors the impact of project activities on rural communities as well as higher level impacts on reducing vulnerability and building resilience in households and communities. In fact, University of Leeds supported the design of the household survey prior to me joining the collaboration.

Documents can also provide a huge amount of information about the perspectives, assumptions and motivations of the actors and organisations that produce them (Bauer and Gaskel, 2000). Therefore, I also collected many documents, which are summarised in Table 2 above. I ensured that I kept databases of all the different

elements and kept a note of decisions in order to maintain research confirmability (Lincoln and Guba, 1985). In chapter 5 I also engage with historical document analysis based on reports, reviews and leaflets produced by past projects implemented in the East Usambara Mountains (mainly environmental conservation projects) and published literature about the Usambara Mountains environmental history.

3.6 Data analysis

This thesis engaged in both quantitative and qualitative data analysis. In Chapter 4 I build on the existing M&E framework of the integrated adaptation project and collaboratively develop a new evaluation framework that is then tested using quantitative analysis method called difference-in-differences (Antonakis et al., 2010). To successfully operationalise the method, I used both descriptive and inferential statistics. For this chapter I also used qualitative data from interviews and focus groups analysed separately through thematic analysis performed in Nvivo 11 (Nowell et al., 2017). I then merged both types of data at the interpretation stage to produce the final report. Empirical chapter 4 includes an extensive methods section, especially in relation to the quantitative data analysis using the difference-in-differences analytical method and there is no point to repeat it here. To expand on what is already in the analysis I add below the following points.

The survey data was collected by the NGOs in 2016 and 2019 to feed into their M&E processes. The partners conducted structured survey with 339 respondents in 30 sub-villages in 8 villages, where the project was implemented. Between 32 – 70 respondents were interviewed per village. According to information written in the project reports the total population of the 8 villages was 10,992 people living in 2,853 households. The survey facilitators estimated the sample size using an online platform Raosoft (RaoSoft, 2004) that produced a minimum sample size of 339 to obtain a 5% margin of error and a confidence level of 95%. A random number generation tool (StatTrek, 2017) was then used to randomly select households that were invited to take part in the survey.

The same number of surveys per village were completed for the baseline and endline in order to allow for comparisons between these two surveys. However, there was no cross reference between the start and end survey. The only identifier was the name of the respondent. Therefore, as part of the data analysis for chapter 4 a cross-check was carried out between the end and the original survey, which returned 291 respondents. Those respondents were either the same individuals participating in both surveys (250) or individuals recruited from the same households (in the event of death, or migration for employment or marriage of the original respondent) (41). That means that 47 households could not be identified and therefore they were excluded from my analysis (chapter 4). One household was also excluded due to abandoning the questionnaire in the first round of the survey. This possibly reduced the statistical representatives of the survey and might have introduced further biases if, for some reason, baseline and endline were not matched correctly.

Chapter 5 and 6 use qualitative data only, however the approach to the data analysis is different in both chapters. In Chapter 5 I performed inductive analysis developed from data, and chapter 6 is based on both inductive and deductive analysis. Both chapters have therefore a common stage of building theory inductively. This process started when I was in the field. I continuously analysed data by making notes, discussing interviews and observations with research assistants, developing themes and comparing and contrasting different pieces of data. These notes, themes and ideas acted as a base from which a more detailed data analysis process was later progressed (Glasser and Strauss, 2017). One important practice while in the field was a continuous validity check performed on myself whether 'either I was buying into the folk explanations or rejecting them without considering their validity' (Bernard, 2006: 361). Doing this exercise in a systematic way allowed me to separate out some engineered stories that were likely volunteered to me because that was what the participants thought I wanted to hear. After I returned from the field my interviews were transcribed, and then organised using Nvivo, files and folders and Excel spreadsheets. I also have a habit of writing short analytical memos of each analysed interview, which was very helpful in sieving through the vast amount of data. This gave me some initial ideas of what's going on in the data and also provided preliminary themes. Themes drew out from the initial analyses were then analysed further. I organised them into broader perspectives to reduce the themes.

Then I went through transcripts most relevant to those perspectives and inductively coded them for both indexical and non-indexical material. Indexical material is descriptive, focusing on 'who did what, when, where and why' and non-indexical material focuses on judgements, concepts, opinions and theories about events (Jovchelovitch and Bauer, 2000: 69). At that stage I had already a good idea how actors understood adaptation, and how they make sense and experience the adaptation project. For chapter 5 these actors' understandings were contrasted with historical document analysis to grasp where the narratives come from. And in chapter 6 a theoretical framework was applied to data, which further guided the exploration of the data and allowed to produce a more coherent report.

3.7 Challenges during fieldwork

Despite the profoundly rewarding nature of my experience in the field, I encountered several challenges. The initial hurdle involved obtaining a research permit and immigration clearance from COSTECH and the Immigration Department, respectively. Despite submitting paper applications, weeks passed without any progress due to the loss of both submissions. Thankfully, intervention from NGOs facilitated a quicker resubmission of my research permit. With regards to the Immigration Department, I went with some colleague's advice to 'find someone in *Uhamiaji* [the Immigration Dep.] to cry to as a way to speed things up'. This thankfully worked as well, and I received both documents in time for starting my fieldwork.

Once in the field, my second challenge emerged as I sought suitable living arrangements in the villages. While still in Iringa, I requested NGOs to assist to find a place for me in the villages, but without specific instructions. Upon arrival, I was directed to stay with a Ward Chancellor and his family. However, given the political nature of the figure, I declined the accommodation because I expected that this could negatively affect my research. Later I found an unoccupied house for rent. The Ward Chancellor did not hold that decision against me and we had a good working relationship throughout my fieldwork.

The third challenge was dispelling the perception that I was associated with the integrated adaptation project. Despite my efforts to clarify my role, some community members viewed me as part of the project, leading to misconceptions about my influence and objectives. This posed difficulties, as some believed I could secure funding for their development needs, while others distanced themselves due to past negative experiences with NGOs. Addressing these challenges required genuine communication and explanation of my position and intentions, which took a long time but eventually was successful.

The remoteness of the study villages presented additional challenges, especially during the peak rainy season in the Usambara Mountains (March to May). Sometimes a lorry got stuck in mud and stayed there for a few days. In this situation we were mostly walking long distances to get to the interviews, which was very time consuming. On one occasion I was unable to go back to my village house for a few days, but I kindly found shelter in the field office of TFCG in Amani Nature Reserve.

Furthermore, I faced a significant challenge related to expectations and reciprocity, a crucial issue in development research (Hammett et al., 2014). I opted not to provide individual payments to informants during interviews, instead proposing a larger donation to a communal development project chosen by the villagers. However, this strategy faced complications when the selected project, involving the transportation of live animals (goats), resulted in the death of one animal. This incident stirred feelings of injustice and anger among villagers who did not receive the goat. It needs to be noted that the decision about which sub-village won't receive the gift was made by the village leader and not myself.

Chapter 4 - Evaluating the impact of adaptation interventions on vulnerability and livelihood resilience.

4.1 Introduction

Development intervention, framed around climate change adaptation and resilience, increasingly tries to tackle the lack of global action in addressing climate change impacts in the global South (Bahadur et al., 2010; Frankenberger et al., 2014a). Such intervention is implemented through projects, by development or other organisations (e.g. humanitarian, environmental conservation), and incorporates policies and activities that aim to reduce vulnerability and build resilience to different shocks and stresses, including climate change (see Christian Aid, 2012; Concern Worldwide, 2019). Resilience is viewed by those development actors as a helpful conceptual tool to understand how people can manage the effects of shocks and stresses that affect their livelihood outcomes (Bahadur et al., 2013).

Designing and evaluating adaptation and resilience building projects aspiring to change vulnerability and livelihood resilience in a positive direction is however complex, and more evidence from intervention and learning is required. Resilience has been recognised as being specific to scale and shock and highly dynamic, and thus difficult to measure (Constas et al., 2014; Cumming et al., 2005). At the same time vulnerability assessments require knowledge on climatic and socio-economic pressures that affect people's lives, their sensitivity and adaptive capacity (IPCC, 2014). Globally, efforts have been made to assess various forms of vulnerability and adaptation to climate change impacts, especially in developing country contexts (see Omerkhil et al., 2020; Pandey et al., 2016). Similarly, many conceptual frameworks concerned with operationalising vulnerability and resilience, and more broadly, climate change impacts, have been put forward by academics, NGOs and major development agencies (see Oxfam, 2016; Sekhri et al., 2020; UNDP, 2014). Yet, their practical utility to elicit the impact of projects on reducing vulnerability and building livelihood resilience, in a given context, has rarely been tested (cf. Béné et al., 2017). Development practitioners usually lack the resources to collect high intensity data to ensure robust impact assessments, or if data is available it often remains unexamined due to the lack of capacities, such as technical expertise (GIZ,

2015). Consequently, development actors and governments fall short in understanding their programmatic contributions to reducing vulnerability and building livelihood resilience of the vulnerable people they deem to support. This is necessary not only to monitor implemented interventions but also to ensure their broader accountability in national and global adaptation responses.

The present study develops the BACI Adaptation Impact Evaluation Framework, which allows a robust project impact evaluation by adopting the Before-After-Control-Impact (BACI) research design. This approach compares changes in indicators of vulnerability and resilience before and after an intervention and for households who participated in the intervention and those who did not. By using the non-participant group as a control, it is possible to attribute factors of change directly to the intervention, thereby accurately evaluating the impacts of an intervention. The Before-After-Control-Impact (BACI) approach, also called difference-in-differences (DiD), is more robust than the Before-After (BA) approach alone (Bos et al., 2017). With this in mind, this study sets to fulfil two specific research objectives:

1. Describe the methodology that allows operationalising the BACI Adaptation Impact Evaluation Framework
2. Operationalise the framework to evaluate one of the European Union's Global Climate Change Alliance (GCCA+) flagship adaptation and resilience projects in Tanzania (2015- 2019)

Most specifically, this study focuses on the assessment of the GCCA+ project impacts on vulnerability and on enhancing households' livelihood resilience through building buffer capacity, self-organisation and capacity for learning. The paper provides two major contributions to the adaptation literature. First, the operationalisation of the BACI design in a study on adaptation and resilience, which combines survey evidence with ethnography, facilitates the understanding of intended and unintended outcomes. Second, it offers new insights for designing effective development interventions aimed at reducing vulnerability and building livelihood resilience. Next, the paper presents the theoretical background, followed by the project impact evaluation method. The results illustrate the findings from the BACI analysis, showing how the intervention impacted the mitigation of vulnerability

and the enhancement of livelihood resilience. Finally, the discussion compares the evidence to other studies on adaptation and resilience-building interventions and concludes with recommendations for development practice.

4.2 Theoretical background

This section introduces the related concepts of vulnerability and resilience and explores how they have been operationalised for adaptation and development. Specifically, we provide a brief overview of where the debate on assessing vulnerability and resilience currently stands in the development discourse and position our study in this literature. In the second part of this section, we present the theoretical foundation for our framework, before focusing on its analytical power for evaluating the impact of adaptation and resilience interventions.

4.2.1 Theoretical foundations and assessment of vulnerability and resilience for adaptation and development

The relationship between vulnerability, adaptation and resilience is historically complex (Cutter et al., 2008; Gallopín, 2006; Vogel et al., 2007). Adger (2006) refers to vulnerability as the “state of susceptibility to harm from exposure to stresses associated with environmental and social change and from the absence of capacity to adapt” (p. 268). Adaptation is often regarded as a process (cf. Adger et al., 2005) that results in an adjustment in response to actual or expected climate stimuli and its effects (IPCC, 2014). Many academics define resilience as the capacity of a system to absorb disturbance without losing its basic structure and function and the capacity for self-organisation and learning (Folke, 2006; Nelson et al., 2007; Speranza et al., 2014). Some authors suggested that vulnerability and resilience are antonyms (Folke et al., 2002), others saw their relationships whereby one is a subset of the other (Cutter et al., 2008). Nelson et al. (2007) consider adaptation as an actor-centred process of negotiation and decisions, and resilience as being concerned with the implications of these processes on the whole system. Studies also attempted to quantify vulnerability assessments, in the context of adapting to climate change, to produce policy-relevant recommendations (Gerlitz et al., 2017; Hahn et al., 2009; Pandey & Jha, 2012). They often turned to the vulnerability definition that came from

the Intergovernmental Panel on Climate Change (IPCC), which considers vulnerability to be a function of the system exposure, its sensitivity and adaptive capacity (McCarthy et al., 2001) and are based on climate vulnerability indices constructed on weighted factors grouped into key components.

More recently, however, resilience has been used as a synonym for adaptation and vulnerability reduction, and so, to mean taking action to reduce risk (Schipper and Langston, 2015). This is especially prominent in the development discourse where there is widespread adoption of resilience among NGO and donor agency programmatic pillars. For instance, in 2016, Oxfam set out its vision on resilient and sustainable development, that is “development that does not cause or increase risks, stresses and volatility for people living in poverty, and which makes progress towards a just world despite shocks, stresses and uncertainty” (Oxfam, 2016, p. 6). Despite various critics (Cannon & Müller-Mahn, 2010; Manyena, 2006), resilience gradually became an overarching concept and a long-term goal for the process of adaptation.

Similarly to vulnerability, assessing resilience proved complex for academics and development practitioners. Concerns relate to the lack of clear and coherent definitions, multiple scales and multilevel interactions, specificity to shocks and stresses, identification of common yet context-appropriate indicators, to name a few (Constas et al., 2014b). While substantive progress has been made to formulate and actively pursue the agenda to inform resilience assessment, for instance by the Resilience Measurement Technical Working Group (Constas et al., 2014a), complexities persist especially when it comes to its practical operationalisation (Constas et al., 2016; Williams, 2016). Recent research increasingly points out the need to develop robust monitoring, evaluating and learning frameworks for assessing and documenting the impact of resilience interventions (Béné et al., 2017). In the present development landscape, where many development actors use the principles of resilience in their programmes, evaluating resilience has become a key component of assessing projects’ success. The ability to evaluate projects for resilience through robust and consistent mechanisms, is needed in order to enhance the accountability of donor funding flows for projects, and as a way of assessing progress towards achieving resilience, as defined by various global policy frameworks, for instance the UN Sustainable Development Goals or the Sendai

Framework for Disaster Risk Reduction 2015-2030 (Schipper and Langston, 2015). It is also an opportunity for initiating institutional learning about what works and what doesn't work, and ultimately to implement more effective and equitable programmes of intervention. Still, very few frameworks for evaluating adaptation and resilience interventions are formulated with an operational, robust impact assessment in mind (see GIZ, 2015).

4.2.2 Theoretical foundations and operationalisation of the BACI Adaptation Impact Evaluation Framework

For our BACI Adaptation Impact Evaluation Framework we draw from the theoretical heritage of vulnerability, adaptation and resilience research (Adger, 2006; Folke et al., 2002) and focus on livelihood resilience, particularly the conceptual framework of livelihood resilience developed by Speranza et al. (2014). Speranza et al. (2014) created their livelihood resilience framework to conceptualise how people's livelihood practices contribute to maintaining individuals' capacity to respond to adverse conditions and to influence societal structures and processes that support, or constrain, maintaining livelihoods, especially during shocks and stresses. Consequently, livelihood resilience is defined as "the capacity of livelihoods to cushion stresses and disturbances while maintaining or improving essential properties and functions" and is determined "by actors' assets and strategies to maintain and increase assets, to self-organise and to learn" (Speranza et al., 2014, p. 111). We adapt this framework from Speranza et al. (2014) and create the BACI Adaptation Impact Evaluation Framework (Figure 2) that conceptualises how to empirically assess the contribution of adaptation interventions to households' capacity (buffer capacity) and the societal processes (self-organisation and capacity for learning) that support positive livelihood resilience outcomes.

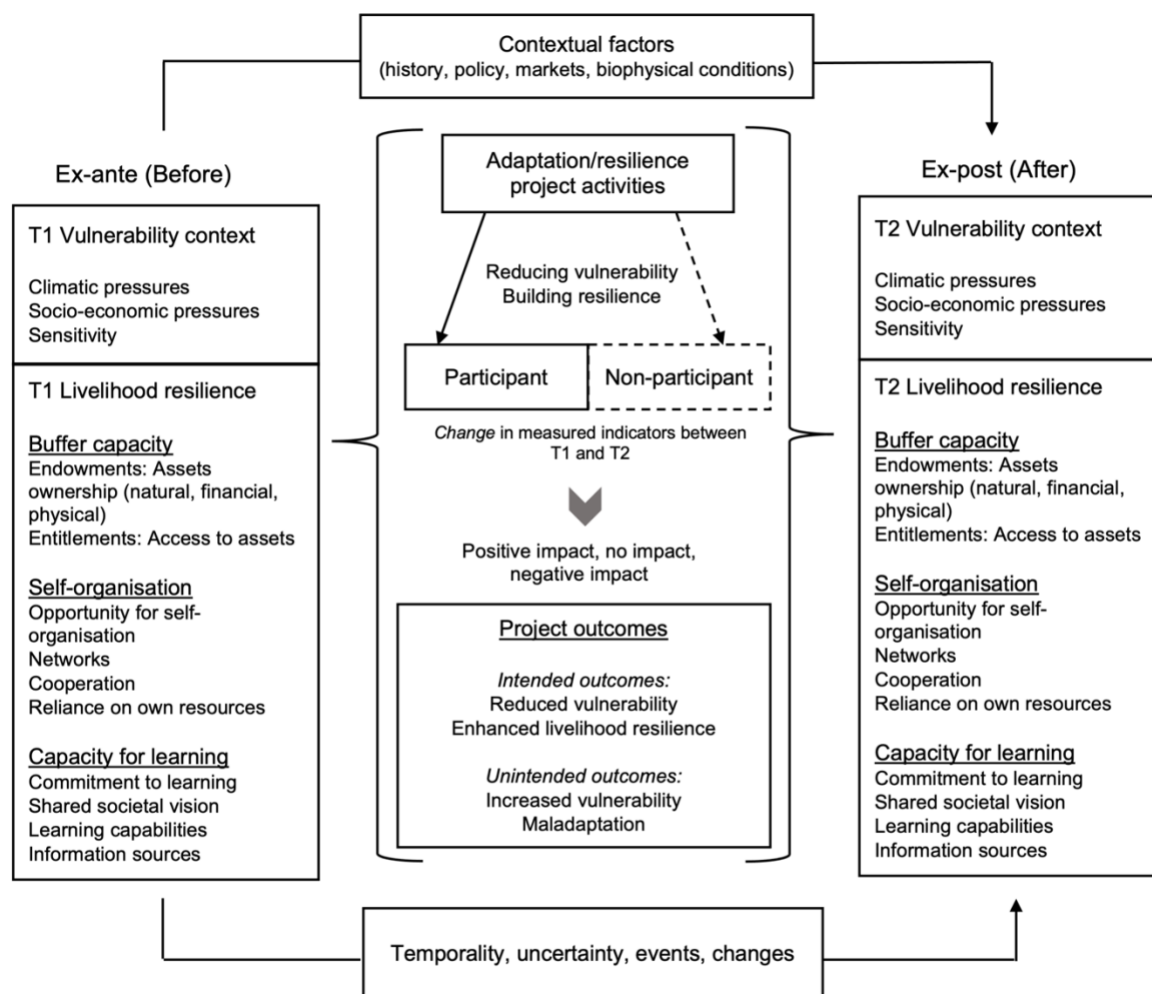


Figure 2: The BACI Adaptation Impact Evaluation Framework for evaluating the impact of adaptation interventions on reducing vulnerability and building livelihood resilience (livelihood resilience approach was adapted from Speranza et al. 2014).

Buffer capacity refers to “the capacity to cushion change and to use emerging opportunities to achieve better livelihoods outcomes such as reduced poverty” (Speranza et al., 2014, p. 112), and depends upon endowments, entitlements and their diversity. Endowments represent people’s livelihood assets, referred to as ‘capitals’ in the Sustainable Livelihoods approach (Chambers and Conway, 1992) and include a mix of human (skills, knowledge), natural (land, trees, crops), financial (income, savings), social (networks, reciprocity) and physical (livestock, infrastructure) capitals (DFID, 1999). Entitlements represent goods and services that a person can gain access to “using the totality of rights and opportunities that he or she faces” (Sen, 1984, p. 497 cited in Devereux, 2001). Livelihood resilience theory assumes that the accumulation and exchange of capitals provide a safety-net

against shocks and stresses. Studies have shown that diverse assets and services (e.g. crops, financial and agricultural services) and strategies (e.g. alternative income-generating activities) improve resilience by spreading risk (Sallu et al., 2010; Sina et al., 2019; Speranza, 2013). To operationalise buffer capacity, it should therefore include locally-relevant indicators of assets, access and diversity, as it was achieved in previous studies (Matter et al., 2021; Pandey et al., 2017; Quandt, 2018). In the framework, we omit the human and social capital from *buffer capacity* due to significant overlap with the dimensions of livelihood resilience - *self-organisation* and *capacity for learning*.

Self-organisation can be understood as either the process of emergence/re-creation of society through a dialectic of social structures (top-down processes) and individual actions (bottom-up processes), or the ability of social actors to determine their own rules that affect them in a collective process of social cooperation (Speranza et al., 2014). Internal community interactions regulating these processes are vital for self-organisation. Trust, norms and networks, which constitute key features of social capital, can improve the efficiency of society by facilitating cooperation and coordinated action (Putnam, 1993). This is fundamental for risk management. Previous studies have shown that many adaptive decisions, made at local levels, derive from participation in social networks and rely on good relations with others (Adger, 2003). Development practitioners who introduce a new set of rules and networks, alongside existing community dynamics and negotiations, influence components of self-organisation. Outcomes, in terms of changes to household's livelihood resilience, are likely to hinge on whether the process leads to increased trust and cooperation, or the opposite (Bahadur et al., 2013). Indicators reflecting participation in local groups and networks, cooperation and self-reliance are relevant to describe this dimension of livelihood resilience (Speranza et al., 2014).

Capacity for learning, the last dimension of livelihood resilience in the framework, describes the acquisition of new knowledge and skills, together with the capacity to act on them (Speranza et al., 2014). Ensor & Harvey (2015) argued that "learning processes can contribute to adaptive capacity by providing a way to alter practices or decision-making norms in the face of uncertainty" (p. 512). Committing to learning and having the ability to identify valuable knowledge, through exploring various

sources of information and considering new ideas and practices through experimentation, is the core in adapting livelihoods to ever changing conditions (Marschke & Berkes, 2006; Speranza et al., 2014). Development practitioners have an important role to play in facilitating the introduction of new knowledge and skills through adaptation and resilience projects. At the same time, any behavioural changes and acceptance of new knowledge are contingent on many factors and require supportive systems that foster processes of learning (Armitage et al., 2008).

Recent research shows that adaptation and resilience-building interventions do not adequately address the root causes of vulnerability (Eriksen et al., 2021). Although vulnerability is implicit in the original framework from Speranza et al. (2014), we position our analysis of livelihood resilience alongside the *vulnerability context* of climatic and socio-economic pressures that affect people's lives and their sensitivity (Suckall et al., 2014). These pressures represent the type of disruption households experience from different events such as crop failure from drought, poor prices for produce, illnesses etc. Temporality, uncertainty, events, and changes plus other contextual factors such as history and policies, constitute the unique local context that situates livelihoods and projects. In this framework, the unit of analysis is the household, a level where the impacts of intervention are predominantly felt (Quandt, 2018). As a result of an intervention, the livelihood resilience of households may be enhanced, and their vulnerability reduced. Other outcomes might include unintended consequences such as increased vulnerability or even maladaptation (Barnett & O'Neill 2010; Eriksen et al., 2021). The aim is to measure *changes* in vulnerability and livelihood resilience capacities between ex-ante (before) and ex-post (after) an intervention, and for households who participated in the intervention, and those who did not. By measuring *change* in vulnerability and resilience capacities from time T1 to T2, the framework goes beyond assessing a 'snapshot' of vulnerability and livelihood resilience in a fixed moment in time (cf. Quandt, 2018). Resilience, as an *emergent property* can only be manifested through the interaction of the system over time, thus a 'snapshot' of a few factors cannot accurately represent resilience (Tyler et al., 2016). Moreover, the framework is robust to the so-called "history threat" that occurs when other confounding factors or events, which also could affect the outcomes, take place between the before and after measurements (Robson et al., 2001, p. 20). A study design measuring indicators before and after intervention, but

without the non-participant comparison group, could be susceptible to this type of validity issue (cf. Jha et al., 2017). The Before-After-Control-Impact (BACI) or difference-in-differences (DiD) approach, presented in this study, aims to control for these contextual changes and constitutes a robust method to evaluate the impact of intervention on vulnerability and livelihood resilience (Bos et al., 2017; Smokorowski & Randall, 2017).

4.3 Materials and methods

4.3.1 Study area and the GCCA+ intervention context

The research was conducted among agricultural communities of the East Usambara Mountains located in Tanga Region, in north-eastern Tanzania. Due to proximity to the Indian Ocean, these highlands receive relatively high annual rainfall with approximately 1600 to 2300 mm, depending on location (Hamilton, 1989). The area has two main rainy seasons: the long rains of *masika* (March-May) and short rains of *vuli* (October-December). Long-term climatic records from the East Usambaras show that rainfall on the plateau is variable from year to year (Yanda and Munishi, 2007). In 1989, Hamilton and Macfadyen (1989) showed a tendency to a greater number of exceptionally dry years and a smaller number of exceptionally wet years, from the 1960s onwards. Rains have become less reliable and less predictable in terms of onset, duration and termination, which creates problems for the East Usambara communities relying on rain-fed agriculture. Climate projections for the area are also inconclusive. Some models suggest an increase in annual precipitation in this part of Tanzania (Luhunga et al., 2018), others project a drying trend for the region (Conway et al., 2017). Even the latest regional convection-permitting climate modelling, illustrates high levels of uncertainty in future projections of rainfall for the region (Chapman et al., 2020).

The European Union funded GCCA+ project (2015-2019) entitled “Integrated Approaches for Climate Change Adaptation in the East Usambara Mountains” formed the basis for this study. It was implemented by two non-governmental organisations - Engineering for Human Development (ONGAWA) and the Tanzania Forest Conservation Group (TFCG) - and Muheza District Council to support the

highland communities to adapt to climatic changes and to strengthen livelihood resilience. Two research institutions contributed to the design of monitoring and evaluation and conducted research to stimulate learning on resilience and adaptation. The project covered 8 rural villages with a population of 10,992 people in 2,853 households (ONGAWA, 2013). The dominant tribe in the area is the Wasambaa, but other ethnicities such as Zigua and Bondei are also present due to historical in-migration to the region (Powell et al., 2013). Average household income in the period 2016-2019 was 355 USD per annum (own data), which signals abject rural poverty even before income distribution to all household members (Aikaeli, 2010). The villagers depend mostly on farming and grow various food and cash crops including maize, cassava, beans, yams, banana, sugarcane, tea, vegetables and spices (Reyes et al., 2005). Job opportunities outside agriculture are scarce (small businesses, motorbike taxi, construction) and even employment in the nearby tea estates is vulnerable to low rainfall limiting the tea yield. The project introduced various capacity building and income-generating activities and technologies aiming to support local livelihoods under climate change (see Table 3). Some of the implemented activities sought to reduce households' vulnerability and improve buffer capacity through spice tree nurseries, livestock hand-outs, farmer field schools and extension for uptake of climate-smart agriculture (CSA) technologies, and income-generating forest-based enterprises (butterfly farming, beekeeping, ecotourism). Others supported the functioning of village structures and networks overseeing forest, land and water management (including water supply technologies) and various self-help and development groups nurturing collaboration and self-reliance (ONGAWA, 2013). The training that was provided and the knowledge platforms that were developed were designed to enhance capacities to learn and to experiment, contributing further to building livelihood resilience in the East Usambara Mountains.

4.3.2 Data collection

We used quantitative household survey and qualitative insights from focus groups, interviews and ethnographic notes from observations of project activities to help interpret the quantitative findings and to provide additional context. Structured survey information was collected in person in October 2016 and September 2019 from the same households, which provided panel data of 291 randomly selected households

before and after the intervention. Panel data (the same person/household over time) is considered a powerful tool for estimating policy or project effects (Wooldridge, 2012, pp. 465-468). The sample comprised of both project participants and non-participants. The project participants in the intervention were selected based on specific criteria such as 'spice producer' or 'suitable land holder' for some groups, e.g. economic groups and butterfly-farmer groups respectively, and general criteria such as 'at least 50% from poor/vulnerable background', '50% females' for most groups. In our survey a 'household' was defined by the Swahili word *kaya* that implies family members that have a common residency (Randall et al., 2011). The survey was divided into 6 sections covering the following topics: basic households' characteristics, households' vulnerability, buffering capacities and assets, agricultural practices, social capital and self-organisation, capacity for learning and project participation. The questions were close-ended with a mix of nominal, multiple-choice, and yes/no questions (Creswell, 2003). For instance, the participants were asked how many months they experienced water shortage in the last 12 months (nominal) or to indicate which agricultural services they have access to (multiple choice). This research was conducted according to the principles of academic excellence and integrity. The rights and dignity of the research subjects were prioritised on all occasions, including obtaining informed consent, data protection, anonymity and confidentiality and the right to withdraw from the study at any time.

Qualitative focus groups (FG) and face-to-face interviews were carried out in intervals from December 2016 to April 2019. The aim of the focus groups (n=8) conducted in each intervention village in 2016 was to investigate the villages vulnerability context. Further interviews (n=60) were undertaken between March 2018 and April 2019. The respondents were selected through convenience and targeted sampling (Newing et al., 2011). These interviews were semi-structured and unstructured, and while some topics related to the participation in the project were pre-prepared, there was also scope for the interviewees to express their own opinions (Bernard, 1995). We also carried out interviews with households who did not participate in the project (n=12) and those who dropped out after some time (n=10) due to lack of time or not seeing the benefits. Ethnographic notes and "jottings" produced throughout the fieldwork provided additional analytical depth and context (Bernard, 1995, p. 181). All interviews were conducted in locally relevant

languages (*Kiswahili* or *Kisambaa*), recorded on a voice recorder, and then transcribed into English by two qualified translators.

4.3.3 Indicators and measurements

It is crucial to select context appropriate indicators when operationalising a method or framework (Jones and Tanner, 2017). We constructed 12 simple indicators of vulnerability and 13 simple indicators of livelihood resilience based on the respondent's survey answers. The indicators reflect different dimensions of locally relevant characteristics of vulnerability and livelihood resilience in relation to the activities that the GCCA+ project implemented. Table 3 provides evidence of theoretical literature, which, together with the expertise of researchers and practitioners in the field, informed the choice of indicators. Each indicator measures one outcome used in the difference-in-differences regression models described below, against which the project impact was evaluated.

Table 3: Summary of the GCCA+ East Usambara project activities.

Description of project activity	Indicator of vulnerability and livelihood resilience	Theoretical link of project activity with indicator *.**	Measurement
	Exposure		
Climate smart agriculture (CSA)+	Climatic pressures	CSA technologies decrease exposure to climatic pressures (Khatri-chhetri et al., 2017)	Climatic pressures experienced (yes/no, crop failure from drought, crop pests and diseases, soil erosion, livestock diseases)
- CSA - Financial education - Business education - Searching for markets - Income generating activities	Socio-economic pressures	Education, diversified income-generating activities and access to markets decrease exposure to socio-economic pressures (Thulstrup, 2015; Sina et al., 2019)	Socio-economic pressures experienced (yes/no, poor price for produce, illness/family problems, land shortage, transport problems, lack of information, lack of tools)
	Sensitivity		
- Improved water supply++ - Management of water resources - Environmental by-laws regulating agricultural activities near water	Water shortage	Improved water infrastructure and water management decrease sensitivity to water shortages (Thulstrup, 2015)	Months HH has insufficient water during the year (total number of months)
- CSA - Income generating activities	Food shortage	Improved and diversified farm technologies and income activities decrease sensitivity to food shortages (Speranza et al., 2008; Matter et al., 2021)	Months HH has insufficient food during the year (total number of months)
	Buffer capacity		
- Training on tree nurseries - Promoting agroforestry (including spice trees)	Tree ownership+++	More household resources (trees) increase buffer capacity (Quandt et al., 2017)	Trees owned by HH (total number of fruit and spice trees)
- Training on dairy livestock husbandry - Livestock hand-outs	Livestock ownership+++	More household resources (livestock) increase buffer capacity (Weldegebriel and Amphune, 2017)	Livestock owned by HH (total number of livestock)
CSA technologies	Crop diversification	Increased diversity of crops increases buffer capacity (Speranza, 2013)	Crops grown by HH (total number of different crops grown)
Income generating activities: butterfly farming, dairy cattle, eco-tourism, beekeeping, income from CSA and small businesses	Total income	Diversified household resources (income) increase buffer capacity (Sina et al., 2019)	Sum of all income sources (agriculture, salaried job, own business, daily labour, dairy cattle, forest enterprises)
Access to inputs, access to extension (agricultural and livestock), access to agricultural storage facility	Agricultural services+++	Better access to agricultural services increases buffer capacity (Speranza, 2010)	Agricultural services HH has access to (total number of services)
- Rural microfinance groups - Access to bank loans	Financial services+++	Better access to financial services increases buffer capacity (Ulrich et al., 2012, Weldegebriel & Amphune, 2017)	Financial services HH has access to (total number of services)
Economic groups	Market services+++	Better access to market services increases buffer capacity (Speranza, 2010)	Market services HH has access to (total number of services)

Access to market: spices, milk, butterflies, honey and eco-tourism			
	Self-organisation		
Establishment of new community groups and village institutions (as above)	Networks	Participation in networks supports self-organisation (Marschke & Berkes, 2006; Speranza et al., 2014)	Professional groups and village institutions HH members are part of (total number of groups)
Cooperation through group work	Cooperation	Cooperation increases self-organisation (Adger, 2003; Speranza et al., 2014)	Reciprocal livelihood activities (total number of productive activities done with neighbours)
Supporting self-reliance within family and neighbours	Self-reliance	Availability of own/local sources of support increases self-organisation (Speranza et al., 2014)	Own/local sources of support HH has access to (total number of local sources of help)
	Capacity for learning		
Knowledge platforms (places/people) for discussing issues and opportunities	Information sources	Availability of alternative sources of knowledge increases capacity for learning (Speranza et al., 2014)	Information sources HH uses (total number of information sources)
Provision of education to established groups and institutions	Commitment to learning	Committing to education increases capacity for learning (Speranza et al., 2014)	Trainings HH participated in during the project (total number of trainings received)
CSA technologies	Experimentation	Experimentation increases capacity for learning (Marschke & Berkes, 2006; Speranza et al., 2014)	Sustainable agricultural technologies HH practices on their own farm (total number of CSA technologies practiced)

+CSA refers to integrated land management framework with 3 main objectives: increase productivity (intensification), enhance resilience to climate change (adaptation), reduce greenhouse gas emissions (mitigation). See Figure A2 in Appendix I for breakdown of CSA technologies promoted by the GCCA+ in the East Usambara.

++Improved water supply refers to installation of 31 new public water points (small gravity technology)

+++ Livelihood activities and services already existent in the project villages that were intended to scale up.

*Decreased exposure = reduced vulnerability; decreased sensitivity = reduced vulnerability

**Increased buffer capacity, self-organisation, capacity for learning = increased livelihood resilience

4.3.4 Data analysis

4.3.4.1 Project impact evaluation method

We assessed the project impact using several analytical methods. For the quantitative analysis we adopted the difference-in-differences (DiD) method (Angrist and Pischke, 2008) to allow for comparisons over time between participant and non-

participant households (HHs). The DiD method measures the effect of a treatment or intervention by comparing the treatment group (the participant HHs), before and after the intervention, with a similar control group (the non-participant HHs) that did not receive the intervention. The intervention effect is the difference between the participant HHs and the non-participant HHs, across time. This is possible because the non-participant comparison group effectively ‘differences-out’ contemporaneous confounding factors (Antonakis et al., 2010). We define participant HHs as those with at least one household member participating in the project and non-participant HHs as those whose household members did not participate in any of the project activities. DiD assumes that, in the absence of the intervention (counterfactual outcome scenario), the difference between those two groups would be relatively stable over time and that their trends would follow parallel paths. Groups that do not exhibit those characteristics are not suitably matched analytical groups (Wing et al., 2018). Figure 3 demonstrates a simple two-period and two-group DiD design, as adopted in this study.

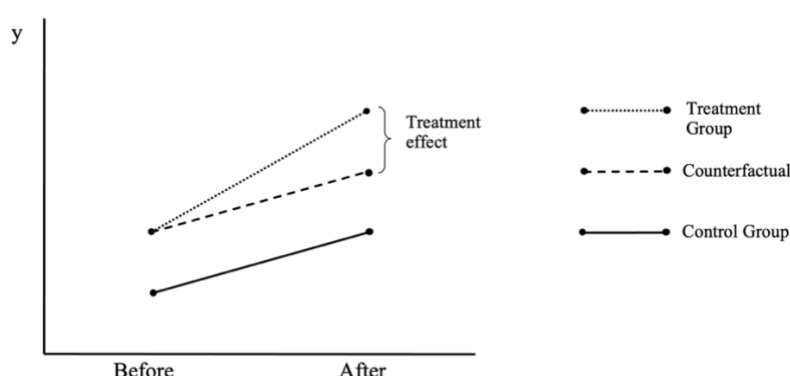


Figure 3: Estimating intervention effect using difference-in-differences.

Source Antonakis et al., (2010: 1109).

The statistical analysis was performed in Stata 16.1 software. We obtained differences in outcomes between the participant and non-participant HHs before and after the intervention (in T1 and T2) and the ‘participation by time’ interaction terms (DiD estimators) by computing difference-in-differences regression models for continuous outcomes of livelihood resilience and sensitivity and logit regression models for binary outcomes of exposure. Participation (dummy variable where 0=non-participant HHs and 1=participant HHs), time (dummy variable where 0=pre-

project period and 1=post-project period) and the interaction of 'participation by time' were the model fixed effects. Covariates representing HHs socio-demographic characteristics (see section "Characteristics of participating and non-participating households" below) were added to the models to mitigate for potential imbalances between participant and non-participant HHs at baseline. Robust standard errors were used in all models. Our model is summarised in the simplified equation below:

$$Y = \beta_0 + \beta_1 * \text{Participation} + \beta_2 * \text{Time} + \beta_3 * (\text{Participation} \times \text{Time}) + \text{covariates} + \text{error term}$$

Our primary interest - the coefficient β_3 - captures how the mean change in outcomes from before to after the intervention was different for the participant and non-participant HHs, thus reflecting the project impact (DiD estimator). In the probability metric of the logit models of exposure, the project impact was obtained from additionally calculating the marginal effects. For variables of vulnerability, where higher absolute values indicate higher vulnerability, positive and significant DiD scores indicate greater increase in vulnerability in the participant group, in comparison to non-participant group, therefore negative project impact. Inversely, for indicators of livelihoods resilience, where higher absolute values indicate more resilience, positive and significant DiD scores indicate positive change for the participant group in comparison to the non-participant group and thus positive project impact. When the mean difference in outcomes from before to after was greater for the non-participant than the participant HHs, and/or the DiD estimator was not statistically significant, there was no project impact.

We also analysed trends in rainfall data sourced from Marikitanda Tea Research Centre and the East Usambara Tea Company (EUTCO) to determine whether annual rainfall has changed over time using the Mann-Kendall trend test.

Qualitative interviews, focus groups and field notes supported the quantitative analysis. They were coded in NVivo 11 software using thematic analysis (Boyatzis, 1998). Codes and themes were developed along the research process and represented developed theories about the project impact on participant and non-participant HHs. We frequently compared quantitative and qualitative data to

triangulate our findings. Developed memos also provided relevant quotes for this work.

4.3.4.2 Limitations of the framework, data and design

To confidently attribute changes in vulnerability and livelihood resilience to the project activities, the participant and non-participant HHs should be comparable in the pre-project period, with regards to the outcome indicators and the covariate distributions of the household characteristics (Sills et al., 2017). Trends in outcomes can be plotted if sufficient data is available (>2 time periods). In this study we lack such data therefore baseline trends could not be properly evaluated. Three out of 25 of our outcome indicators ('getting poor price for produce', 'information sources' and 'markets') were statistically different at baseline for the participant and non-participant HHs ($p < 0.01$, $p < 0.05$, $p < 0.05$ respectively), with the participant HHs having higher means (for indicators of resilience) or lower proportions (for indicators of vulnerability). This could suggest that the participant and non-participant HHs have already been on different pathways with regards to those indicators. Furthermore, the difference-in-differences methodology is sensitive to 'spillovers' from higher level interventions to the households' level variables. Such 'spillovers' might reduce the ability to separate the project impact from other factors. In this study we use qualitative understanding to triangulate our findings. Finally, 4 out of 13 of the baseline HHs covariates ('HH size', 'wealth ranking', 'HH head years of schooling' and 'ownership of mobile phone') showed statistical differences between the participant and non-participant HHs, exposing the participant selection bias. These covariates were included in all difference-in-differences models as controls.

4.4 Results

4.4.1 Characteristics of participating and non-participating households

Descriptive statistics of socio-demographic characteristics of the participant (hereinafter P) and non-participant (hereinafter NP) HHs pre-project are presented in Table 4. Among the random sample of HHs surveyed across the project villages (10.2% of all HHs), 207 HHs participated in the project and 84 HHs did not. The results show that P HHs were bigger, have HHs heads that are more educated and

have more access to mobile phones. P HHs were also less poor than NP HHs despite the project intention to target poor and more vulnerable HHs. All other socio-demographic characteristics were comparable (Table 4).

Table 4: Comparison of the socio-demographic characteristics of the participant and non-participant households at baseline

Variable	Participant HHs (N=207)	Non-participant HHs (N=84)	p-value
	Mean / Proportion		
HH size	4.69 (2.02)	4.11 (2.25)	0.034**
Working age adults	2.00 (1.11)	1.90 (1.14)	0.491
Male	53.2% (110)	50.0% (42)	0.627
Female	46.8% (97)	50.0% (42)	
Male-headed HHs	78.3% (162)	71.4% (60)	0.214
Female-headed HHs	21.7% (45)	28.6% (24)	
Poor HHs	41.1% (85)	52.4% (44)	0.049**
Average HHs	47.3% (98)	44.0 (37)	
Better off HHs	11.6% (24)	3.6% (3)	
Land owned (acres)	3.14 (3.24)	2.66 (2.15)	0.214
Years of schooling (HH head)	6.17 (3.37)	5.19 (3.04)	0.021**
From the village	71.01% (147)	69.05% (58)	0.739
Has electricity	22.71% (47)	21.43% (18)	0.813
Has mobile phone	73.91% (153)	55.95% (47)	0.003***
Has transport	13.53% (28)	9.52% (8)	0.347
Has satisfactory house+	88.89% (184)	82.14% (69)	0.122
Using improved water source++	28.50% (59)	20.24% (17)	0.146

+Walls and roof made of solid materials such as wooden poles (with mud), bricks and iron sheet roof

++Piped water, borehole or protected stream

p-values estimated by two sample T-test (for means) and Pearson chi2 (for proportions) ***

p<0.01; ** p<0.05; * p<0.1

Reported in brackets – standard deviation for variables expressed as means and No. of respondent HHs for variables showing proportions

4.4.2 Vulnerability context and mitigation

During the project implementation period, the climatic conditions and related livelihoods pressures changed. At the start of the project, in 2016/2017 the East Usambaras, like most of the region, experienced severe drought caused by the El

Niño–Southern Oscillation (ENSO) (FAO, 2014; Kolusu et al., 2019). On the other hand, in the second half of the project in 2018/2019 the rainfall was particularly abundant (Figure 4). Our analysis of annual rainfall recorded daily in the East Usambara Mountains between 1969 and 2019 confirmed considerable annual variation, however there was no evidence of long-term decline or increase in rainfall in the area (Mann-Kendall trend test - monthly averages used, $\tau = -0.0204$, $\text{Prob} > |z| = 0.451$).

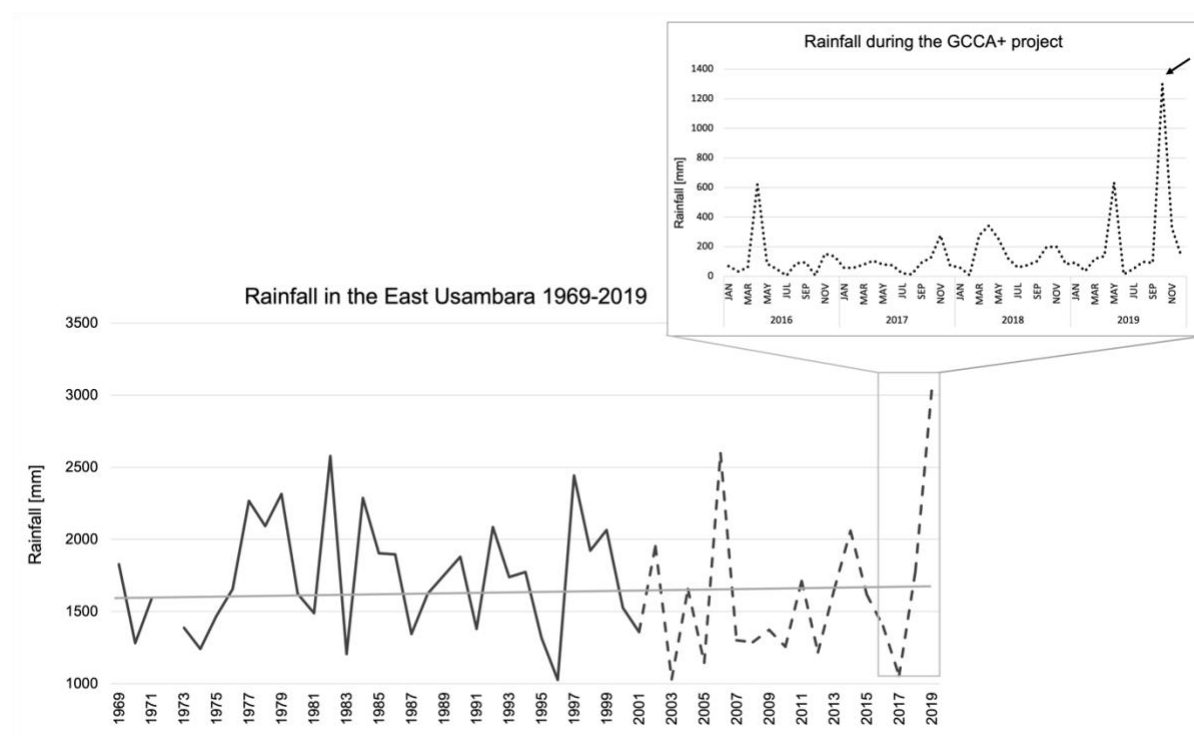


Figure 4: Trends in annual rainfall in the East Usambara.

Between 1969-2019 with fitted trend line. The period when the project was implemented is enlarged (averages by month). Data sourced from Marikitanda Tea Research Centre (continuous line) and the East Usambara Tea Company (EUTCO) (dotted line). Data for 1972 is missing.

Regression models demonstrated that all indicators of climatic pressures improved during the project. However, the observed changes were not related to the project activities - there was no statistical difference between P and NP HHs (Table 5). With regards to socio-economic pressures the project had small positive impact on mitigating 'lack of tools and equipment' with P HHs having lower probability of reporting those issues. Notably two indicators of socio-economic pressures worsen over time – 'getting poor price for produce' and 'land shortages' with P HHs being

less likely of having land shortages than NP HHs, although this effect also cannot be assigned to the project activity. Poor prices for produce may relate to the seasonal variation in production that may have been influenced by the increase in rainfall in the second half of the project. This is also demonstrated by the indicators of sensitivity discussed next. Reported number of months with food and water shortages decreased for both groups on average from over 4.5 to 1.5 months (food shortage) and from 2.3 to 1 month (water shortage) from before to after the project. Again, the differences between P and NP HHs on those indicators across time were not significant and thus not attributable to the project.

Table 5: Comparison of variables of exposure and sensitivity before and after the intervention for participants and non-participants households.

	Participant HHs (N=207)		Non-participant HHs (N=84)		Difference-in- differences model (robust s.e.)	Project impact
	Before	After	Before	After		
<i>Climatic pressures+</i>					Marginal effects	
Crop pests and diseases	35.2% (73)	16.9% (35)	38.0% (32)	11.9% (10)	0.073 (0.076)	No impact
Crop failure from drought	89.3% (185)	56.0% (116)	88.0% (74)	45.2% (38)	0.083 (0.076)	No impact
Soil erosion	30.4% (63)	13.0% (27)	33.3% (28)	8.3% (7)	0.089 (0.073)	No impact
Livestock diseases	16.4% (34)	6.7% (14)	14.3% (12)	3.5% (3)	0.027 (0.053)	No impact
<i>Socio-economic pressures+</i>						
Getting poor price for produce	40.5% (84)	53.1% (110)	46.4% (39)	54.7% (46)	0.042 (0.089)	No impact
Illness and/or family problems	54.1% (112)	39.1% (81)	57.1% (48)	47.6% (40)	-0.051 (0.089)	No impact
Land shortage	29.9% (62)	30.4% (63)	27.3% (23)	33.3% (28)	-0.044 (0.083)	No impact
Transportation problems	38.1% (79)	10.1% (21)	39.2% (33)	5.9% (5)	0.060 (0.070)	No impact
Lack of information and/or understanding	24.6% (51)	14.9% (31)	27.3% (23)	13.0% (11)	0.050 (0.071)	No impact
Lack of tools and/or equipment	28.9% (60)	9.6% (20)	20.2% (17)	14.2% (12)	-0.139 (0.067)*	Positive impact
<i>Sensitivity++</i>					DiD scores	
Food shortage	5.01 (2.98)	1.53 (1.79)	4.63 (3.17)	1.63 (1.73)	-0.433 (0.460)	No impact
Water shortage	2.28 (2.23)	1.09 (1.81)	2.28 (2.64)	0.93 (1.87)	0.159 (0.421)	No impact

All models were adjusted for socio-demographic differences between P and NP HHs

+ Indicators of climatic and socio-economic pressures (binary dependent variables)

estimated with logistic regression (proportions and marginal effects reported)

++ Indicators of sensitivity (continues dependent variables) estimated with linear regression (means and DiD scores reported)

p-values *** p<0.01; ** p<0.05; * p<0.1

4.4.3 Enhancing livelihood resilience

Table 6 summarises the results of the project impact on different dimensions of livelihood resilience. The DiD estimators were calculated by difference-in-differences linear regression models and adjusted for socio-demographic differences between P and NP HHs presented in section 4.1. Qualitative enquiry supported the interpretation of the results throughout.

Table 6: Project impact on livelihood resilience before and after the intervention for participants and non-participants households.

	Participant HHs (n=207)		Non-participant HHs (n=84)		Difference-in-differences model	
Indicators of livelihood resilience	Before	After	Before	After	Coefficients Participation x Time (DiD scores) (robust s.e.)	Project impact
Buffer capacity	Means (SD)+					
Tree ownership	30.41 (74.38)	35.70 (86.21)	20.08 (33.83)	31.50 (90.53)	-5.944 (13.374)	No impact
Livestock ownership	1.17 (2.81)	1.65 (3.22)	0.82 (1.62)	1.14 (2.79)	0.092 (0.447)	No impact
Crop diversification	5.62 (2.75)	6.43 (3.15)	5.48 (2.85)	4.66 (2.97)	1.660 (0.497)***	Positive impact
Total income (USD)	315.26 (551.0)	460.13 (684.53)	255.80 (390.84)	391.48 (553.31)	-5.456 (91.113)	No impact
Agricultural services	0.86 (1.01)	1.02 (0.87)	0.85 (0.98)	0.38 (0.63)	0.581 (0.160)***	Positive impact
Financial services	0.83 (0.72)	1.15 (0.79)	0.80 (0.71)	0.50 (0.63)	0.607 (0.123)***	Positive impact
Market services	0.47 (0.56)	0.72 (0.67)	0.30 (0.51)	0.75 (0.55)	-0.162 (0.103)	No impact
Self-organisation						
Networks	0.65 (1.06)	2.89 (2.54)	0.42 (0.74)	0.46 (0.79)	2.155 (0.220)***	Positive impact
Cooperation	0.35 (0.63)	0.22 (0.75)	0.28 (0.50)	0.22 (0.44)	-0.063 (0.098)	No impact
Self-reliance	0.84 (0.95)	1.37 (0.50)	0.79 (0.87)	1.39 (0.65)	-0.082 (0.144)	No impact
Capacity for learning						
Information sources	2.40 (1.53)	5.29 (3.51)	1.83 (1.28)	1.93 (2.23)	2.694 (0.386)***	Positive impact
Commitment to learning	0.09 (0.29)	2.85 (2.89)	0.07 (0.25)	0.11 (0.32)	3.467 (0.300)***	Positive impact

Experimentation	3.41 (2.30)	2.66 (1.60)	2.95 (2.35)	1.45 (1.60)	0.787 (0.357)**	Positive impact
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All indicators of livelihood resilience estimated with linear regression adjusted for socio-demographic differences between P and NP HHs

+Unadjusted means reported

p-values *** p<0.01; ** p<0.05; * p<0.1

4.4.3.1 Buffer capacity

Regression analysis suggests that the implementation of the project led to an improvement in indicators of ‘crop diversification’, ‘agricultural services’ and ‘financial services’ among P HHs compared to NP HHs, which indicates a positive project impact. However, further analysis supported by qualitative data suggests a possible unintended outcome for the NP HHs. In parallel, the project oversaw the introduction of village-level by-laws that prohibit growing certain crops such as yams and vegetables, near water courses, for environmental conservation reasons. The number of NP HHs vegetable cultivators dropped from 26.1% before the project to 9.5% after, while only about 3% of P HHs gave them up (Figure 5). Similarly, amid those by-laws NP HHs did not expand planting yams, in contrast to P HHs where the number of yam cultivators increased by about 20%. It is likely that while the project aimed to reduce cultivation near the water for conservation purposes overall, it disproportionately affected those households that did not participate, and were not provided with alternatives. P HHs, which were more powerful and better positioned in the village, likely were less intimidated by the new by-laws and may have found a better way not to obey them. In our interviews, poorer NP HHs seemed to be the most disappointed with those by-laws:

‘I cannot accept such solutions. With one yam you can feed all your children (...) They grow fast [yams] and we also sell them seasonally’ (ID60, women).

A female focus group participant also explained that vegetable cultivation helps women to earn income during drought:

‘When it is dry like now, we plant vegetables [in farms near water to allow bucket irrigation] and sell them to fellow villagers because not many people have vegetables on their farms [that are not near water]’ (FG2, women).

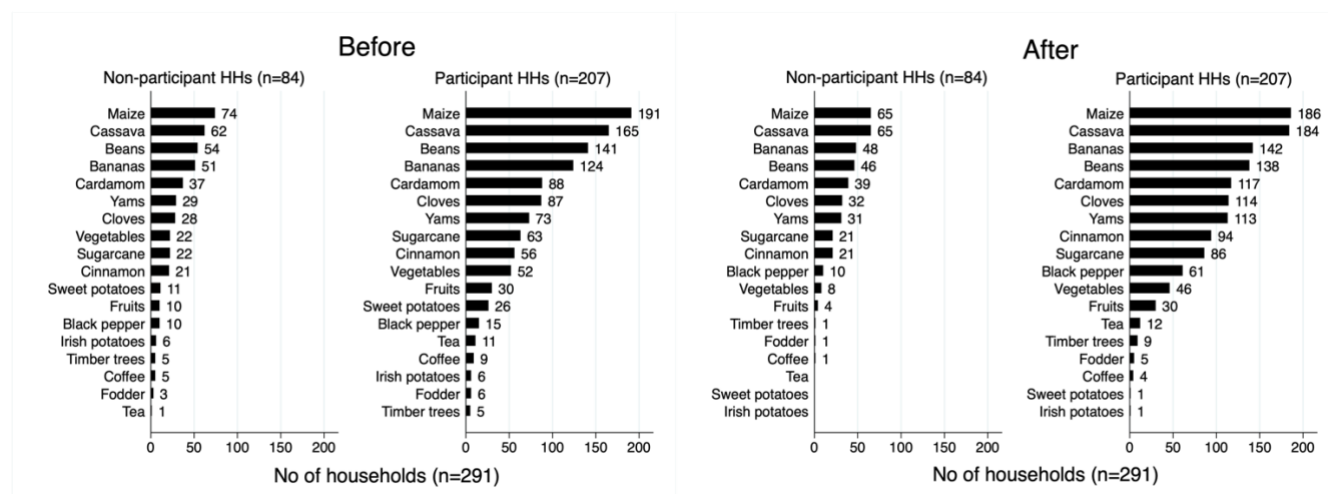


Figure 5: Crops grown by participant and non-participant households before and after the intervention.

Similarly, increased access to agricultural services for the P HHs, through the farmer’s field schools, may have had a negative knock-on effect on the NP HHs that struggled to access extension services during the programme operation period. Indeed, testimony from NP farmers suggest that district staff became too occupied with the project activities, which resulted in decreased delivery of everyday services to other villagers:

‘I used to call XX [extension officer] for advice but he is too busy now with shamba darasa [farmer field school] (...)’ (ID12, man).

Regression results also show that, overall, the project had little impact on ‘total income’ earned, ‘tree and livestock ownership’ and ‘market services’, despite the introduction of income-generating activities (e.g. butterfly farming, beekeeping and ecotourism), dairy cattle hand-outs and searching for new markets. Interviews with farmers indicated that agricultural income did not significantly increase, after the project, due to poor uptake of climate-smart technologies, long maturing period of introduced cash crops, and poor performance of drought-resistant seeds due to heavy rainfall. Other income generating activities such as butterfly farming were also

compromised by a nationwide ban on exporting live animals (including butterfly pupae) issued by the Tanzanian government in 2016. Detailed breakdown of different income sources before and after the project is presented in the Appendix I in Figure A1. On the other hand, there was a high interest in possession of spice tree seedlings (indicator of 'trees ownership') in both groups over time, followed by an increased access to 'market services' (Table 6). Although not attributed to the project, this suggests a growing desire for planting spices as a chosen adaptation strategy among the villagers:

'When I think about the future, I see that the spices can take us to the next level. Nothing else' (ID34, man).

4.4.3.2 Self-organisation

The project's positive influence on *self-organisation* manifested in increased number of networks that more than doubled for the P HHs compared to NP HHs (Table 6). This is likely to be due to the many development groups and village institutions the P HHs engaged with throughout the project. On the other hand, small means of the indicator of 'cooperation', which captures the help HHs offer to each other in relation to productive livelihood activities, show that cooperation was low in the intervention villages; and this was independent of the project. During our focus groups the residents explained:

'Most families work individually here. But people show good collaboration for funerals, weddings, births and to attend sick persons' (FG3, women).

Focus groups attendees also suggested that people might increase support to each other during drought:

'I know that my fellows who are more blessed than me will give me some work. In the year like this [drought] we sometimes work for cassava [provide labour in exchange for food]. Others will give you food even for free' (FG4, woman).

Inversely, the improvement over time in the indicator of ‘self-reliance’ was significant, however no difference between P and NP HHs indicates no project impact on this indicator either.

4.4.3.3 Capacity for learning

The results show a positive project impact on the *capacity for learning* dimension of livelihood resilience. Overall, during the project, P HHs received almost 3.5 times more training than NP HHs and increased their use of different information sources on average over 2.5 times. Regression analysis also suggests that despite downward trend the project positively influenced agricultural experimentation, with P HHs reporting practicing more climate-smart technologies than NP HHs (Table 6). Interestingly, during interviews, majority of participating farmers reported struggles with practicing many of the introduced technologies, for instance constructing terraces on their farms:

‘This is a very hard work and requires many men to accomplish. You need to have money to hire people to help you’ (ID 23, man).

The survey and interviews also provide evidence that certain technologies promoted by the project, particularly those focusing on soil conservation in food production such as contour farming, retaining grasses or mulching, may have been considered redundant by some farmers and show low uptake amid increasing spice cultivation (compare Figure A2 in the Appendix I). A testimony from one village leader confirms this:

‘Farmers now calculate how much return they can get from 1 acre of land. Spice production gives them better return than cultivation of maize or cassava. From the money earned they can easily buy food’ (ID7, man).

4.5 Discussion

Having shown how the BACI Adaptation Impact Evaluation Framework can be operationalised to evaluate the impact of adaptation interventions, we now move to

discuss the key findings from its application during this study. We make inferences with other studies on adaptation and resilience-building interventions, reflect on our learning, and offer recommendations for development practice.

4.5.1 Vulnerability context and mitigation

In East Usambara, the vulnerability context changed with the change of rainfall from 2016 to 2019, and the outcomes for households' vulnerability proved largely independent from the project activities. One reason is that the project predominantly focused on mitigating drought, and its impacts likely became less relevant when climatic conditions changed from drought to heavy rain. For instance, Gaworek-Michalczenia et al. (2019) noted that drought or disease-resistant seeds do not perform well in wetter conditions in the East Usambara Mountains. On the other hand, the observed outcomes of socio-economic pressures for P and NP HHs likely reflect the existing differences between them: for instance, NP HHs with fewer assets, education, and mobile phone access might have more difficulty in securing enough land. However, those differences in vulnerability between P and NP HHs were mostly not significant and should be interpreted with caution. Our findings support previous studies that highlight the necessity of thorough investigation of a broad range of shocks and stressors and their effects on livelihoods to inform adaptation and resilience intervention (Béné et al., 2015; Frankenberger et al., 2014a). Current projection models are not clear cut about the direction of precipitation change in this region of Tanzania (Chapman et al., 2020). While drought remains an important livelihood risk, increases in extreme rainfall are expected, especially in the highlands (Luhunga et al., 2018). Development practitioners must therefore ensure a risk-informed project design, and be prepared to address various climate scenarios to avoid gearing up for short-term solutions and heading towards maladaptive outcomes in the future (Magnan et al., 2016). At the same time, there are challenges that development practitioners face when working with rain-fed agriculture-dependent communities in areas with a highly uncertain and variable climate. While longer projects may have more opportunities, for instance, to test different seed varieties 'on the ground' in various weather conditions, it is clear that the 'best practice' guides used in designing similar interventions do not offer enough guidance on how to make approaches like climate-smart agriculture more effective

under such conditions (see URT, 2017). Those gaps are limiting the impact of investments on reducing vulnerability and building resilience to climate change.

4.5.2 Enhancing livelihood resilience

Our analysis illuminated various challenges for development assistance to design programmes that enhance livelihood resilience. Positive impact of the project was most visible on the *capacity for learning* dimension of livelihood resilience, particularly the indicators of ‘commitment to learning’ (training that HHs received) and diversified ‘information sources’ (knowledge platforms HHs use). The project committed to fostering learning including the development of ‘know-how’ practical skills and other education, involving training on good governance, entrepreneurship, or natural resource management, and created links between those platforms. There is also a possibility that ‘information sources’ were partially increased through other factors, not related to the project. On the other hand, primary activities aiming to build households’ buffering capacities, such as income-generating activities, dairy livestock keeping, climate-smart agricultural technologies, or market services, demonstrated limited impact at the end of the project. Frankenberger et al. (2014a) noted that short funding cycles of development projects do not allow the time for addressing adaptive and transformative capacities related to the underlying drivers of risk and vulnerability, such as human capital (skills, health, education), good governance, infrastructure (markets, roads, communications systems), policies and regulations that provide enabling environment for bigger systemic changes (Béné et al., 2015). Our findings suggest that projects can potentially be successful in transmitting new knowledge related to those capacities during the intervention period. However, the transmission of knowledge alone is not sufficient for a meaningful modification of the capacity base necessary for resilience building. Speranza et al. (2014) argued that learning in resilient systems should come with the ability to translate new knowledge into action. Acceptance and subsequent conversion of new knowledge into action is contingent on many factors, including the broader systemic processes that foster social learning (Rist et al., 2006), existing ‘generic’ capacities (Williams et al., 2015), shared vision (Wenger, 1998) and many others. In the East Usambara Mountains some of the introduced ‘new knowledge’, including various climate-smart agricultural technologies, seemed disconnected from

the residents' existing capacities and their shared adaptation vision. This was evident in P and NP HHs high uptake of spice tree seedlings and low experimentation with technologies in food production, which also required additional funds. The growing importance of spice production in the area requires continued support with markets and creating enabling conditions allowing households to earn sustainable income from the sale of spices. This in turn requires sustainable funding mechanisms, and longer-term intervention consisted of multiple, complementary, and integrated activities, instead of short-term and fragmented projects demonstrating transient impacts.

Nurturing community self-organisation is another livelihood resilience building strategy (Speranza et al., 2014). The project was mindful of community self-organisation and achieved positive impact in expanding social networks, which constitute an essential part of social capital, upon which people draw in pursuit of their livelihoods (DFID, 1999). However, the expansion of community networks did not go in tandem with the increase in households' cooperation, which was reported as low for activities other than funerals, births, weddings, and attendance of the sick. Slightly better cooperation was reported in the dry year (2016) than the wet year (2019), for both groups, which signal that there was some work-related cooperation among neighbours during drought. Those results were nevertheless independent of the programme activities. Bahadur et al. (2013) noted that it is somehow naïve to assume that project-based interventions, limited in time and resources, can fully accommodate the complexity of fostering community networks and cooperation. It is like ignoring that multiple values, agendas and interests are present in 'communities', which are not made up of homogenous groups of people (Agrawal and Gibson, 1999). This part of building livelihood resilience requires developing long-term relationships of trust, negotiating differences and building on shared vision with communities (Bahadur et al., 2013); and this is difficult to achieve in 3-5 year-long projects. At the same time projects should recognise that certain adaptation or resilience-building activities may themselves erode trust and create unintended, and often negative externalities for livelihoods, which we discuss next.

During the project tensions arose between conservation policies and livelihood enhancement goals, due to their disproportionate negative effect on the NP HHs.

Negative impacts included reduced access to district extension staff, who became less available while working on the project, and decreased crop options due to conservation-related by-laws. The latter is also linked to elimination of an important livelihood option in times of drought (yam and vegetable cultivation). While protecting key resources is part of learning, and attention to major ecological aspects of resilience is necessary to achieve long-term sustainability (Folke and Gunderson, 2010), trade-offs between livelihoods and natural resources and across scales (household-community-landscape) are inevitable and need to be considered at design stage to avoid unintended outcomes. Bamberger et al. (2016) argued that ignoring unintended outcomes in development projects, especially those affecting the most vulnerable groups, leads to breaching equity objectives and allows more powerful citizens to reap the benefits or even worsen the situation of the poor. It is especially likely if the levels and quality of participation and representation are low, with those who participate not adequately representative of the full extent of the community and/or merely consulted (Botes and Van Rensburg, 2000). This runs the risk of many important situations and lived experiences relating to the presence of the intervention going unnoticed (Morell, 2010). This also resonates with what has long been discussed in the livelihoods and human-oriented resilience literature: what looks like resilience building from one perspective or at one level might not be when observed from another level or perspective; thus tools to achieve resilience are not value neutral (Béné et al., 2014; Brown, 2014; Marschke & Berkes, 2006). Recognising this is a first step for more reflective and ultimately more equitable adaptation and resilience intervention.

4.6 Conclusions

The BACI Adaptation Impact Evaluation Framework expanded the livelihood resilience framework of Speranza et al. (2014) to incorporate a BACI research design, which allows to accurately evaluate the impact of adaptation interventions on vulnerability and livelihood resilience of households. It is relatively easy to operationalise yet a robust tool that can be used to assess vulnerability and resilience in different contexts. Some knowledge of inferential statistics and longitudinal data sets with at least two time points is, however, required to successfully operationalise this framework. We envisage that this study will be

relevant to the international community, including donors and development practitioners, involved in delivering and evaluating adaptation and resilience programmes supporting livelihoods. This framework and associated methodology can generate robust evidence on the impacts of resilience-building initiatives that can inform learning within projects and inform future intervention design. This is needed to ensure more effective and equitable adaptation and resilience-building intervention, and avoidance of unintended outcomes, which then can guide recommendations for setting policy priorities.

Our focus on several key outcomes in the GCCA+ project, enabled us to accurately evaluate which dimensions of livelihood resilience and vulnerability the project influenced and in what ways. Education and hands-on training in local groups visibly strengthened the capacity for learning and networks for the participating households. Yet the project impact on most buffering capacities (e.g. income, markets) remained low. We trace this result to the traditional funding mechanisms, where the short-term cycles of projects do not allow for effective transfer of knowledge into action. Funding should therefore prioritise long-term in situ projects at local and regional levels to increase ongoing support for the introduced resilience-building activities, while communities still learn how to derive sustainable benefits from them. We also produced evidence of unintended consequences and maladaptation, particularly among poorer non-participating households. This shows that trade-offs between livelihoods and environmental policies, which are frequently unrecognised in adaptation interventions, are real and should be considered carefully by development practitioners. Finally, the results show that in communities where livelihoods are largely dependent on rain-fed agriculture, variable weather plays a significant role in determining the vulnerability context of livelihoods. Hence, projects intending to reduce vulnerability must consider climatic variability and apply risk-informed project design to avoid maladaptive outcomes. At the same time, there is a need for more research and practical guidance on how such intervention might look in areas with highly uncertain climate scenarios.

Appendix to Chapter 4

Supplementary materials to Chapter 4 can be found at the end of the thesis

Chapter 5 - Narratives of climate change adaptation in global biodiversity hotspots

5.1 Introduction

Biodiversity hotspots² (BH) are of global importance for conservation due to their unique biodiversity and significant pressures from habitat loss (Myers et al., 2000). For the past thirty years, the dominant discourse that guided conservation and development action in BH has focussed on the conservation of rare and endangered biodiversity, and was driven by international investments targeting those specific locations (Marchese, 2015). BH became the centrepiece of global conservation policy that have attracted over \$1 billion in funding from major conservation and development agencies (Sloan et al., 2014).

While global discourses and institutions historically played an important role in funding and managing BH, the needs of local people living in these areas were often neglected (Lele et al., 2010). Being traditionally perceived as places of wilderness, biological laboratories or commercial sites (e.g. for wildlife tourism), and also under high pressure from human activities, did not serve the prioritisation of the local livelihood priorities (Neumann, 2001; Conte, 2010). Rather, the biodiversity conservation or commercial interests dictated levels and specifics of social development available to communities living in biodiversity-rich areas (Adams and Hutton, 2007; Brockington and Wilkie, 2015). Narratives of environmental degradation, which situate local communities and their livelihoods as the primary agents and drivers of environmental degradation, fuelled global conservation discourses (Leach and Mearns, 1996b). Despite the introduction of more integrated conservation policy, including the addition of alternative livelihood projects under the broader 'conservation with development' approach, initiatives have often led to trade-offs between short-term livelihood improvements with long-term conservation objectives (Brown, 2003; Roe et al., 2015).

² Biodiversity hotspots are defined as biogeographic regions with more than 1500 endemic vascular plant species and less than 30% of original primary habitat remaining. Endemic species refer to species that are found in that particular region and nowhere else on Earth (Myers et al., 2000).

With the shift in global environmental narratives towards the climate change agenda in mid-2000s (Roe, 2008), a new wave of climate change adaptation projects have been introduced within BH. Climate change discourse changed the focus of sustainability and arguably, the aim is no longer 'preserving natural resources for future generations' but 'strengthening resilience and adaptive capacity in social–ecological systems' (Werners et al., 2013: 334; Khan and Cundill, 2019). Most development agencies talk about reducing vulnerability and strengthening resilience to climate change, with mutual benefits to ecosystems, and to the local poor and vulnerable (Frankenberger et al., 2014; UN, 2020). Millions of dollars have also been transferred to a range of implementing organisations to run climate adaptation projects in BH, with a varied objectives of addressing climate change and conservation issues, whilst also supporting sustainable development (Perez et al., 2010).

In this article, we present the findings from a 3-year long ethnographic research that explored the processes of adaptation project implementation in a BH through a critical analysis of climate adaptation narratives that emerged around a high-profile Global Climate Change Alliance's (GCCA+) adaptation project called 'Integrated Approaches to Climate change Adaptation' and implemented in the East Usambara Mountains BH³. In our analysis, we deconstruct the interactions and consequences of climate adaptation narratives generated by various stakeholders throughout the project implementation. This deconstruction aims to illustrate the connection between current adaptation narratives and historical legacies in BH's locations. We explore how these historical influences shape the adaptation process and justify specific approaches to adaptation action, thereby revealing injustices that impact the design and implementation of the project.

Our focus on adaptation narratives in BH provides a unique contribution to the debates around the interactions between global and local narratives that inform the understandings and framings of climate change vulnerability and adaptation responses (Donald et al., 2022; Evans et al., 2014; Farbotko and Lazrus, 2012;

³ The East Usambara Mountains are part of the Eastern Arc Mountains that belong to the Eastern Afromontane biodiversity hotspot. Previously, this hotspot was known as the Eastern Arc and Coastal Forests of Tanzania and Kenya hotspot (Marchese, 2015).

Krauß and Bremer, 2020). Through this the paper contributes to the broader discussion about the effectiveness and fairness of project interventions and their ability to reduce vulnerabilities encoded in adaptation narratives (Eriksen et al., 2021; Gaworek-Michalczenia et al., 2019; Nagoda, 2015). It also shows how adaptation approaches in BH are related to and limited by old conservation paradigms capable of perpetuating historical injustices. We envisage that the findings will support the design and implementation of more effective and equitable climate adaptation projects in BHs and inform global climate adaptation policies.

5.2 Theoretical background

5.2.1 Defining narratives

Following Fairhead and Leach (1995: 1023) we define narratives as ‘stories of apparently incontrovertible logic which provide scripts and justifications for development action’. This definition originated from an earlier work of Roe (1991), who observed that most development policy prescriptions rely on blueprint solutions derived from simplifying assumptions about human-environment interactions encoded in, what he calls, ‘development narratives’. Roe further argued that regardless of whether narratives are true or not, when established, they are difficult to refute even if negative evidence appears (Roe 1991, 1995). Policy makers and development practitioners are allured to such narratives, because they simplify and stabilise complex and uncertain realities, in which programmes and policy-making are taking place (Keeley and Scoones, 2003). Social and political factors also influence how knowledge informing narratives is created and used. For instance, Hajer (1995) claims that narratives are ‘discursive storylines’ that act as political devices created to maintain discursive order that shapes perception and action. Those devices position actors and attribute specific ideas of ‘blame’, ‘responsibility’, ‘urgency’ and ‘responsible behaviour’ to them (Hajer 1995: 64-65). Their role is to suggest unity in a situation when many discursive components of a problem exist, and to achieve discursive problem closure by inhibiting the exploration of the problem in broader contexts. Narratives are therefore entangled with values, social relations, power and histories (Beymer-Farris and Bassett, 2012; Forsyth and Walker, 2008).

The political economy of past and present resource use and control in many ways reflects such discursive narrative production. This is demonstrated, for instance, in how the colonial and postcolonial bureaucracies and conservation policies utilised environmental degradation narratives to justify the appropriation of local resources (Fairhead and Leach, 1995; Forsyth and Walker, 2008). Many studies documented how interventions informed by such narratives or 'received wisdom' (Leach and Mearns 1996a) involve poor empirical evidence, as well as narrow thinking about local history, traditional land-use systems, culture and other social priorities inherent to rural livelihoods (Nygren, 2000; Stringer, 2009). Narrowly selected solutions are then applied out of local contexts, failing to recognise counter-narratives that present divergent understanding and at times better explain the complexity of local environmental problems and vulnerability. Disruption of local communities, dislocation, marginalisation, and unnecessary restrictions on traditional livelihoods are just a few of the possible outcomes.

5.2.2 Global versus local narratives and their implications for projects design and implementation

It is not a new observation that just a handful of powerful global narratives underpin most policy prescriptions directed towards solving what has been defined as 'global environmental problems' (Jasanoff, 2013; Taylor and Buttel, 1992). Global narratives on deforestation, desertification, biodiversity loss and most recently, climate change frame issues in such a way that favours external policy intervention over locally derived, culturally-relevant and context-specific perspectives (Adger et al., 2001). International actors and knowledge regimes produce global narratives through global institutions and assessments such as the Millennium Ecosystem Assessment, which endorsed the biodiversity hotspot concept, and the Intergovernmental Panel on Climate Change (IPCC), which became central to producing knowledge about climate change. Typically, these narratives focus on multiple winners, positive outcomes, and synergies, while ignoring losers and costs (Massarella et al., 2020). They also possess a vast mobilising power in terms of dominating thinking, determining funding and structuring institutional arrangements; hence, they have been described by some scholars as both managerial and hegemonic (Adger et al., 2001; Arnall et al., 2014; Morchain, 2018). The success of the biodiversity hotspot

concept illustrates a dominant narrative at work, which led to enormous financial investments in projects targeting those areas. The climate adaptation narrative, originating from distant United Nations offices, has faced similar criticism for its perceived lack of relevance to communities actively confronting climate change at the frontline (Klepp and Chavez-Rodriguez, 2018a). Below, we explore the origins of both narratives and examine how they might permeate the design and implementation of projects in the BH areas.

5.2.2.1 Biodiversity hotspot discourse

The biodiversity hotspot discourse originates from global processes such as the United Nations Convention on Biological Diversity (CBD) and focuses on strict environmental conservation approaches that view biodiversity as separate from human life, envision protected areas as ‘islands without people’, and recognise modern science as the most important source of knowledge (Zinngrebe, 2016). Ecologist Norman Myers introduced the biodiversity hotspot concept in the late 1980s as a novel priority-setting strategy for biodiversity conservation. The aim was to direct scarce conservation resources to the most biodiverse and threatened areas around the world, which have become hugely successful with international funders and philanthropy (Dalton, 2000; Marchese, 2015). Jepson & Canney (2001, p. 225) then noted that such ‘silver bullet’ blueprint solutions are particularly appealing to the international community and policy makers who view conceptually simple and well-promoted ideas as ‘cure-all’ solutions. Later Redford et al., (2013: 437) named such approaches in conservation policy - that attempt to sell old wine in a new bottle - the ‘conservation fads’. BH quickly became part of the ‘fad’ family. Other examples include the ‘conservation with development’ projects rolled out from the 1980s across many conservation sites including BH, that were designed to promote participation, empowerment and decentralisation, but resulted in less ideal outcomes when institutionalised and reconfigured in design and practice (Blaikie, 2006; Dressler et al., 2010). Being built on largely speculative assumptions (Adams et al., 2004), and questionable equity records, including often wrongly attributed degradation narratives (Abbott and Campbell, 2010; Hajdu and Fischer, 2017), these approaches have mostly failed to meaningfully reconcile ecosystem conservation with the needs of local people dwelling close to nature (Lele et al., 2010; Chambers

et al., 2022). Hence, delving into the historical legacies embedded in BHs and understanding how they have shaped recent narratives tied to this wave of adaptation projects can elucidate the potential injustices hidden in the design and implementation of these projects. This exploration is essential for enhancing future outcomes and refining the approach to such projects.

5.2.2.2 Climate adaptation discourse

The climate adaptation discourse shares some common characteristics with the biodiversity hotspot discourse. The global climate adaptation discourse too largely emphasises scientific knowledge produced by global ‘experts’, focuses on ecosystems as opposed to the social drivers of vulnerability, and favours simplistic blueprint solutions that are broadly applicable (Arnall et al., 2014; Klepp and Chavez-Rodriguez, 2018). While, the United Nations Framework Convention on Climate Change (UNFCCC) and the IPCC, major contributors to these narratives, have evolved their understanding of adaptation and vulnerability over time – shifting from adaptation conceptualised as ‘adjustment’ to reduce vulnerability to climate stimuli in early IPCC reports (see Bassett and Fogelman, 2013) to an approach concerned more with equity issues in the most recent one (IPCC, 2023) - the governments and practitioners continue to struggle with providing adaptation interventions that effectively reduce vulnerability (Eriksen et al., 2021; Nunn and Kumar, 2019). A well-documented obstacle to progress is the tendency to overlook local realities and contextual nuances encoded in local narratives, which are essential to achieving effective and equitable adaptation outcomes (Ensor, 2015; McNamara et al., 2020). Some recent critics pointed out that despite the common label of community-based or community-driven adaptation approaches, the prescribed solutions and management measures are often top-down and driven by global experts, which significantly differ from what actions are valued and taken by the local people themselves (Westoby et al., 2021).

In the context of BH, many conservation organisations adopted the global climate adaptation discourse to secure funding for their projects (de Wit, 2018). It is widely acknowledged that adaptation responses should incorporate various forms of environmental conservation to strengthen resilience and adaptive capacity and thus

reduce vulnerability to future climatic changes (Folke and Gunderson, 2010; Haque et al., 2022). At the same time analysts highlighted that there often are trade-offs related to addressing multiple livelihoods and environmental challenges (Adams et al., 2004; Roe, 2008) and lessons needs to be learned from previous conservation projects to avoid past mistakes (Blom et al., 2010; Chishakwe et al., 2012; Reid, 2016). Perhaps one of the most important lessons emphasised in the literature is that the communities should be at the centre of any planned adaptation intervention with local initiatives holistically targeting vulnerability and equity framings (Reid, 2016). In this context, academic debates emphasise that adaptation research and practice feature two different orientations towards reducing vulnerability (O'Brien et al., 2007). One framing of the climate problem focuses solely on the biophysical impacts of the changing climate and interprets vulnerability as the negative outcome of those impacts. It then seeks solutions through specific adaptation strategies, for instance, technical adjustments on a farm or environmental management, without considering how underlying social, historical and political factors, and individual capacities, influence vulnerability and adaptation processes. This orientation has been named in the literature as the 'end point' (Kelly and Adger, 2000) or the 'outcome' vulnerability approach (O'Brien et al., 2007). Yet this framing misses the opportunity to engage with the contextual capacities and constraints that existed in the communities before the intervention. It consequently fails to address the 'root causes' of vulnerability (Ribot, 1995), which constitute the 'starting point' or the 'contextual' vulnerability approach (Kelly and Adger, 2000; O'Brien et al., 2007). The latter approach understands adaptation as a dynamic social process (Adger, 2003; Smit and Wandel, 2006) and one that needs historically relevant, localised, bottom-up, and co-produced approaches in order to be successful (Ayers and Forsyth, 2009; McNamara and Buggy, 2016; Rayner, 2010). Projects that overlook the intricate complexity of local vulnerability and adaptation processes in BH run the risk of historical injustices seeping into the design and implementation of adaptation efforts, resulting in maladaptive outcomes.

5.3 Methods and materials

5.3.1 Case study selection

We used a case study design to provide a robust, context-specific and detailed exploration, which is suitable to investigate local adaptation narratives in their real-life context (Baxter and Jack, 2015). The case study context is the implementation of the GCCA+ 'Integrated Approaches for Climate Change Adaptation in the East Usambara Mountains' project (2015-2019). The Usambara Mountains are divided into the West and East Usambaras, and have a long history of external intervention dating back to colonial times (Conte, 2004). In more recent years, the East Usambara has seen large international investments in forest conservation shaped by the biodiversity hotspots narratives (Hamilton and Bensted-Smith, 1989).

Figure 6 marks the eight villages participating in the project. The area has high population densities, limited roads and services and high levels of rural poverty. While it is an ethnically diverse area due to historical in-migration, most livelihoods revolve around rain-fed subsistence and cash crop agriculture (Powell et al., 2013). The main ethnic group is the Wasambaa tribe that have occupied these mountains for millennia due to relatively wet and stable climatic conditions owing to dense forest cover and the proximity of the Indian Ocean (Feierman, 1974). Bondei and Zigua are less populous tribes, much later arrivals on the plateau. Conservation schemes have historically brought fewer benefits to these eight remote communities (see Figure 6) than, for instance, those nearby the Amani Nature Reserve - Tanzania's first Forest Nature Reserve. Some villages in the project area also had their agricultural land absorbed into ecological corridors that linked protected areas on the plateau, such as the Derema and Kambai corridor (see Rantala et al., 2013).

Recent changes in rainfall patterns resulting in increased episodes of drought or extreme rainfall have left the villagers struggling to produce enough crops (Gaworek-Michalczenia et al., 2022). At the same time, the climate projections for the region are inconclusive. Consecutive rainy days are projected to decrease, while extreme rainfall events are also highly probable (Chapman et al., 2020; Conway et al., 2017).

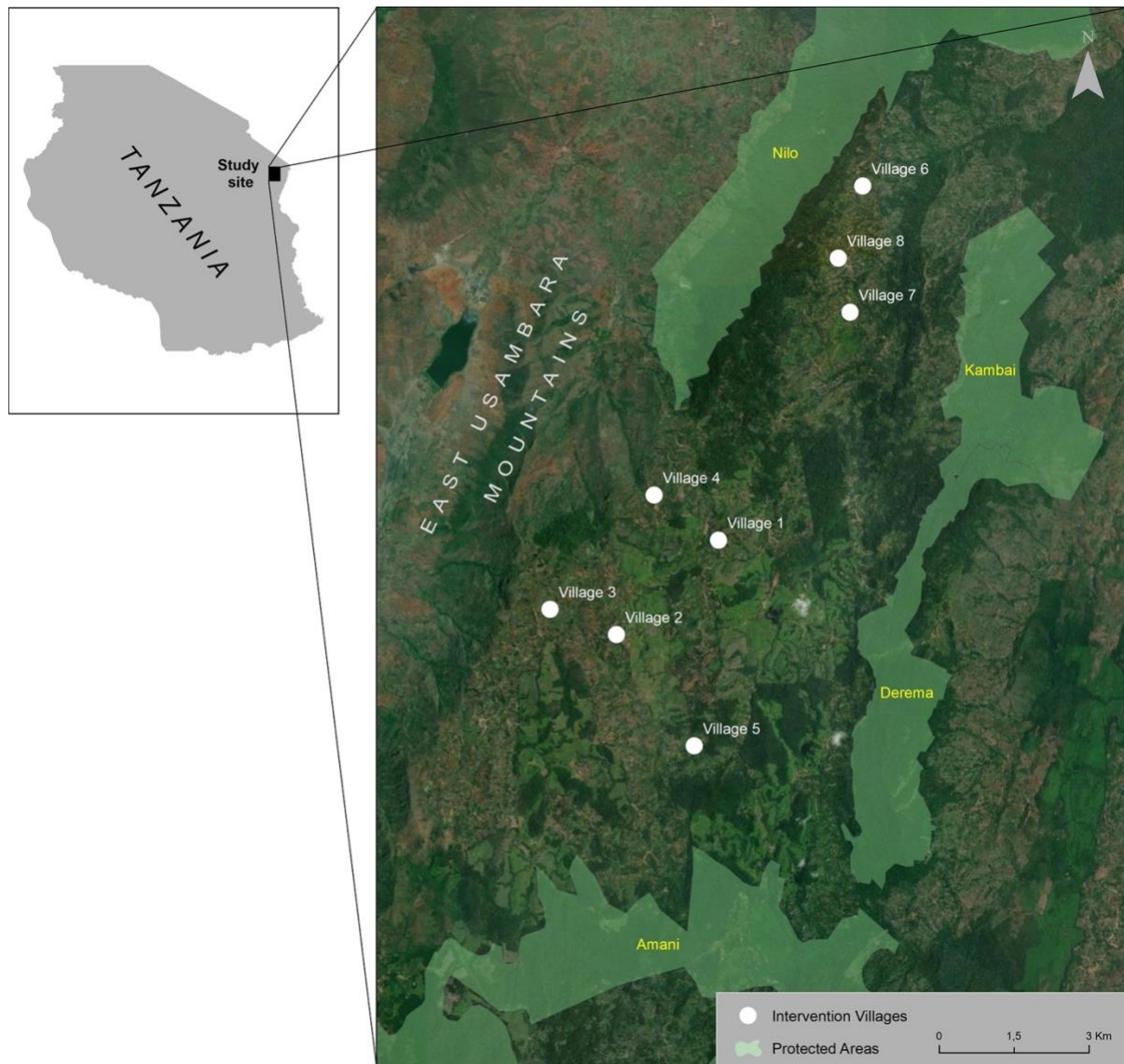


Figure 6: Map of the GCCA+ project location with the villages participating in the intervention surrounded by protected areas of the East Usambara Mountains.

Tanzania was one of the first countries to receive financial assistance for climate change adaptation under the European Union's GCCA initiative. The alliance's aim is to nurture cooperation and political dialogue on climate change between the EU and developing countries most vulnerable to climate change (European Commission, 2011). The GCCA in Tanzania funded several projects implemented in two consecutive phases. Projects implemented in phase one (2010-2014) set up a limited number of 'eco-villages' in different ecological zones so that successful practices could be replicated in similar environments in the future. 'The Integrated Approaches for Climate Change Adaptation in the East Usambara Mountains' was part of the second phase (2015-2019) of the GCCA interventions in Tanzania

(GCCA+, 2018a). A consortium of development and conservation non-governmental organisations (NGOs) and a local District Council of Muheza implemented the project, whose objective was 'to support eight communities living near high biodiversity forests in the East Usambara Mountains to increase and diversify incomes, strengthen resilience and reduce vulnerability to climate change-related impacts' (ONGAWA 2013: 6). Communities participating in the 'eco-village' scheme received a variety of interventions and training broadly labelled as 'climate change adaptation technologies and approaches' (GCCA 2017: 2). Water infrastructure and water resources management, alongside climate-smart agricultural technologies, were the main adaptation technologies offered to the communities, supported by forest-based enterprises, village economic groups and building of knowledge and capacities about climate change adaptation in villages and at district level.

5.3.2 Data collection and analysis

We applied an ethnographic (Hammersley and Atkinson, 2019) multi-method approach to investigate climate change adaptation narratives during the implementation of the project. The research followed the implementation of the on-the-ground project activities in real-time, at intervals, over a 3-year period. Full immersion in the intervention allowed us to achieve the depth of study, while the multi-methods approach enabled data triangulation (Lincoln and Guba, 1985).

We collected data in three stages that aligned with the project implementation. First, in November/December 2016, we conducted focus groups in all intervention villages (n=8) to explore local perspectives on vulnerability. In 2018, the lead author conducted seven months of ethnographic fieldwork that involved narrative interviews and participant observation. In April 2019, we observed the project phasing out and handing over to the Muheza District and the intervention villages. We chose a conversational narrative approach to interviewing and adaptation research to encourage the participants to report their experience of the project in their own words (Paschen and Ison, 2014). This allowed us to elicit a diversity of voices and knowledge(s) from a broad range of stakeholders, including villagers from different socio-economic backgrounds (n=60), balanced ratio of genders, community leaders (n=16), NGOs staff (n=7), district and ward officers and extension workers (n=22).

The lead author also participated in and observed, alongside the villagers, many of the project activities. Participant observation of village meetings and project activities grounded the interviews in community life and expanded our understanding of how actors' experiences and narratives relate to the social and environmental context they are in (Bernard, 2006). All interviews and some meetings were audio recorded and transcribed from Swahili and English by two experienced translators and the lead author.

Narratives were analysed using basic principles of social constructivism that human thought, knowledge and action are shaped by language and discourse (Keller, 2013; Lakoff, 2010; Leach et al., 2010). This interpretation of environmental discourses questions the simplifications of dominant narratives that marginalise local narratives representing the knowledge and values of less powerful actors within the society (Forsyth and Walker, 2008; Nygren, 1998). Specifically, we analysed the data through an inductive approach (Strauss and Corbin, 1998). Preliminary coding of interview transcripts and field notes returned broad narrative categories related to actors' understanding of adaptation problems, their solutions and associated justifications (Roe, 1991, 1994). At that stage we also realised that past narratives influenced more recent ones. To grasp the origin of the narratives we used historical document analysis alongside the analysis of our interview transcripts and of the project documents (Ralph et al., 2014). The historical document analysis was based on reports from the Usambara's past conservation and development projects and literature about the regions' environmental history, and helped to understand the context in which adaptation narratives emerged. We then assessed whether narratives across the interviews and the analysed documents influenced or contrasted one another. Our aim was to understand the interactions between these narratives, and discern the consequences based on the accounts provided by the participants. Finally, in the spirit of 'holism' and 'interpretive lens' unique to narrative analysis (Spector-Mersel, 2014: 3-4), we then re-read the whole interviews, placing them in the broader context identified in historical literature. This approach ensured that the accounts weaving together adaptation narratives were accurately reported, bearing in mind that only a small fraction of the complexity, diversity and 'thick description' (Geertz, 1973) can be reported in this article.

5.4 Results

Below, we present the main narratives identified from the analysis: the environmental degradation narrative, the climate resilience-building narrative, and the social development narrative. The first narrative explores the historical legacies of external interventions embedded in the East Usambara landscape. These legacies have had varied effects on the stakeholders involved in the adaptation process, influencing their understanding of vulnerability and shaping their perspectives on climate change drivers and impacts. The subsequent two narratives dissect the interactions between these historical legacies and the adaptation project processes. The final section presents the consequences of this narrative landscape. Together, the results showcase how historical injustices continue to infiltrate the project's design and implementation, leading to maladaptive outcomes.

5.4.1 The environmental degradation narrative

The first identified narrative was named by us 'the environmental degradation narrative'. This narrative was dominant in the landscape of the East Usambara Mountains. It is an old narrative that carries historical legacies of externally defined interventions, reaching back to colonial period. The narrative's endurance and its impact on current adaptation processes, underscore the need for a nuanced understanding of the various contributors to shaping and perpetuating this environmental degradation narrative.

During the colonial period, environmental degradation narratives were strongly at play in the Usambara Mountains as elsewhere (Conte, 2004; Leach and Mearns, 1996). These narratives were fuelled by Western orthodoxies and scientific ideas that generally devalued African land-use systems (Fairhead and Leach, 1995). They advocated for exclusionary solutions to forest management to protect commercially valuable resources from 'the detrimental habits of the local people' (Schabel 1990: 132-133).

In the Usambaras, the German and later British administrations gazetted large swaths of forest for commercial interests in timber, agriculture (coffee and tea) and to

protect watershed services, causing conflicts with the local population, land shortages and widespread poverty (Woodcock, 2002; Vihemäki, 2005). Forestry documents revealed that the German land management system in [Tanzania](#) was oriented on economic development, which remained 'sharply discontinuous with pre-colonial economic patterns' and was 'strongly resented by local people, both for its content and its heavy-handed enforcement' (Schabel, 1990: 131). This related particularly to land use restrictions, coercive labour and imposed taxations (Schabel, 1990). Subsequently, the British, emphasising environmental conservation, gazetted more forests for climate and soil protection, reflecting concerns about climate and water catchment preservation. At the same time, the tea industry was introduced to the Usambara Mountains, which caused in-migration of workers and further land competition. As Conte (2004: 102-125) reports from the West Usambara the pressures from colonial land alienation had significant impacts on local agricultural livelihoods faced with lack of arable land, shorten fallow periods leading to rapidly decreasing land fertility, crop diseases, drought and famine etc., which eventually resulted in unsustainable system that easily fitted into the colonial narratives of environmental degradation. In response British administration undertook vast rehabilitation schemes of the Usambara soils that lasted over 10 years but were eventually abandoned in 1957 due to local resistance. Conte (2004: 144) writes: 'the schemes could not succeed because its designers decided to attack single-mindedly an environmental problem rather than rural poverty'. The existing social, environmental and economic conditions were simply too harsh for such soil conservation schemes to make a difference and the burden of their implementation to local people was too significant.

The colonial agendas pursued in the Usambaras resulted in significant environmental and social consequences. Some of the research participants in this study, remembered working for colonial administrations that 'reaped the trees to bare ground to plant tea for the colonial project'⁴. Other interviewees also described how they escaped from the West Usambara to the East because of worsening climatic and agricultural conditions, reflecting the historical accounts described by Conte: 'My

⁴ Interview with a villager, age 86, man, non-leader, April 2018

family ran from the West to the East as the conditions were harsh. Several years in a round we lost all crops. The land was tired, and it was bad weather'⁵

These accounts also showcase the distinguished historical paths for the West and the East Usambaras, which determined their development and subsequent programmes of intervention. The West Usambara were subject to greater deforestation and agricultural intensification, which reinforced trajectory that one of our respondents from the Muheza District described as 'more aggressive development'⁶. In contrast, in the East Usambaras, forest remained significantly more intact, despite episodes of forest clearing in post-colonial era, and subsequently became a battlefield of global conservation policies trying to prevent East Usambara from going into the footsteps of the West. As Conte put it, the East Usambara became a site of 'global biodiversity cult', where 'resource conservation projects have successfully embedded environmental issues into the discourse of political economy at all levels of society' (Conte, 2004: 311).

Indeed, in our interviews many Muheza District officers spoke about the East Usambara Mountains as the ultimate 'conservation zone'. They recognised that it is not a coincidence that the East Usambara attracts much foreign attention: 'Foreign donors must love the mountains so much because there are always conservation projects over there'⁷.

These statements accurately reflect the global conservation movement and the discourse on biodiversity hotspots that Muheza District and local communities have been exposed to over the years. The hotspot discourse drove an enormous conservation effort to this area from the mid-1980s onwards⁸. Many influential global actors such as the European Union (EU), the International Union for Conservation of Nature (IUCN), the United Nations (UN), the World Bank (WB) and the World Wild

⁵ Interview with a villager, age 73, man, non-leader, July 2018

⁶ Interview with Muheza District officer, Agricultural Department, March 2019

⁷ Interview with Muheza District officer, Planning Department, April 2019

⁸ The Eastern Arc Mountains were formally classified as a global biodiversity hotspot in 2000 (Myers et al., 2000), but modern conservation efforts into this area have much longer history, for instance: the East Usambara Conservation and Agricultural Development project (EUCADP) (1987-1998), the East Usambara Conservation Area Management Programme (EUCAMP) (1999-2002) (EUCAMP, 2002).

Fund for Nature (WWF) established their resource conservation projects in the region (EUCAMP, 2002; Hokkanen, 2002). Environmental degradation narratives have been a part and parcel of these projects. Conservationists argued that the existence of the forests is vital for their intrinsic value and for the benefits of people and environmental health (Conte, 2010). The forests have been known to sustain not only the richness of species, but also favourable climate and water supply for the Tanga Municipality beneath the mountains (Hamilton and Bensted-Smith, 1989). Hence, environmental education, on-farm soil and water conservation schemes, alternative livelihood activities, and annual tree-planting campaigns all became integral to community conservation and development projects (Stocking and Perkin, 1992). These initiatives were part of the villages' 'sensitisation' agenda aimed 'to deter them from engaging in forest destruction' (WWF-France, 2019: 2). While these interventions gradually embraced more participatory approaches to forest governance, the primary focus remained on using livelihood components as a means to achieve forest conservation (Vihemäki, 2005; Rantala et al., 2012). Consequently, many communities experienced the enforcement of regulations that curtailed their previous access rights (to forests or water), encountered land shortages due to protected areas, and suffered from the underdevelopment of infrastructure and services (Rantala et al., 2013), especially in more remote villages that were the subject of this study.

Despite evolving with new actors and gaining international attention through global conservation efforts, the core premise of this narrative remained therefore unaltered: local inhabitants were portrayed as the primary contributors to environmental degradation on the plateau, reinforcing the need for even stricter environmental management measures. This enduring narrative encapsulates the historical dynamics and challenges associated with both the colonial and then conservation policies, which mostly marginalised the local population while prioritising global perspectives.

5.4.2 The climate resilience-building narrative

In 2015, the adaptation project introduced a new narrative among Muheza District officials and in intervention villages. This 'climate resilience-building' narrative

emphasised the urgent need to support poor, forest-dependent communities whose livelihoods rely on the East Usambara's biodiverse ecosystems, increasingly threatened by climate change (GCCA+, 2019a).

Recently, NGOs have used climate funding to secure resources for their projects, leading to a proliferation of adaptation and resilience-building initiatives adopting the climate resilience narrative in various contexts. In the East Usambara, NGOs aligned their climate resilience-building narrative with that of their GCCA funder. They introduced the GCCA's eco-village model, promoted as 'a holistic community-driven approach integrating interventions in multiple sectors to improve climate change resilience and reduce poverty' (GCCA+, 2019b: 1). However, the dominant environmental degradation narrative in the area significantly influenced how stakeholders framed and interpreted the climate resilience-building efforts.

Firstly, the historical legacy affected the types of projects foreign funders were willing to sponsor. The GCCA initiative in Tanzania funded proposals integrating forestry, water, agriculture, and energy sectors to achieve a broader impact and test various intervention mixes. Consequently, locations without 'good forests' struggled to secure funding for adaptation projects despite genuine needs. The biodiversity hotspot status of the East Usambara, meeting all donor criteria, attracted EU funding, reinforcing global biodiversity hotspot legacies. Some District officers noticed this mismatch: 'I sometimes wondered why the adaptation project focused on the East Usambara Mountains when there are greater adaptation needs elsewhere in our district.'⁹

In Tanzania, environmental degradation, especially deforestation, is often seen as the main cause of insufficient rainfall (Pauker et al., 2010). In Muheza District, this perception has been reinforced by the emerging issue of climate change. District authorities used the environmental degradation narrative to explain recent changes in rainfall patterns, viewed as local manifestations of climate change. A high in rank district officer reflects this view: 'What I know are the complaints about the impact of deforestation [in the East Usambara] on changing rainfall patterns. This district

⁹ Interview with Muheza District officer, Agriculture Department, May 2018

usually has a conducive environment for rainfall, but in the last few years, we have experienced very little rain and drought... this causes us to suffer.’¹⁰

As a result, planting thousands of trees every rainy season became part of the district development plans and the resilience-building narrative of the project. However, during an interview with the district forester, it became clear that simplified explanations were given to communities about the complex links between the mountain environment, tree cover, and rainfall to illustrate climate change impacts¹¹: ‘I am not sure you can explain these scientific things to the local communities. You just have to say that when you plant trees, you will have rainfall, or if you destroy the environment, you will have a drought, etc.’¹²

This approach perpetuated the historical environmental degradation narrative, leading East Usambara residents to believe that deforestation was responsible for the lack of rain and drought in the villages. Consequently, community members trusted that planting new trees and engaging in environmental conservation could reverse this trend, expressing sentiments such as: ‘It will rain again like in the old days because we are tirelessly working to plant more trees and conserve the river.’¹³ Some village leaders even believed the climate had already been ‘repaired’ due to the tree planting efforts: ‘Don’t you see how we repaired the weather [addressing fellow villagers]? It already rains like it was in the past [referring to the very wet season of 2018/2019].’¹⁴

Historical concerns about the mismanagement of forests and rivers by local communities also influenced how facilitator NGOs framed vulnerability. The NGOs highlighted climate change impacts, such as unreliable water flow in the Zigi River and inadequate water infrastructure, which ‘the district has not given priority’ in the highlands (ONGAWA, 2013: 8). ‘This left the population particularly vulnerable,

¹⁰ Interview with Muheza District officer, Director office, December 2016

¹¹ District officer refers here to orographic precipitation - precipitation that occurs when forested hills or mountain ranges redirect moisture-laden air masses upward, leading to cooling and the release of moisture in the form of precipitation (Tucker, 2005)

¹² Interview with Muheza District officer, Forestry Department, March 2019

¹³ Interview with a villager, man, age 43, non-leader, a member of the Village Natural Resource Committee, May 2018

¹⁴ Interview with a villager, man, age 65, leader, a member of the Village Council

relying on natural springs, rivers, or wells with little water during the dry season. As these water sources are not protected, they can easily be polluted rendering the water unsuitable for human consumption ...' (ONGAWA, 2013: 8).

Therefore, to support long-term resilience building, the project introduced new institutional arrangements for natural resource management. These included agreements with local authorities to enforce environmental laws and establish new by-laws to protect river systems, such as prohibiting planting near waterways and banning villagers from using the river for household chores. This was deemed essential for conserving the upper watershed and ensuring continuous water flow under climate change. This shows that the NGO's resilience-building narrative emphasised long-term ecological resilience, focusing on supporting livelihoods dependent on forests and ecosystem services, as well as the community's responsibility to conserve rivers for downstream users. A quote from one of the project activity meetings encapsulates this perspective: 'If you engage in human activities in the river, will it continue to provide you with water? When the river dries up, will you still be able to plant or use it for washing? The water flowing here serves the people in Muheza and Tanga. Don't we have relatives using the same water over there? So, why would we want them to suffer?' ¹⁵

5.4.3 Local vulnerability context and social development counter-narrative

The long history of land alienation, in-migration, resource access restrictions, and land gazettement for protected areas from past projects created a complex social vulnerability environment in the East Usambara Mountains. Villagers consistently mentioned land shortages, reliance on rain-fed agriculture, limited income opportunities, and general underdevelopment as the main drivers of their vulnerability. One woman from a poor household explained: 'There are no employment opportunities, no livelihood options other than rain-fed agriculture, no spare land, no roads, and no markets... so when the crops fail, it has a huge impact on our lives.' ¹⁶

¹⁵ Village training group, May 2018

¹⁶ Interview with a villager, women, age 64, non-leader, May 2018

In response to these hardships, social change and poverty alleviation became key motivations for community participation in the project's adaptation processes. One villager expressed this perspective: 'I wanted to participate in the adaptation project because of education. I am hoping to learn from the experts and improve my life a bit.'¹⁷

This local counter-narrative, termed by us the 'social development narrative', linked adaptation to poverty reduction and development - dimensions overlooked in previous narratives. This narrative framed the impacts of a changing climate as intricately linked to broader livelihood challenges, highlighting the community's development aspirations and their determination to overcome poverty. The early enthusiasm of villagers, particularly regarding the agricultural component of the adaptation project, confirms this: 'The agricultural experts arrived here to push us to the next level and assist us in our development.'¹⁸

However, the NGOs' focus on long-term ecological resilience overlooked the underlying causes of vulnerability in the villages. The project introduced interventions like climate-smart agriculture (CSA) and other income-generating activities, touted as 'cost-effective, financially viable, and low risk' (ONGAWA, 2013: 12). However, these efforts often incentivised environmental management over livelihood resilience. Similar agricultural initiatives had been previously implemented in the East Usambara Mountains by various conservation groups, including IUCN, WWF, and UNEP, with questionable success (Stocking and Perkin, 1992). The primary difference was the terminology used, such as sustainable or conservation agriculture instead of climate-smart agriculture. Interviews with farmers trained in CSA reflected this continuity. One farmer summarised the adaptation plan: 'To adapt, we need to plant trees for rainfall and shade, avoid random planting, dig trenches to preserve soil moisture, use natural fertiliser, and avoid polluting rivers.'¹⁹

¹⁷ Interview with a villager, women, age 30, member of village environmental committee, June 2018

¹⁸ Interview with a villager, man, age 34, non-leader, a member of the farmers field school, April 2018

¹⁹ Interview with a villager, man, age 40, leader, a member of the farmers field school and butterfly farming, July 2018

These responses appeared to be rehearsed lists of environmental recommendations from past projects, now ‘repackaged’ under the resilience-building narrative. This shows that the old environmental degradation narrative significantly influenced the newer resilience-building narrative, impacting the project design and implementation. Allowing these historical legacies to shape adaptation processes led to extensive maladaptation.

5.4.4 Consequences of historical legacies shaping adaptation processes

Firstly, similar to colonial soil conservation schemes described by Conte (2004) the burden of implementing such interventions on local communities has been significant, while the benefits remain uncertain. The project interventions were based on implicit assumptions that the introduced activity groups would a) work harmoniously without conflicts or inequalities (elite capture), b) develop long-term capacity to turn project provisions (agricultural and butterfly inputs and training) into reliable income and sustainable environmental outcomes (conservation of land and forests), and c) have the time, skills, and access to the necessary information and support to achieve desired adaptation outcomes. However, poor families, as well as others, found it very difficult to invest their time, money, and resources for uncertain or long-term benefits. One participant, who later dropped out, stated: ‘Attending seminars, digging trenches across slopes, or transporting manure to the farm [as part of CSA adjustments] consume a lot of time and money while at home you have a family to look after... And if the harvest doesn't materialise, it's your loss.’²⁰

Internal social dynamics and socio-political factors significantly influenced who could benefit from the project and who could not. Inequality emerged in the participant selection process and determining participation criteria. Although the project's official recommendation was to include representatives from poor and female-headed households, the criteria reported in interviews by the group leaders mainly focused on being ‘cooperative’ and ‘well-liked.’ Poor households were not explicitly prioritised, although villagers admitted that some poor individuals participated. This

²⁰ Interview with a villager, man, age 45, non-leader, a member of the farmers field school and the butterfly farmer group, August 2018.

indicates that internal social exclusion and inequality operated at the village level, with local elites leading the process. Yet, many adaptation projects choose to be seen as neutral providers of technical assistance rather than addressing the root causes of vulnerability.

An example of this is the implementation of the 'economic groups' aimed at uniting cash crop farmers and eliminating middlemen to secure better prices for spices. Our analysis revealed that these groups favoured larger producers, excluding poorer farmers with only a few spice trees. Poor families were also reluctant to join because the cooperative prohibited the practice of 'selling spices ahead of harvest' to the middlemen, a survival mechanism involving pre-sale of future spice harvests for informal cash loans. While most farmers viewed middlemen negatively for offering low prices, poorer families maintained these relationships for the critical service they provided. One farmer commented: 'There are times that I don't mind getting less money for my cloves because in May [dry period between harvests] I am struggling to survive.'²¹

This highlights the differing abilities and needs of villagers in the adaptation process. Better-off individuals utilised the project's resilience narrative to their advantage, joining economic groups and setting rules, while poorer families with fewer assets and lower capacities to negotiate were disadvantaged (cf. Gaworek-Michalczenia et al., 2019). Consequently, the project failed to recognise differentiated vulnerability. A previous collapse of a similar cooperative nearby due to trust issues and power dynamics, further illustrate the challenges in achieving harmonious project processes and outcomes.

Secondly, the new by-laws focused on river conservation disrupted local coping strategies and land rights, particularly for poor families, women, and youth. Yams and vegetables, grown near water, are vital food and cash crops for many Usambara families, especially during dry years when traditional agriculture is compromised (cf. Gaworek-Michalczenia et al., 2019). One villager explained: 'I can't stop using my farm [near water]. I have a big family with seven members. One andazi [local

²¹Interview with a villager, man, age 56, poor wealth ranking, not a member of the project groups, April 2018.

doughnut] costs 100 Tsh, so imagine how much I need to pay to feed my whole family. But with yams, everyone is satisfied and just waits for lunch.’²²

Yams and vegetables offer quick returns due to their short maturing time, unlike spice trees, which take several years to bear fruit. Women also valued vegetable gardens near water for providing independent income, especially during drought.

The new by-laws caused many conflicts and governance issues in the villages. Village leaders struggled to mediate between supporters of the by-laws (e.g. environmental committee members) and opponents (e.g. poorer families, female-headed households). Community members critical of these policies pointed to the significant negative impacts, such as loss of productive land, loss of water-user rights (especially for women), and a lack of compensation - issues familiar from previous conservation projects (c.f. Rantala et al., 2013). Women argued that such by-laws should not be enforced until all villages had access to improved water infrastructure for domestic chores. In some circumstances, they gave themselves moral permission to publicly disobey the laws, showing everyday resistance. The youth also noted that their inheritance near the river have now become worthless. This shows that the most vulnerable community members, the poor, women and youth, became the most affected by the project. The benefits of water protection were seen as unfairly displaced to lowland towns at the expense of the rural poor.

Feelings of injustice were also intensified by specific environmental histories. Villagers blamed a nearby tea estate, operational since the 1950s, for much of the area’s environmental degradation, including cutting indigenous trees and planting water-intensive Eucalyptus. District officers in Muheza referred to this conflict as the ‘local Eucalyptus syndrome,’ noting that it began when the tea company withdrew villagers’ rights to cultivate on some of the estate’s wetlands ²³. Villagers criticised NGOs and the government for neglecting their land rights and excluding them from decision-making: ‘This tea company is planting Eucalyptus that suck water, and no one touches them because they pay taxes. Then the organisations tell me I can’t cultivate near my water. How just is that? They should show they care about my

²² Interview with a villager, man, age 57, non-leader, poor wealth ranking, July 2018.

²³ Interview with Muheza District officer, Forestry Department, April 2019

rights by dealing with the biggest polluter first. But instead, everyone is applauding these projects that bring us what? Oppression! So where is my right to speak up?’²⁴

These narratives highlight the imperative to understand the contexts into which adaptation projects are implemented, including historical specifics and local social and power dynamics. Historical legacies significantly influence the design and implementation of adaptation projects in BH and shape local vulnerability contexts. Ignoring these legacies and complexities can inadvertently worsen vulnerability. In the GCCA+ project, adjusting access rights to land and water to bolster long-term ecological resilience ended up exacerbating vulnerability for the most vulnerable community members.

5.5 Discussion

The climate adaptation narratives that emerged during the implementation of the adaptation project in the East Usambara Mountains were shaped by externally defined agendas, historically rooted in global environmental discourses. These encompassed the environmental degradation narrative associated with biodiversity hotspots and, subsequently, the climate resilience-building narrative tied to the global climate adaptation discourse. The tendency of donor agencies to change their priorities and their influence on NGOs is well documented (Edwards, 1999; Banks et al., 2015), and so is the importance of donor funding in the formation of dominant policy narratives (Roe, 1991; 1994). The recent enthusiasm for climate change adaptation among the conservation and development organisations is linked to the availability of donor funding for adaptation and resilience-building projects (de Wit, 2018). However, previous studies have shown that changing the dominant policy narrative does not necessarily replace it, but often leads to the accumulation of subsequent narratives, their ‘repackaging’ and further reinforcement (Redford et al., 2013; Weisser et al 2014; Whitfield et al., 2015).

Our ethnographic analysis of the interactions and consequences of adaptation narratives at project level in the East Usambara Mountains showed that the influence

²⁴ Interview with a villager, man, age 45, non-leader, average wealth ranking, May 2018

of the dominant environmental degradation narrative, commonly associated with biodiversity hotspots, persisted within the subsequent climate resilience-building narrative. The environmental degradation narrative also acted as a barrier to delivering socially just adaptation projects in the East Usambara Mountains. This hindrance was attributed to the historical legacies of past injustices intricately weaving into and affecting the project adaptation processes, including renewed calls for restrictions on land and water access. This dominant narrative overpowered local counter-narrative associated with social development ambitions and arguing against these harsh restrictions. We contend that the findings hold substantial implications for the design and implementation of adaptation projects in biodiversity hotspots, showing that historical legacies can influence current approaches to adaptation in these locations, leading to only marginal differences compared to past projects. It is especially pertinent in cases where actors formerly engaged in conservation projects have now assumed roles as key facilitators of climate change adaptation.

Anderson et al., (2009) suggested that environmental NGOs are not suitable to support adaptation by the poor because they are unable to solve the complex environment versus livelihoods trade-offs in a way that benefits the poor. In rural areas, particularly within developing nations, the susceptibility to climate change, shaped by social and contextual factors, is intricately tied to the overall *underdevelopment* context. The preferred strategy for adaptation has often been perceived as sustainable development in these regions (Ayers and Forsyth, 2009; Schipper, 2007). Climate change adaptation, particularly through methods such as community-based adaptation (CbA) and other rights-based approaches, is inherently connected to the pursuit of development outcomes, with a specific focus on pro-poor development (Ayers and Forsyth, 2009a). However, our results suggest that organisations working in BH might prioritise long-term ecosystem resilience influenced by their organisational missions, established practices, and historical legacies from earlier times. In this context, relying on these actors to fund and implement local level adaptation risks tying adaptation to the priorities of external donors and implementing organisations, much as the environmental degradation narratives shaped local agendas for many years in the East Usambaras (Conte, 2004). When external ‘experts’ lead the adaptation process instead of allowing communities to drive it through participatory processes, there is a higher likelihood of

neglecting important contextual factors influencing vulnerability. Outside interventions are more prone to misjudging the appropriate community 'parameters' (McNamara et al., 2020). This includes poor understanding of the internal community dynamics that may lead to inequalities and elite capture. We observed that community members did not accept fully the project recommendations and being nice and cooperative was picked over being poor. Also, our analysis revealed how the relationships between poor spice producers and the middlemen were completely misjudged by the project, which pushed them out of the spice co-operatives. Therefore, it is crucial to collaborate with local communities in identifying trade-offs and solutions that are both specific and pertinent to their unique situations, histories and capacities (McNamara and Buggy, 2016, see also Chapter 6 of this thesis).

The articulation of climate change as an 'environmental issue' in most national policies in Tanzania (URT, 2007; URT, 2021) legitimised the project's focus on forest and water conservation. The climate resilience-building narrative, constructed around blueprint technologies as part of the 'eco-village' model from the EU, fitted into the Tanzanian climate change adaptation priorities oscillating around sustainable agricultural development and environmental management (Shemdoe, 2013; Smucker et al., 2015). Yet the current focus on environmental management not only is insufficient to buffer the Usambara livelihoods from present and future climatic changes, but also leads to exacerbating vulnerabilities of the most vulnerable groups in society. The findings show a staggering negative impact on women, the poor and even the youth future land rights, which were not acknowledged by the project facilitators due to blind-fully following environmental directives.

Moreover, contrary to the local beliefs, neither planting trees nor conserving the river can 'stop' or 'reverse' climate change impacts in the East Usambara. The magnitude of impacts will be determined by global carbon emissions. Thus, telling communities that environmental conservation is a sufficient and the most appropriate adaptation response is misleading and may cause maladaptation (Gaworek-Michalczenia et al., 2019). According to Pilato et al. (2018: 15), who assessed the integration of climate and development strategies in Muheza District as part of earlier work associated with this project, the NGOs claimed that 'the pre-existing understanding of the impact of local environmental degradation on climate change offers an opportunity for

integrated approaches to development at village level ... environmental education might facilitate the implementation of reforestation and forest conservation, with simultaneous benefits for local development'. There is, however, a real concern that such simplified accounts of climate change drivers and impacts and misrepresented views of local vulnerability and development interests will drive ecosystem-centred vulnerability approaches in biodiversity hotspots at the expense of human vulnerability and more livelihood-oriented approaches.

Various scholars have reported the dominance of ecosystem-centred models over livelihood approaches in climate change mitigation and adaptation projects, especially on high value conservation 'sites' (e.g. Beymer-Farris & Bassett, 2012; De Oña Plaza, 2018; Newsham et al., 2018). For instance, Beymer-Farris & Bassett (2012) documented how communities in Refuji Delta in Tanzania became pronounced as environmental destroyers when their mangrove forests became amendable to fit into neoliberal carbon market schemes. Yet alternative environmental history presented by the authors depicts the Warufuji in a very different light, which questions the dominant narratives presented by the Tanzanian government and environmental NGOs. Similarly, De Oña Plaza (2018) analysis from Mexico-Guatemala border reveals that many environmental NGOs implementing adaptation tend to adhere to standardised adaptation framing, emphasising ecosystem-based adaptation (EbA) models. These projects often overlook social and political factors contributing to vulnerability (De Oña Plaza, 2018). It is thus paramount to recognise how differentiated vulnerabilities and the interplay of social and historical factors extend beyond the direct impacts of climate change on ecosystems and the environment, and how the legacies of past interventions influence current designs. In the East Usambaras, as well as in the Eastern Arc Mountains more broadly, the vulnerability of local livelihoods has historically been side-lined amid greater conservation priorities (Conte, 2010). This created the historical injustices related to resource access restrictions and underdevelopment that the communities reported in this study. Conte (2010) wrote that conservation actors have the tendency to portray the Eastern Arc Mountains as fragments of high value forests with a complex evolutionary history, but devoid of human habitation. This narrative presents people as 'a recent and destructive intruder in forested ecosystems' (Conte, 2010: 311), which fails to recognise the complex and dynamic

nature of human occupancy of the mountains. It also dismisses decades of unfavourable forestry and agricultural policies dating back to the colonial period that significantly transformed the Usambaras ecology and the livelihoods of its people (Conte, 2004; Woodcock, 2002; Vihemäki, 2005). Local communities in the East Usambara continue to be regarded as the main destroyers of their environment (cf. Forsyth and Walker, 2008), which is used in the current debates about climate change to justify changes in access to local resources in the name of long-term ecosystem resilience.

5.6 Conclusions and recommendations

This article employed ethnography to critically examine climate change adaptation narratives in global biodiversity hotspots, focusing on a case of high-profile adaptation project aimed at enhancing climate resilience and reducing poverty in the East Usambara Mountains of Tanzania. By delving into the human dimensions of climate change adaptation and drawing on environment and development narrative studies, we specifically explored the historical context and legacies that shaped the local adaptation processes. Our analysis revealed how the longstanding narrative of environmental degradation has influenced the interpretation and justification of climate change adaptation within the project. The emphasis on long-term ecological resilience, as opposed to locally preferred forms of adaptation presented merely incremental change compared to past projects and has undermined local expectations for better life and social development. As a consequence, the project has likely increased human vulnerability in the intervention villages.

This case study generated new empirical and practical contribution. Empirically, we provide an ethnographic account of the lived experience of a climate change adaptation project in a biodiversity hotspot, addressing a gap in the limited available data on the human dimensions of climate change adaptation in biodiversity hotspots. Our study also underscores the inadequacy of current human adaptation efforts in these areas, highlighting a significant risk of perpetuating historical injustices in the design and implementation of adaptation projects, thus providing further contribution to practice. Our aim is to raise awareness among development practitioners, local

governments, and other stakeholders about the impact of historical legacies in biodiversity hotspots. We caution against the tendency to uncritically 'repackage' old approaches into those centred on ecosystem-based models and ecological resilience. Such interventions, we argue, may neglect local adaptation priorities, and fail to address the root causes of vulnerability, ultimately compromising the effectiveness of adaptation measures, or even increasing vulnerability.

Efforts to enhance resilience and reduce vulnerability to climate change in global biodiversity hotspots necessitate a more nuanced integration of human needs with environmental sustainability. In the East Usambara communities, challenges arose in pursuing long-term adaptation when immediate needs went unmet, particularly when the focus on long-term resilience was framed around narratives of ecological resilience. It is crucial to recognise that adaptation efforts should not be used as a pretext for appropriating local resources and restricting access to essential assets, particularly as climate change introduces new threats and vulnerabilities. Shifting beyond conventional approaches to transform 'local ways of being and living' into more equitable and effective adaptation is imperative (Westoby et al., 2021).

While practitioners and donors play pivotal roles in supporting local actors, it is imperative to empower these actors to become genuine and equal partners in the adaptation process. Resolving the tension between development and conservation in biodiversity hotspots is essential for crafting an adaptation plan geared towards new ideas to enhancing resilience and capacities amidst anticipated climate and social changes. This requires authentic dialogue, creating spaces for stakeholders to come together, build trust, and shift established narratives and historical legacies toward more transformative approaches to adaptation (Taylor et al., 2022). The intricate narratives present in development and environment policy within biodiversity hotspots must be transparently articulated, making evident the trade-offs between ecological qualities and other developmental assets. Without a conscious effort to address these trade-offs, adaptation interventions in biodiversity hotspots are likely to become 'repackaged' agendas from the past that fall short in generating positive effects for both the environment and the vulnerable populations they aim to support.

Chapter 6 - Unpacking bottom-up adaptation mainstreaming and local participation in policy processes

6.1 Introduction

In recent years adaptation mainstreaming became a major preoccupation of many governments, development assistance and adaptation scholarship (Chuku 2010; Klein, Schipper, and Dessai 2005; Price, 2019). Acknowledging the inter-relationships between adaptation and development processes, intensified calls to integrate or ‘mainstream’ adaptation measures within countries’ development policies and foreign assistance. Whereas much of the adaptation mainstreaming debate has been focussed on top-down policy engagement, various adaptation scholars suggested that the success of adaptation mainstreaming is inherently linked to bottom-up processes informing adaptation policy formulation and implementation (Lebel et al., 2012; Regmi and Star, 2014; Reid and Huq, 2014a). Engaging local communities and other local stakeholders in bottom-up policy processes has been found to help improve the inclusivity, uptake and sustainability of adaptation policy solutions (Kirkby et al., 2018; Rahman et al., 2023), increase trust and legitimacy in adaptation policy processes (Fischer, 2021; Rayner, 2010) and reduce the risk of maladaptation (Owusu-Daaku, 2018; Dolšak and Prakash, 2018), thereby producing better policy implementation outcomes. This push for bottom-up processes in adaptation policymaking is also an attempt to break away from the top-down technocentric discourses of climate change vulnerability and adaptation (Nightingale et al., 2020; Brink et al., 2023).

Indeed, adaptation policy processes, particularly in developing countries, are dominated by international specialists such as donors, scientists, and development practitioners (Nightingale, 2017). These actors tend to prioritise scientific and technological solutions over local knowledge, which influence how problems and solutions are framed in the adaptation policy processes (Nightingale et al., 2020; Eriksen et al., 2021). Notably, these actors have resources, power and influence, while local communities, and sometimes disempowered governments, contribute relatively little to the adaptation policy formation and decision-making (Falzon, 2021). This disconnect has resulted in confusing adaptation policy frameworks and

processes, which are built on top-down technical approaches, insufficient engagement with local actors and an inaccurate understanding of local vulnerability (Eriksen et al., 2015b). As a consequence the implementation of adaptation measures poorly represents local priorities, concerns, and capacities (Preston et al., 2011; Mimura et al., 2014). Such an adaptation process is unlikely to be adopted and endorsed by targeted communities, and thus more likely to produce ineffective and unsustainable mainstreaming outcomes (Sherman and Ford, 2014). There is therefore a pressing need to re-focus attention on the need to develop bottom-up adaptation policy processes, with early, clear and effective engagement of local communities, and re-think the role of governments and development practice in adaptation mainstreaming efforts.

To contribute to these debates, this study brings together the adaptation scholarship advocating for the need for a greater bottom-up engagement in policymaking, with policy process theory. The aim is to develop a framework to study bottom-up policy processes in adaptation mainstreaming, with particular attention to the role of local communities in the process. Our framework expands on John Kingdon's multiple streams approach to policy change, where 'policy streams' 'window of opportunity' and 'policy entrepreneurs' play a central role (Kingdon, 1995). We ask how the inclusion (or exclusion) of local communities' perspectives in policy processes (problem, policy and politics streams) contributes to the opening (or closing) of 'the windows of opportunity' for effective adaptation mainstreaming. We argue that giving more room in policy processes to community voices and their involvement in knowledge co-creation can reshape the narrative of climate related problems, and solutions to them, in a way that supports the opening of new 'windows of opportunity' for more effective and equitable adaptation mainstreaming. Conversely, the sustaining of policy windows for adaptation mainstreaming can easily be compromised by the lack of inclusive policy processes. We develop this argument from the analysis of a case study of adaptation mainstreaming into district planning during the implementation of a major adaptation project implementation in rural Tanzania.

Next the paper discusses a conceptual framework for analysing bottom-up policy processes in adaptation mainstreaming. We then apply the framework to our case

study to show how the exclusion of local perspectives and local knowledge generated low support during the implementation of the adaptation policy, compromising the effectiveness of the mainstreaming process at the district level. Finally, we compare our results with the broader evidence from literature and identify a number of practical recommendations.

6.2 Conceptual framework: Integrating bottom-up adaptation processes in the multiple streams approach

We draw on the Multiple Streams Framework (MSF) to address our research question about the role of local communities' in adaptation policy processes, and particularly how their inclusion or exclusion influences the 'windows of opportunity' to affect policy change (=mainstream adaptation policy) at the local level, and we enrich the framework with key bottom-up features of policy processes.

The MSF, originally introduced by Cohen et al. (1972) and developed by Kingdon (1995) in the 1980s, explains how governments make decision about policies and how they uptake them (Cairney and Zahariadis, 2016). While the Kingdon's original framework is associated primarily with the agenda setting stage of policymaking, in this study, we adapt it to unpack the policy implementation stage (see Fowler, 2022) during an adaptation mainstreaming project at the community and district level. Studying policy implementation through the MSF has been done previously by a handful of political scientists (Ridde, 2009; Zahariadis 1999). In adaptation policy processes the link between adaptation policy agenda formation and implementation is clear due to the international nature of climate adaptation governance and the fact that many actors involved in earlier stages of the policy process through influencing policy agendas (mainly at the national level), carry on their involvement into the policy implementation stage (at local levels). That means that international donors, non-governmental organisations (NGOs), national and local governments, and community level stakeholders all might participate in both policy agenda-setting and implementation. Adaptation mainstreaming literature also emphasise that community-level adaptation projects are also important 'entry point' for adaptation policy mainstreaming into local development planning (Gogoi et al., 2017).

Therefore, at that level, adaptation policy agenda-setting can occur simultaneously with adaptation policy implementation.

What we find relevant in the MSF approach in relation to our study of bottom-up adaptation policy processes, is that policymaking in Kingdon's model is examined not through tasks per se (in contrast to the linear 'policy cycle' models (Lasswell, 1971)) but through the study of the interactions of several sets of actors pursuing particular visions of policy problems and solutions as well as the politics surrounding them (Howlett, 2019). These actors play a role in influencing policymaking by framing issues according to their worldviews and values and suggesting solutions acceptable to their audience. As scholars suggest this is not an evidence-based process. It is a political process in which actors exercise power to pursue their preferred outcome (Cairney, 2019). Kingdon conceptualised these interactions as being concealed to three, free flowing 'streams' that at a certain juncture might come together to form a 'window of opportunity' during which policy change can occur (Kingdon, 1995). Most studies drawing on Kingdon's work noticed that the 'window of opportunity' opens when attention raises to a policy problem that is framed in a certain way (the problem stream), a feasible and technically and politically acceptable solution to that problem exists (the policy stream), and the political conditions are conducive to action (the politics stream) (Lorenzoni and Benson, 2014; Rose et al., 2020). Yet windows of opportunity open only for a short period of time and if not exploited the opportunity to successfully change policy will shut. In our study successful exploitation of policy windows would mean that adaptation policy had been up taken by local actors and successfully mainstreamed into district planning.

Another important metaphor in Kingdon's work is that of a policy entrepreneur. Policy entrepreneurs are actors who 'seek policy changes that shift the status quo in a given areas of public policy' (Mintrom, 2015: 103) and characterise 'willingness to invest their resources – time, energy, reputation, and sometimes money – in the hope of a future return' (Kingdon, 1995: 122). In climate change adaptation policy processes broad stakeholder engagement is widely recognised as crucial to mainstreaming adaptation throughout the policy cycle (Lebel et al., 2012). Both climate scientists and development practitioners can play the role of policy

entrepreneurs influencing adaptation mainstreaming, alongside the decision-makers (Tanner et al., 2019). Many also believe that wider public involvement, including local communities, is needed (Innes and Booher, 2004: 432) despite the existing adaptation planning systems' failure to support wider engagement and deliberation. Some scholars noted that adaptation can be portrayed as a rational and clean policy process where people are viewed as 'recipients' of adaptation rather than 'active policy agents', which in fact stripes people from shaping their own destinies (Eriksen et al., 2015). A recent review of policy entrepreneurship in developing countries confirms that local communities are absent from this body of scholarship altogether (Bakir and Gunduz, 2020). The exclusion of local insight and knowledge concerning adaptation remains a major limitation to adaptation planning and provides a strong argument for the introduction of more efforts aimed at improving the amount of, and quality of participation and local deliberation in adaptation policy processes (Ayers et al., 2011; Lebel et al., 2012). Other authors go further and suggest that rather than enhancing participation of vulnerable groups in adaptation processes designed by powerful groups, there is a need for co-production of these processes by the vulnerable through various forms of inclusive and deliberative governance (Arriagada et al., 2018; Manuel-Navarrete and Pelling, 2015).

Below we present our adapted framework that incorporates bottom-up processes into the MSF (see Figure 7). We argue that the inclusion of bottom-up processes in the MSF can improve the analysis of adaptation mainstreaming in some important ways. The framework brings attention to why local perspectives of adaptation problems and solutions matter in the policy process, and how the inclusion or exclusion of these perspectives shapes the problem, policy and politics streams and influences the possibility to open and sustain the windows of opportunity for effective adaptation mainstreaming into local contexts.

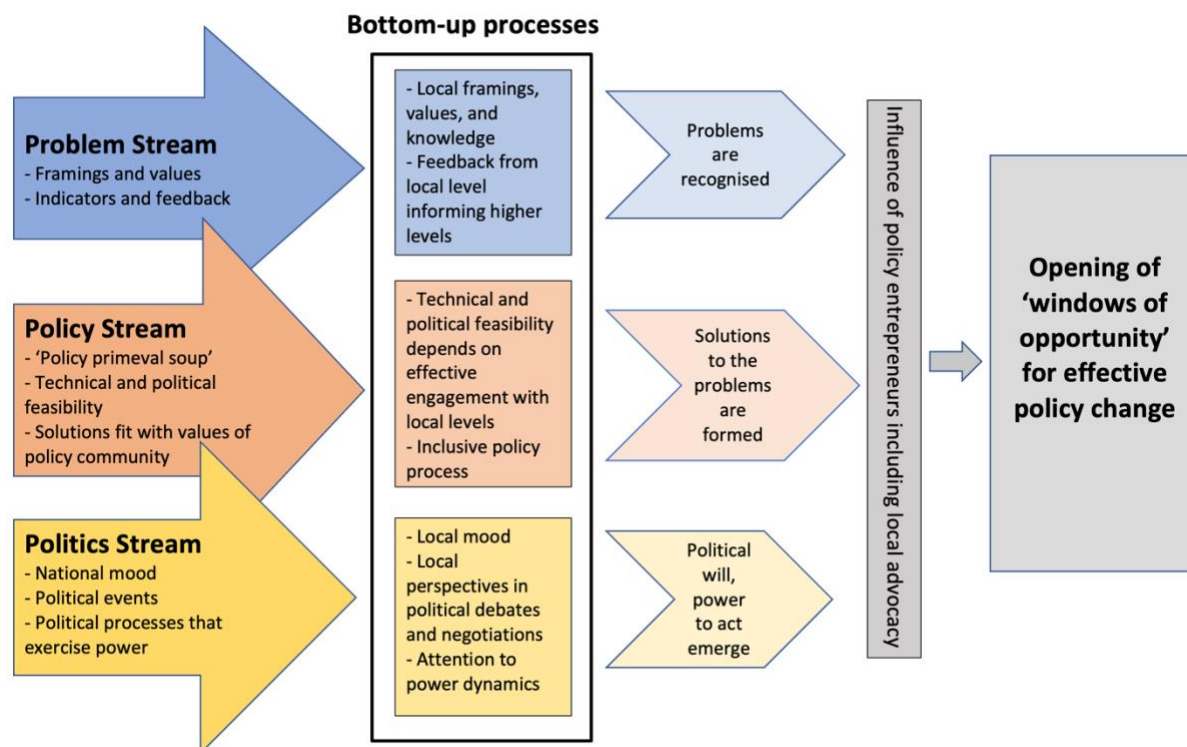


Figure 7: Framework for analysing bottom-up policy processes in adaptation mainstreaming (based on Kingdon, 1995).

In black frame – the conceptual expansion of the Kingdon's MSF to include bottom-up processes and their impact on effective exploitation of policy windows during adaptation project implementation.

Critical adaptation scholarship speaks to the problem stream of the framework by highlighting that defining and framing adaptation is a political process that involves the inclusion and exclusion of certain groups' voices, knowledge and values (Eriksen and Lind, 2009; Eriksen et al., 2015; Nagoda and Nightingale, 2017). Local knowledge is essential for designing and implementing successful adaptation strategies, because it is positioned in the context of broader livelihood and development challenges that matter locally (Ayers and Forsyth, 2009; McNamara and Buggy, 2016; Mfitumukiza et al., 2020). Feedback plays a major role in defining problems as worthy policy attention (Kingdon, 1995). Consequently, it is essential that feedback from communities and local knowledge, including perspectives on communities' vulnerabilities and priorities, informs the adaptation problem stream.

Kindgon compared the policy stream to a 'policy primeval soup', where proposals are tested, refined and sampled; and those that survive are typically technically and

politically feasible and fit with the dominant values of the policy community (Kingdon, 1995). Our framework highlights that the technical and political feasibility of adaptation solutions depends on the effective engagement with local communities during adaptation mainstreaming process (Regmi and Star, 2014). Such engagement is created through an inclusive policy process that brings together different voices, co-creates inclusive solutions that consider equity, and creates and strengthen local ownership, agency and capacities (Ziervogel et al., 2022; Pereira et al., 2020). The role of local communities' in the process is not reduced to recipients of adaptation solutions, but they are considered active policy agents and partners (Eriksen et al., 2015; Dolšak and Prakash, 2018; Mikulewicz, 2018) and become policy entrepreneurs in their own rights. This requires representation and recognition of local perspectives in political debates and negotiations, which often feature unequal power dynamics. This is necessary to create conditions that allow opening and sustaining the 'windows of opportunity' for effective adaptation mainstreaming into local contexts. In contrast, top-down policies and programmes, designed without paying attention to local knowledge and values, produce solutions that are not locally accepted and are technically and politically unfeasible. This might translate in local resistance and low political backing of policy change and the windows of opportunity to uptake adaptation policy stay shut. Thus, our revised framework deepens understanding of the role of bottom-up policy processes in adaptation mainstreaming in explaining the effectiveness of adaptation policy processes at local levels. Through this the study contributes new knowledge to adaptation governance and mainstreaming literature grappling with questions of how to ensure that adaptation mainstreaming works effectively (Cid and Lerner, 2023; Gogoi et al., 2017; Khan et al., 2020; Regmi and Star, 2014; Runhaar et al., 2018).

6.3 Methods

6.3.1 Introduction to the Global Climate Change Alliance+ (GCCA+) project case study

This research is based on a case study of bottom-up adaptation mainstreaming in Tanzania. The case study was the 'Integrated Approaches for Climate Change Adaptation Programme' implemented in the East Usambara Mountains (EUM) in

rural Tanzania between 2015-2019. The project was funded by the European Union as part of the Global Climate Change Alliance+ (GCCA+) initiative. The project goal was to instigate policy change and mainstream adaptation into local level development processes (from village to district) by delivering pilot interventions and integrating adaptation measures into routine planning procedures. In principle, the project was participatory, designed to create varied 'policy spaces' for local deliberation and the local communities' engagement in policy implementation. The case was selected based on its capacity to increase the understanding of the issue under study, that is the bottom-up processes and local participation in adaptation mainstreaming. One of the NGOs who facilitated the project (with collaboration from the Muheza District Council) had expertise in forest conservation and worked in the region for two decades. The second organisation had expertise in water related development and sanitation. The project was designed as an integrated intervention aiming to build resilience and reduce vulnerability of forest adjacent highland villages through a suite of climate-adjusted interventions, where both organisations are contributing their expertise. The bottom-up mainstreaming process was rolled out in two stages: 1) first the project implemented a suite of pilot adaptation proposals designed to generate field evidence about 'good' strategies for adaptation 2) then it attempted to mainstream the 'locally chosen and tried' adaptation solutions into regular district planning procedures.

6.3.2 Data collection

District and village level data were collected through a total of 91 face-to-face interviews undertaken over a three-year period (November 2016-April 2019, at intervals). The first round of interviews was undertaken in 2016 after a few months into the project. Second round of interviews was done in 2018 over a period of seven months during the main bulk of the fieldwork. The last part of the data collection was in 2019 and tried to capture the 'local mood' when the project was withdrawing after all project activities were completed. During each round of the interviews the interviewing was carried out until the 'theoretical saturation' was reached (Fusch and Ness, 2015) meaning that no new information was obtained in subsequent interviews. The individual interviews were complemented with participant observation of project processes (when in country) and reviews of the project documents such as

interim reports and call reports (when away) (Table 7). Gathering data from more than one method provided multiple perspectives, triangulation and validity (Bernard, 1995).

On the local level eight villages of the Amani Division, in Zirai and Misalai Wards were the focus of the study. However, two villages were selected for more in-depth data gathering during the most intensive fieldwork period in 2018. The selected villages were thought to represent the most and least vulnerable villages in the project based on a scoping vulnerability analysis in 2016 (Gaworek-Michalczenia and Sallu, 2017). A total of 60 conversational interviews were collected. The interviews were open ended, focusing on local communities' perceptions of key factors related to the presence of the intervention such as project benefits, local perspectives on adaptation as well as how their concerns were taken into account in decision-making processes. The authors made effort to hear perspectives from a range of groups representing different socio-economic status (such as poorer and better off households, both genders, different livelihood modes). Data on socio-economic status was obtained from the District Social Services in the form of a list of people receiving TASAF (Tanzania Social Action Fund): a small amount of money given bi-monthly for the poorest families.

At the District level, 31 qualitative interviews were undertaken in the district headquarters in Muheza town – about 3 hours motorbike drive from the location of the villages. We interviewed district leaders, politicians, governmental officials from various departments and some NGO staff, who also temporarily set up their office in the district headquarters (see Table 7). Questions related to the implementation of the adaptation mainstreaming project, how information from local level is used in district decision making processes, opinions on the project performance, and topics related to sustainability of adaptation projects. We also observed meetings and informal interactions between district and ward governmental officials, politicians, development practitioners, researchers and the villagers. Detailed notes were taken during these meetings and the notes were included in data analysis.

Table 7: Summary of data used to investigate bottom-up adaptation mainstreaming.

Project stakeholders (No of interviews)	Description
Decision-makers	
• District Agricultural Officer (2)	Two senior officers working in Muheza District Agriculture Department for +10 years
• District Forest Officer (2)	The same person interviewed twice (2016 & 2019). Forester with 'high skills'*
• District Community Officer (2)	In post for a long time - visited all but one village in the district
• District Executive Director (1)	Most Senior in Muheza District - 'casually giving orders to others'
• District Planning Officer (2)	Senior officer, in the post for a long time +15 years
• District Land and Natural Resources Officer (1)	Has seen many projects implemented in this district, but didn't say how long in the post
• District Environmental Officer (2)	One senior and one junior officer. Both collaborated on previous projects with the policy entrepreneurs.
• District Water Technician (1)	District technical staff – 'just doing his job'
• District Complaints Officer (1)	In post for 2 years so still learning
• Ward Executive Officer (Zirai Ward) (2)	Relatively new in this Ward, but was working in another district for a long time; interviewed twice (2016 & 2018)
• Ward Executive Officer (Misalai Ward) (1)	Always lived in the Amani Division, thus 'knows everyone here'
• Ward Councillor (Zirai Ward) (2)	The same person interviewed twice (2016 & 2019). Locally elected politician interested in development +5 years
• Ward Councillor (Misalai Ward) (1)	Locally elected politician +2 years
• Project handing over meeting at district (1)	Present - about 35 District Council staff, NGOs, Primary Secretary, researchers, no communities
• Planning meetings at district (2)	Present - about 20-25 District Council Staff, NGOs, on one occasion EU delegation, no communities
Policy entrepreneurs	
• NGO1 (3)	One office clerk and two members working in the field, extensive experience in international collaborations
• NGO2 (4)	All worked on similar projects previously
• Internal planning meetings (3)	Present – NGO staff, 2 District officers, researcher, no communities
Policy recipients	
• Villagers (52)	Cross-section of different socio-economic status, genders, and modes of livelihood
• Village chiefs (8)	Village leaders across all villages
• Project handing over meeting at villages (3)	Present – communities, NGO staff, 2-3 district officers, researcher
• Project activity groups (10)	Present – communities, NGO staff/external consultants, researcher, district extension staff

*quotes in Table 7 – descriptions made by the interviewees themselves.

6.3.3 Data analysis

Using the framework presented in section 2.0, in this study we analysed how ‘windows of opportunity’ for adaptation mainstreaming were formed and exploited during the project and the role of local communities in the process. The data analysis process followed an iterative approach that combined inductive and deductive processes. The inductive analysis of ethnographic notes from the project withdrawal meetings and interviews in late stages of the data collection, allowed the identification of the phenomenon under study. The analytical process involved developing analytical memos after the completion of each interview to document what was learned from that interview and preliminary insights (Miles, Huberman, and Saldana, 2014). Preliminary codes and themes emerged from this analytical process. After all interviews were completed, recordings were transcribed by two native Kiswahili speakers and qualitative content analysis of the interview transcripts was conducted in NVivo 12 software, exploring the key themes further.

Deductive part of the analysis involved: first, the modification of Kingdon’s framework to incorporate the bottom-up processes based on review of relevant adaptation mainstreaming literature; secondly, the application of the modified framework to guide the exploration of the data for local communities’ involvement in bottom-up policy processes (via the project) and its impacts on effective mainstreaming of adaptation measures in rural Tanzania.

6.4 Results

6.4.1 Problem stream

The problem stream during the project implementation was influenced by the lack of coherence in the adaptation problem framing among the policy stakeholders (particularly the policy entrepreneurs and policy recipients), which led to a largely incomplete and inaccurate picture of the climate adaptation problem in the East Usambara Mountains (see Table 8). Despite being designed as a pro-poor and resilience building project, the NGO policy entrepreneurs framed adaptation to reflect the perspectives of the Muheza District policy community and their own expertise,

while local knowledge appears to be overlooked. The project documents show that the framing was embedded in environmental science understanding of adaptation and vulnerability and focused on the links between local environmental degradation and climate change impacts, perceived as biophysical impacts on ecosystem services (such as water availability), and the communities that rely on them:

“The villages, which surround the Nilo Nature Reserve...rely on Zigi River which experiences water flow that has varied significantly during the last few decades (...) These trends, coupled with increased downstream demands for water, higher pollution due to unsustainable agricultural practices and a lack of income generating alternatives hindering forest conservation, pose a threat for the future” [Project documents, GCCA+, 2019: 1).

This narrative is well-known in Muheza District, influenced by decades of environmental initiatives in the area (Gaworek-Michalczenia et al. in review), as well as historical evidence highlighting the importance of forests in regulating and balancing water systems (Hamilton and Bensted-Smith, 1989). Also, in Tanzania, climate change drivers and impacts are commonly associated with environmental degradation, particularly deforestation (Pauker et al., 2010). This was reflected in the district government’s understanding of adaptation:

“We need our people to learn a sustainable way of keeping the environment and not cutting trees because this drought affects our agriculture and water supply” [District Executive Director, December 2016]; “If we don’t involve proper environmental control and adaptation in our district, in a few years we might not have sufficient food and water for our people” [District Agricultural officer, April 2019]. Thus, the NGOs framing of adaptation reinforced an issue ‘already in the back of people’s mind’ [in the back of the District officers mind] (Kingdon, 1995: 102) in order to further the conservation goals they [NGOs] cherish:

“In the EUM we wanted to strengthen some of the conservation activities implemented previously and expand to other sites while also integrating

other sectors such as water supply and sanitation, which we already worked on in other projects” [NGO employee, January 2019].

However, the emphasis on the environment as the primary issue in the adaptation problem stream resulted in a restricted discourse within the project regarding diverse interpretations of adaptation for various groups and individuals in the villages, the factors that affect their vulnerability and the necessary measures for doing meaningful adaptation. The Usambara communities did not associate climatic risk with environmental management and conservation practices per se. They saw the interlinked elements of climate, environment, poverty, and development as a combined experience affecting their life and livelihoods. This experience depended not only on environmental, but also social, historical and economic factors and some of the most entrenched problems facing people directly reflected their socio-economic status and pre-existing development levels. For instance, villagers who were better off often claimed that climate risk was smaller, while others with limited livelihood options held that droughts determine poverty and high levels of vulnerability in their rain-fed agricultural communities, as suggested by these two accounts below:

"I think the weather is just normal. I planted beans and got a little bit because it was raining too much so they got rotten. But next season I will plant again and hopefully it will be better" [Better-off village women, 55, Kazita]

"We dig our land, we prepare everything nicely but when the rain fails we get nothing. Because we don't have any income we stay to perish" [Poor village women, 60, Kazita].

This demonstrates that the community framing of climatic risk was heterogenous, stratified through peoples' socio-economic status and individual ability to cushion themselves from harmful impacts. For many villagers' adaptation was therefore a signifier of development and social change and related to development activities brought by the project: "We thank TFCG [NGO] for the project because they know that we are poor and want to take us to the next level [improve the development of villages]" [Village women, 44, Kazita]. When villagers spoke about the environmental

change it related to a belief that protecting the forest will stop the impacts of climate change on their livelihoods - adaptation was 'known' to the villagers only through environmental projects that for many years were engaged in 'sensitising' the communities about the importance of tree planting and environmental conservation:

"It will rain again, because we are still adapting the forests and our environment. We have big hope that next year the rainfall will be good for our crops, because we planted a lot of trees" [Village man, 56, Zirai].

These different framings of vulnerability and adaptation have not been explored or incorporated into the project design in a sufficient way because there weren't any safe spaces that enabled participants to explore how to engage with different types of knowledge and develop shared understandings of adaptation that will be useful and valued by all policy participants. This resulted in the problem framing that not only overemphasised natural sciences and environmental management as the main solution space, while downplaying its social dimensions, but also undermined the development of locally acceptable adaptation solutions.

Table 8: Main characteristics of three streams in bottom-up adaptation mainstreaming in Muheza District

Policy participants	Problem stream	Policy stream	Politics stream
Policy entrepreneurs NGOs (TFCG and ONGAWA)	Attached adaptation to older environmental management issues to 'fit' the worldviews of local decision-makers and in line with own goals	Had 'ready' solutions (transferred from other sites) that they believe are useful	Bring expertise and funding via foreign donors; dedicated to environmental issues
Decision-makers (District officers, District Commissioner, Ward Councillors, Ward Executive Officers, some Village Council figures)	See value of adaptation in dealing with existing and future rainfall shortages that impact agricultural production and water scarcity in the district	Low capacities and agency to develop own solutions; reliance on NGOs and donors for solutions	Political will low towards "luxury" solutions (local people lack capacities to adopt them); environment not a political priority; involved in political blame games
Policy recipients Local communities in the East Usambara Mountains	Adaptation recognised as signifier of change: social change (development) and environmental change (will help stop impacts of climate change) for the benefits of livelihoods	Recipients of proposals; not co-designing solutions; have own proposals of solutions that are taken into account; low ownership of policy solutions	Only engaged in project specific spaces; missing from political debates and negotiations about adaptation options affecting their lives

6.4.2 Policy stream

Poor involvement in co-creating adaptation solutions translated into low ownership of policy solutions by the local communities, and limited agency to participate in the implementation of mainstreaming solutions. The project aimed to generate the policy solutions via a suite of 'climate adjusted' pilot activities, providing evidence for mainstreaming 'locally derived' adaptation measures into the district planning routines. The pilot activities aimed to reduce vulnerability and build resilience in the forest-adjacent villages via water infrastructure and natural resource governance, forest-compatible enterprises (butterfly farming, beekeeping, eco-tourism), climate smart agriculture, microfinance schemes and gender issues. However, the pilot proposals were not co-created with local stakeholders or, as Kingdon (1995) would have it, did not 'whirl around' the 'policy primeval soup' 'softening up' the system to become more technically and politically acceptable to the local policy participants. They were pre-determined by the donors' requirements and 'ready' technologies

were fetched from other sites, where previous GCCA+ projects took place, as explained by this NGO worker:

“In the selection of activities we followed the guidance from GCCA+ that wanted interventions in water, forestry, agriculture and energy sectors. They wanted to see which activities work where [in different environments], and we had some experience with these technologies from other sites” [Interview with NGO staff, July 2018].

This suggests that in Muheza District the policy stream was shaped by the priorities of outsiders instead of local policy community. Although some Muheza District officers were involved in discussions on the project design (especially officers from the Forestry and Land and Natural Resource Departments that worked with one of the NGOs on previous conservation projects in the area), their agency in the process was low due to poor understanding of the district government’s role in the adaptation policy process and high dependency on the non-governmental sector: “When it comes to climate change adaptation the clarity on responsibilities is very low at local levels. We rely on organisations such as ONGAWA [one of the NGO]”; “The NGOs bring funding and jobs for ourselves” [District Forestry officer, March 2019].

Similarly, our interviews suggest that the local communities did not fully participate in co-designing of adaptation solutions. The consultation process was largely to extract relevant information (such as technical surveys related to water infrastructure and sanitation) rather than taking local views and knowledge into account. Most planning decisions had been taken beforehand and some positions were already fixed: “The scoping analysis of baseline situation was feeding to what we considered in the original proposal (...)” [Interview with NGO staff, January 2019]. One of the scoping activities was the CRiSTAL vulnerability assessment²⁵, however as reported by an NGOs staff: “This exercise didn’t change much in the project approach, but it reassured us [the NGOs] that the interventions are important for the local people’ [Interview with NGO staff, January 2019]. The adaptation planning process was

²⁵ Community-based Risk Screening Tool – Adaptation and Livelihoods (IISD, 2015)

therefore pre-defined by outsiders with regards to what adaptation options should be implemented and for whom, and thus could be seen as exclusionary.

The participation in the pilot activities including the farmer's field school (known locally as *shamba darasa*), butterfly farming or economic groups was therefore a challenge during the project as community members were reluctant to invest their time, money and labour in uncertain adaptation solutions, they did not co-create: "They say we have to do this and that because of this condition of climate change. It is supposed to help us [in the context of farming] but I haven't seen any benefits yet" [Men, 36, farmer field school participant]. As a result, drop out from activity groups was common.

Indeed, some of the adaptation proposals did not work as intended. After only one season of trials, the yields from the field schools were in some villages below expectations - leaving the financial risks of investment in these climate-smart technologies on the farmers. Likewise, heavy rainfall in 2019 caused high die-offs in butterfly cages, while a new ban on exporting butterfly pupae from Tanzania effectively removed that revenue stream. Detailed analysis of the impacts of all implemented activities are presented in Gaworek-Michalczenia et al. (2022). Overall, low capacities and knowledge of how to translate the project provisions into climate adaptation options discouraged further investments. This shows that the understanding of communities' views on adaptation problems and the solutions to those problems was generally low in the project and as such prevented them informing the very identification of appropriate policy options.

Effective and meaningful local participation in the policy process can be empowering. However, policy decisions must be perceived as fair, accounting for the diversity of values and needs and recognising the complexity of human-environment interactions and possible trade-offs. In fact, community members reported to us various alternatives to the more 'controversial' adaptation solutions, such as the environmental by-laws prohibiting planting near rivers, implemented by the project for environmental conservation purposes. These alternatives included compensation for lost harvest, specialised training on alternative crops, or subsidising more environmentally friendly fertiliser [Informant 43, 39, man and women, Zirai]. Women,

who were disproportionately negatively affected by the by-laws, fearlessly advocated for the installation of piped water in their villages, sometimes by openly showing disobedience. Acknowledging these issues and the proposed alternatives would validate the community problem-solving capacities, promote learning from each other, and build trust and legitimacy of the policy process itself and thus support the policy stream. These alternatives were, however, either not known to the NGO facilitators or ignored during the implementation process. Such lack of inclusion in the policy stream affected the technical and political feasibility of the proposed policy solutions, leading to problems in their implementation and further mainstreaming.

6.4.3 Politics stream

The receptivity of Muheza policymakers to the proposed adaptation mainstreaming process depended on the political buy-in among the district decision makers and a broader acceptance of the adaptation solutions by the community members. The latter had important implications for the overall mainstreaming process because lack of acceptance of the solutions at village level meant that the district decision makers with the mandate to mainstream pilot adaptation measures did not have the motivation to do so.

While the Muheza Council departments that were directly involved in the project implementation (e.g agriculture, forestry, water, community development) reported that the project increased their awareness and a sense of responsibility for climate adaptation issues in the district, they also acknowledged challenges with the proposed adaptation solutions: “Some technologies are difficult for our farmers to implement because they require capacities, specialist infrastructure, investment and so on and we are not there yet” [District Agricultural officer, April 2019]; “We worked with the communities on environmental issues, on agriculture issues, on planting trees but at the end of the day, what they [the villagers] want to see is the benefits” [District Forestry officer, March 2019]. Other officers also referred to the CSA as ‘luxury’ projects due to their high expenditure [District Agricultural officer, April 2019].

Such technically unfeasible solutions also became politically unattractive. For instance, our data revealed that at the start of the project a Ward Councillor (locally

elected politician) had high expectations of gaining political leverage through providing water supply in the project villages and promised to the communities that he 'will take the buckets off women heads' and 'bring piped water to everyone' [Fieldnotes]. Later when it became clear that this couldn't be fulfilled due to high costs, he distanced himself from this statement and stopped supporting adaptation mainstreaming. The politics stream was therefore shaped by the political environment in Muheza District during the project, and influenced whether the interventions were perceived as relevant and publicly desired.

Power dynamics also affected whose perspectives were recognised in the political debates and negotiations and whose not, and who was invited at the negotiation table and who wasn't. We recall one incident discussed about a village leader who refused the water supply intervention in his village and was later accused by a local politician of being against progress. However, it turned out that he rejected this intervention because it offered the water supply to only one sub-village and protecting fellow villagers from conflict was more important to him than the benefits reaching some people [Project meeting at district, August 2018]. Many times, we observed heated discussions at project meetings between the District and Ward authorities (the government) and Ward Councillors (politicians), and even the NGOs, around who was pro or against development and who was fulfilling the manifesto of the ruling party and who wasn't [District meeting April 2019]. The bottom line is that the communities were not present in these policy spaces. Encounters with the villagers were normally concealed to separate project specific 'policy spaces' and took a form of 'sensitising' the communities to pre-defined objectives, often about the need to protect the environment.

Some Muheza District officers recognised these shortfalls. For instance, the District Community Officer pointed that the engagement with local communities was not sufficient during the project, such as there was no social impact assessment, which influenced the 'local mood' [original in Kingdon 'national mood']: "The communities were not presented with full implications of the interventions which influenced how people felt about them" [District handing over meeting, April 2019]. Others pleaded for greater devolution of decision-making and financial resources to the local government and collaborative development proposals between several villages were

being prepared. Ward Executive Officers, for instance, claimed that considerable project money seemed 'wasted' and was not spent appropriately in the local context and that the money, if 'in local hands', could have had a better impact [Ward Executive Officer, July 2018]. Even in statements such as: "We need to make these interventions an everyday life of our people, and not a one-off endeavour" [District Forest officer, November 2016], there was a tone of local concerns for the current adaptation policies' inadequacy, providing only short-lived and transient impacts.

6.4.4 Windows of opportunity for adaptation mainstreaming

The arrival of the project created an entry point for bottom-up policy change and briefly opened a window of opportunity to mainstream adaptation into district planning (see Figure 8). The NGOs framing of the adaptation problem in terms of environmental impacts and uncertainty of water supply captured the district imagination due to its familiarity with this narrative; solutions to that problem seemed readily available; and political will towards adaptation was high from the burst of donor funding and perceived political gains. However, our results show that the window was short lasting as problems in all three streams became apparent. In the absence of extensive community deliberation that could challenge the established adaptation framing and identify more technically and politically feasible adaptation measures, the NGOs policy entrepreneurs were unable to supply the policy stream with locally acceptable policy solutions. Lack of social impact assessments, limited consultations and political representation during meetings further added to the local resentment and low community backing for the introduced adaptation policy. Therefore, while sympathetic and motivated, the district government perceived the actual adaptation process as generally unworkable. The adaptation solutions were seen as 'luxury' projects with uncertain benefits for the local communities and mainly the domain of foreign donors (such as development and conservation partners). This was not something that the local government would be prepared to invest in, while also pointing that the project funding was sometimes spent inappropriately in the local context [Fieldnotes]. The window of opportunity to effectively mainstream adaptation measures into district planning could therefore not be exploited and closed down.

Had the local perspectives been included from the outset (the problem stream), the technical (the policy stream) and political (the politics stream) acceptability of adaptation solutions could have been improved. Greater inclusivity of the adaptation process would also have meant that the district government would have considered backing the suggested adaptation measures, leading to better mainstreaming outcomes:

“If we see that the activities are well received, we have our ways to finance them and scale them up” [District Planning officer, April 2019]; “These projects need to be designed with the communities. They should not be thought off as ONGAWA projects [one of the NGOs], they should be our projects” [District Community Officer, April 2019].

Thus, the exclusion of communities from the problem framing and policy co-design processes influenced the adaptation mainstreaming process through feedback. This contributed to the ineffective exploitation of policy windows during the adaptation project implementation.

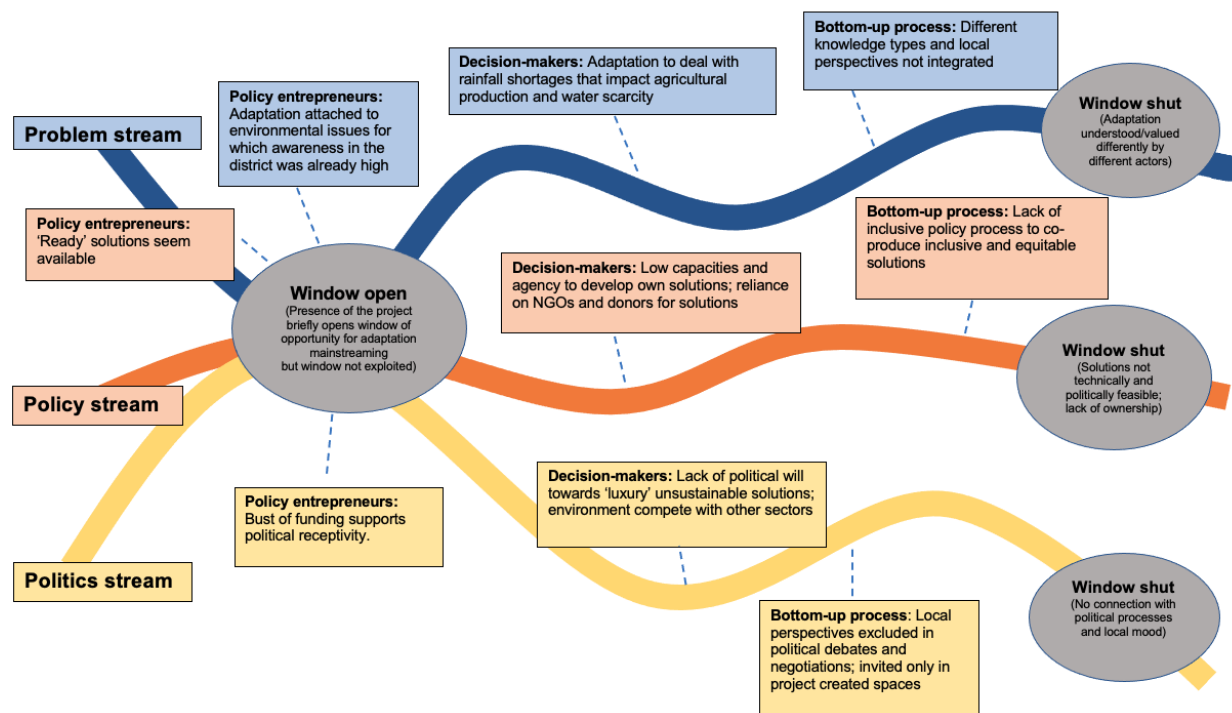


Figure 8: Opening and shutting of policy windows in bottom-up adaptation mainstreaming during the GCCA+ project.

6.5 Discussion

This article contributes to the adaptation governance and mainstreaming literature by combining research on bottom-up adaptation mainstreaming, drawn from studies on community-based adaptation and critical adaptation scholarship, with policy process theories to explore the role of community involvement in effective adaptation mainstreaming in local contexts. Applying an analytical framework adapted from Kingdon (1995) to a case study we have shown that local perspectives on adaptation problems and solutions matter in the policy process, and that the exclusion of these perspectives can lead to ineffective exploitation of policy windows for adaptation mainstreaming in project implementation.

The findings highlight that an inclusive adaptation mainstreaming process starts at the level of problem framing, in which local communities should play a central role. In Muheza District, the project framing of adaptation, as mainly an environmental and technical issue, dominated the problem recognition stream. Such a technocentric approach is common to many adaptation efforts (cf. Ayers, 2010; Nightingale et al.,

2020). In contrast local adaptation priorities in the EUM were focused on addressing co-existing developmental factors that make people vulnerable to climate impacts in the first place. In international climate politics, donors, outside agencies and NGOs, acting as policy entrepreneurs, use organisational resources and framing techniques to draw attention to problems they cherish (Garcia Hernandez and Bolwig, 2021; Cramer et al., 2023). These actors privilege western science and economic calculations over local knowledge, limiting what local people are able to contribute to adaptation planning and implementation processes (Eriksen et al., 2015a). Scholars have long contended that giving preference to the knowledge systems of influential institutional actors (such as 'experts,' 'scientists,' and 'professionals') poses a risk of marginalising local knowledges, perspectives, priorities, and values (Chambers, 1997; Leach et al., 2005). The result is the inhibiting of meaningful and inclusive participation and community self-determination, as well as the devaluing of local adaptive capacities. We suggest that it also leads to community resistance to policy change and to the withdrawal of local governments' political support for adaptation, which prevents from opening and sustaining policy windows for effective adaptation mainstreaming. As the multiple streams approach suggests, the decision makers 'will abort the mission of policy change unless every relevant factor is just right' (Cairney, 2018a: 202 cited in Cairney, 2019), including the technical and political feasibility and public acceptability of policy solutions, and this is out of control of any single actor. As such by excluding local communities at any stage of the policy process, project implementers effectively abort the chance for a positive final outcome.

Several reviews of the adaptation literature have revealed that climate change adaptation policies and initiatives lack dynamism, innovation, and transformational elements, and that technocratic solutions tend to be the default choice (Klepp and Chavez-Rodriguez, 2018; Scoville-Simonds et al., 2020). This comes from a trend in global climate change policy that emphasises uniform approaches to risk, rather than acknowledging the complexity and diversity of local experiences and the need for co-designing contextually relevant solutions with the local actors (Morchain, 2018; Nightingale et al., 2020). This leads to the imposition on local people of a narrative of adaptation 'recipients' or 'beneficiaries' rather than rightful policy agents. During the GCCA+ project it became apparent that local communities' roles in the policy stream was reduced to recipients of pre-defined solutions rather than partners in shaping

their own adaptation priorities. Excluding local voices from the decision-making processes undermined trust and legitimacy in the policy process. It also meant that the NGOs were unable to supply the policy stream with feasible and locally acceptable policy solutions that had a 'reasonable chance for receptivity among elected decision makers' in Muheza District (Kingdon, 1995: 138).

There is however limited debate in the adaptation literature exploring these interdependencies, including the factors influencing adaptation policy uptake at local levels and the successful exploitation of policy windows in mainstreaming processes. Often the lack of capacities, political inertia and institutional weaknesses are the most cited barriers affecting the effectiveness of adaptation mainstreaming at local levels (Musah-Surugu et al., 2019; Pasquini et al., 2013). An exception is a study by Butler et al. who conducted a 4-year adaptation governance experiment in rural Indonesia and concluded that policy windows to mainstream adaptation did not open due to 'ineffective and insufficient time for political engagement and the fluid environment caused by national decentralisation policy' (Butler et al., 2016: 114). We suggest that another factor at play is that bottom-up processes are not institutionalised in climate adaptation policy formulation and implementation. Although engagement with local communities is built into the design and implementation of many adaptation programmes and initiatives, the scope of these processes is limited to project-created 'policy spaces' and agendas, and issues that fall outside the pre-determined range of acceptable frames of decision-making are often ignored (Mikulewicz, 2018). Also, there is no continuity of community engagement beyond project processes, which are normally short lasting. In such top-down and outside-driven policy environment, local participation in adaptation becomes a rhetoric of external agencies that fails to achieve real involvement of community members, leading to limited inclusivity, uptake and ownership of implemented policy solutions and thus their inability to survive on local political agendas (Peters 1996). We show that getting political support for adaptation requires more than just a burst of donor funding and outside expertise - an approach that currently dominates adaptation mainstreaming efforts (Gogoi et al., 2017). Regardless their high dependency on development agencies and NGOs, district policy makers must be convinced that adaptation processes have connection to the 'local mood' - are relevant to the local people, and widely accepted - before any

adaptation mainstreaming could take place. Recent review from Rogers et al. (2023) also found that lack of community support was an important factor influencing adaptation mainstreaming at municipal level.

Having said that, we are mindful that community engagement is not always the most efficient approach for setting and implementing adaptation policies, nor that inclusive policy processes will always produce positive outcomes. Much research has documented how participation and seemingly inclusive processes can in fact mask power imbalances among policy participants (Brink et al., 2023; Nagoda and Nightingale, 2017). Also, the notion of community itself may pose its own conceptual challenges (Agrawal, 2002; Mikulewicz, 2018). It is therefore critical that scholars, governments and practitioners remain sensitive to the issues of power imbalances (Tschakert et al., 2023). In our case, cross-scale power dynamics and personal relationships involving the district government, politicians and the villagers also influenced who was able to participate or have a voice in the politics stream. However, overall, climate adaptation policies can be more effective, can secure a social buy-in, and can support opening and sustaining policy windows to mainstream adaptation in more desired ways, if they are designed and viewed by the citizens as locally relevant, legitimate and fair (Dolšák and Prakash, 2018).

In this regard, several models of governance have been promoted as fostering inclusiveness in adaptation policy processes, including polycentric climate governance, collaborative climate governance, adaptive governance, or deliberative climate governance, among others (Arriagada et al., 2018; Ayers, 2011; Shinn, 2016). For instance, Ayers (2011) following Dryzek (2000) argued that for adaptation governance to be more effective it is necessary to move beyond simply creating institutional spaces for participation, towards 'deliberative governance', which should provide arenas for the 'risk-based' and 'vulnerability-based' adaptation discourses to come together and be resolved (Ayers 2011: 68). According to Ziervogel et al. (2022) a carefully facilitated process of co-production of knowledge can build collective capacity that can influence local policy. Such policy shift is required in order to construct shared knowledge of problems and solutions necessary for transformative adaptation (Filho et al., 2022; Taylor et al., 2022). In other cases, more inclusive processes will entail devolution: delegating authority and power to the local level

(Dietz et al., 2003). Devolution of decision-making authority and administrative control are widely discussed in the community-based adaptation literature as necessary to successfully mainstream bottom-up adaptation into existing development processes (Regmi and Star, 2014). The present study's contribution is the enrichment of Kingdon's framework that equally calls for more inclusive adaptation mainstreaming process, in which local engagement is not reduced to passive recipients of projects, but rightful policy entrepreneurs and owners of the policies shaping their futures (Hermans et al., 2023). To practically engage with this approach would require a reorientation of adaptation thinking to focus on bottom-up policy processes. Such processes would be able to better challenge the established adaptation problem framings and create new narratives that support innovative and locally acceptable policy solutions. These narratives could inform more locally appropriate adaptation plans and create new windows of opportunity for more effective adaptation mainstreaming.

6.6 Conclusions and recommendations

The enrichment of Kingdon's multiple streams framework with a bottom-up approach, as applied in this study, enhances our understanding of what is needed to design and implement more effective adaptation policy processes for the local level. Our aim was to use a policy process theory to study bottom-up adaptation mainstreaming from an innovative perspective and encourage a dialog among different approaches to adaptation mainstreaming research. In doing so we capture important dependencies in policy processes at the local level and show that the exclusion of local perspectives and knowledge generates low political support for the implementation of adaptation policy, which remains a significant limitation for adaptation planning and the effectiveness of mainstreaming efforts. We conclude that the exclusion of local perspectives from any of the policy streams during adaptation policy mainstreaming into local contexts may shut important policy windows before they have even the chance to be exploited.

Nonetheless, we do not aim to present a zero-sum game between local and outsider visions of adaptation mainstreaming, but seek for ways of making adaptation policies more compatible with local needs and experiences, which can support opening and

exploiting of policy windows in a more equitable and effective way. Using diverse knowledge sources, and looking for synergies and contradictions, reduces the reliance on knowledge generated from one source alone, and allows each to be viewed in its own context. We acknowledge that policymaking environments are complex and built by iterative processes of social construction, involving problem and solution framing, power struggles and social learning. These processes are critical to policy outcomes. Yet they have not fully infiltrated into the mainstream adaptation governance and mainstreaming literature, limiting adaptation to blue-print policy and practice prescriptions. Our study suggests that in order to exploit 'windows of opportunity' in bottom-up adaptation mainstreaming during project implementation, it is necessary:

- in the problem stream - to engage local communities in the framing and identification of the climate and other socio-economic challenges and in the assessment of the impacts of these challenges on their lives and livelihoods. This will help to ensure that root causes of vulnerability are accurately defined and that the identified problems are relevant to the local context. This must go beyond simply enhancing local participation. There is a need for co-production in decision-making processes by the vulnerable people themselves.
- in the policy stream - to involve local communities in the development and evaluation of policy options, and to ensure that their perspectives and needs are taken into account in the design of adaptation solutions reflecting community relevant problems. This includes engaging communities in policy design and implementation and ensuring that they have a voice in decision-making processes. It means involving people in thinking about the solutions rather than coming with pre-defined solutions and agendas.
- in the politics stream - it is important to recognise a full range of actors involved in managing change, not only the policy makers and experts. At present the adaptation policy community do not accurately represent the local communities. This implies putting more effort to engaging communities in local advocacy, and to ensure that their perspectives are represented in

political debates and negotiations. It must also entail unpacking the existing power dynamics and working to build the capacity of local communities to participate in policy processes, so that they can become adaptation policy entrepreneurs capable of representing their interests.

Overall, more inclusive policy processes across all three streams need to be institutionalised in climate change adaptation mainstreaming. In this regard, local leadership and local processes that support more inclusive forms of governance and grassroots policymaking are critical. Clearly there is a need for more powerful actors to create space in this outsider driven adaptation policy environment in order for genuine bottom-up processes to emerge and achieve more effective and equitable adaptation outcomes.

Chapter 7 - Discussion

7.1 Introduction

In Chapter 1 I presented the research questions and overarching research aim of this thesis, that is to examine the lived experiences, implications and lessons learned for adaptation programming from a collaborative integrated adaptation project in rural Tanzania.

To fulfil this aim I followed the project in real time, at intervals, and observed and participated in the project adaptation processes on the ground. The engagement with the project through the research-practitioner collaboration led me to asking three research questions:

RQ1: How can projects achieve their objectives of reducing vulnerability and strengthening resilience and how can their differentiated impacts on both be assessed?

RQ2: How do specific local contexts influence project adaptation processes, design and implementation?

RQ3: How does participation impact on adaptation mainstreaming into policy at local levels?

In my three empirical chapters I responded to each of the research questions through critical exploration of the adaptation processes within an integrated project. Chapter 4 evaluated the project differentiated impacts on vulnerability and livelihood resilience and developed the methodology to support the study of these aspects. Chapter 5 investigated the specific context into which the project was implemented and explored how this influenced its design and implementation and local vulnerability outcomes, and Chapter 6 investigated how community participation impacted mainstreaming adaptation into policy during the project implementation.

This chapter draws together the findings of the empirical chapters and outlines the key contributions of this work to knowledge and academic debates. Reflecting on the overarching research aim and individual research questions, below I present five cross-cutting themes that together build a picture of the lived experiences, implications and lessons learned for adaptation programming from the collaborative integrated adaptation project in rural Tanzania, thus fulfilling the research aim.

7.2 Interactions between components of integrated adaptation projects may lead to trade-offs and maladaptive outcomes that compromise the achievement of reducing vulnerability and building resilience.

In addressing my first research question, particularly its first part—*how projects can achieve their objectives of reducing vulnerability and strengthening resilience?* — the analysis presented in chapters 4, 5, and 6 reveals that adaptation programmes encounter multiple challenges in designing and implementing integrated projects to effectively reduce vulnerability and enhance resilience. The results indicate that interactions among various components within the adaptation project, with the goal of reducing vulnerability and enhancing resilience, lead to differentiated impacts, trade-offs and maladaptive outcomes compromising the achievement of reducing vulnerability and building resilience. The analysis further suggests that these trade-offs are not addressed in projects because they stem from processes of social construction and inequality, which are often not recognised.

The integrated intervention followed the EU's GCCA+ blueprint of an eco-village, incorporating a diverse mix of interventions aimed to support social, cultural, economic, and ecological components in the system for greater resilience and sustainability (GCCA+, 2017). For that reason, the project combined a broad range of climate-adjusted technologies and training on climate change adaptation with natural resource management and environmental restoration. This thesis uncovered, however, that integrating multiple technological interventions from across broader sectors might not be the optimal 'solution' to reducing vulnerability and enhancing livelihood resilience if, at the same time, the core assumptions underlying

vulnerability, and how adaptation is framed as a 'problem' and 'for whom' are not questioned (chapter 5 and 6). In this sense, emergent trade-offs can be viewed as much a product of social construction as they are a result of poor design and implementation leading to unintended outcomes and maladaptation.

It is important to emphasise a considerable tension in the use of the terms trade-offs and unintended outcomes in the context of scholarly debates about maladaptation. While the concept of maladaptation holds significant potential for improving adaptation strategies by anticipating unforeseen impacts and risks (Magnan et al., 2016), this thesis cautions against its over-simplistic application. One of the primary concerns regarding the current use of the term is its potential to overlook the complexities and nuances of adaptation programming and significantly underplay the failures of adaptation projects. By categorising all negative outcomes as merely 'unintended' side effects there is a risk of overlooking systemic issues that should have been anticipated and addressed during the design, planning, and implementation phases of projects. This can perpetuate a narrative where failures are dismissed as unavoidable consequences rather than failures of foresight or accountability.

Chapters 5 and 6 of this thesis illuminated trade-offs that emerged when adaptation efforts were framed in terms of environmental management, and vulnerability was perceived as originating from biophysical impacts rather than societal processes. These trade-offs manifested in significant tensions between livelihoods and environmental policies aimed at bolstering long-term ecosystem resilience. By imposing restrictions on planting certain crops near water sources, the GCCA+ project inadvertently hindered local coping mechanisms during drought and diminished opportunities for income (especially for the poorer farmers and women). It also created new burdens for women by withdrawing water user rights to perform households' chores in rivers. These negative outcomes could and should have been anticipated by the project and cannot be dismissed as entirely unintended outcomes. Sovacool et al. (2015: 616) described such situation as a process of 'exclusion' driven by adaptation initiatives, where projects may limit access to resources or exercise influence over specific stakeholder groups, as a way to prevent them from intervening with one's interests. Consequently, ignoring these issues as mere side

effects of well-intentioned projects overlooks the structural injustices and power imbalances that shape adaptation processes (Taylor et al., 2022).

Furthermore, ambiguity of the term maladaptation risks oversimplifying complex socio-environmental systems. Adaptation programming operates within dynamic and interconnected contexts where outcomes are influenced by a multitude of factors, including governance structures, power dynamics, inequalities, and historical legacies (chapter 5 and 6). As such, labelling outcomes as solely 'maladaptive' may obscure the multifaceted nature of challenges and hinder efforts to address root causes effectively. On that note, Fisher et al. (2022) reiterate the importance of paying attention to the underlying social dimensions when considering sustainability and systems transformations. They argue that it is paramount to ensure that environmental benefits do not occur at the expense of social justice. Similarly, Ziervogel et al. (2017) observed that the key to building resilience to multiple risks, discussed in the context of cities, is to focus on the causes of peoples' failings to secure basic rights. Attention must be placed on local knowledge, creating opportunities for 'negotiated resilience' and integrating diverse interests, as simply adding projects within existing systems and governance structures is insufficient and perpetuates how injustices are re-produced. Chapter 5 extends these arguments demonstrating how historical injustices may become perpetuated in adaptation project processes, without paying sufficient attention to the root causes of trade-offs, and as to why local communities are unable to support long term resilience before their basic needs are met. I further showed that if local knowledge is not valued and is seen in programmes and policies largely as a means to extract relevant information (e.g. technical surveys related to infrastructure planning), then it cannot be used to inform problem definitions and designing solutions that are just and locally relevant (chapter 6).

However, there is a tendency within adaptation programming to downplay the socio-political drivers of trade-offs and maladaptation, and refer to win-win outcomes instead (Ellis and Tschakert, 2019, Suckall et al., 2014; Taylor et al., 2022). This tendency stems from the pressure to showcase positive successes in order to secure support from funders and governments (Daw et al., 2015; Roy et al., 2022). Such rhetoric inadvertently hinders the recognition of, and the ability to anticipate

maladaptation. For instance, in the realm of schemes such as climate-smart agriculture, the interventions frequently hinge on the feasibility of techno-economic measures to achieve positive outcomes, paying considerably less attention to the underlying social, political, and cultural conditions that give rise to unevenly distributed costs (Chandra et al., 2017; Smith et al., 2021). In chapter 4 and 5 and 6 I discussed how CSA activities were perceived by local project stakeholders as unfeasible, expensive, ‘luxury’ interventions that presented too much burden of implementation on local actors, both the communities and the local government, highlighting that projects tend to overlook the impact of local contexts of poverty in hindering synergistic potentials while exacerbating the risks of undesirable trade-offs (Suckall et al., 2014). Additionally, the agricultural vision presented by the project to communities in the *mashamba darasa* [farmers field schools] was largely disconnected from the communities’ own vision of cash crop expansion, particularly spice tree farming, which limited the project’s positive impact (chapter 4). Such outcomes should be entirely avoidable if local people have the voice to bring their lived experiences, priorities, and potential risks to the planning and decision-making processes (chapter 6).

Drawing on decades of experience with development projects, it is broadly acknowledged that addressing negative externalities in projects is challenging. Designing adaptation projects that reduce vulnerability and build resilience in a way that benefits everyone without any costs anywhere, and anytime is impossible (Adger et al., 2005). Yet, despite these challenges, achieving positive outcomes, minimising trade-offs and preventing maladaptation should always be the goal (Schipper, 2020). While analysts should recognise that projects may inequitably distribute benefits, and some individuals may experience losses, Sovacool et al. (2015: 616) caution that adaptation practitioners and policymakers must continually ask: (i) adaptive capacity/resilience for whom? (ii) who benefits from this adaptation project? and (iii) who can stand to lose, now or in the future? I also add to this list (iv) how adaptation and vulnerability are framed to allow for reflection, epistemic diversity, and challenging own assumptions (Balanzó-Guzmán and Ramos-Mejía, 2023). Without such reflection adaptation programmes will be unable to meaningfully engage with reducing vulnerability and building resilience.

7.3 Evaluating vulnerability and resilience in adaptation projects requires innovative frameworks combining traditional objective approaches with subjective understandings of adaptation.

This theme responds to the second part of research question one - *how can reducing vulnerability and building resilience be assessed in integrated projects?* The analysis in chapters 4, 5 and 6 demonstrate that assessing integrated adaptation projects require novel mixed method approaches to comprehensively evaluate projects contributions to reducing vulnerability and building resilience.

Mindful of the critiques of indicator based approaches, their generalisations, approximations and limited ability to integrate the underlying drivers of vulnerability (Jones, 2019; Ensor et al., 2021), Chapter 4 of this thesis illustrated how applying a livelihood resilience lens within a robust BACI (Before-After-Control-Impact) research design, combined with an innovative analytical methodology (difference-in-differences) and ethnographic insights, can yield promising results. The framework and associated methodology facilitate a mixed-method evaluation of the impacts of the adaptation intervention on selected indicators representing household vulnerability and livelihood resilience capacities. While mixed-method approaches to vulnerability and resilience assessments are not new in the adaptation evaluation literature (Bours et al., 2013; Islam et al., 2014; Mohan and Sinha, 2017), the framework and methodology carries novelty in its ability to attribute project outcomes to specific intervention activities through the incorporation of the control group in the BACI design (for details see methods section in Chapter 4). In Chapter 4 I also show the advantages for combining this method with qualitative findings that allowed to elicit trade-offs, unintended outcomes and maladaptation, discussed already in section 7.1. This framework is an outcome of the learning process between myself and implementors of the project during the research-practice collaboration and I consider it a significant outcome of that collaboration. It was jointly designed, mutually supported and resulted in peer-reviewed publication. However, the framework and method have drawbacks, which became more visible during further data analysis and triangulation (chapter 5 and 6).

Firstly, the framework had limited ability to ‘pick up’ differences between vulnerable households based on the vulnerability criteria selected by the evaluation team – the indicators of climatic and social-economic pressures. The analysis in chapter 4 showed that despite some socio-economic differences between households, the participating (better-off) and non-participating (poorer) households were similarly vulnerable to climate change. To the contrary, qualitative inquiry in chapters 5 and 6 showed that poorer households (selected based on TASAF lists) were not able to shield themselves from climatic risk in the same way as better-off households (chapter 6) or benefit from the project (no land, time and negotiation power to join the groups) or being more disadvantaged by it (elimination of coping strategies due to by-laws). Internal community dynamics and inequalities also could not be analysed by using quantitative vulnerability indicators (chapter 5). This suggests that different methods might derive different conclusions and these differences should be accounted for in vulnerability and resilience assessments.

Secondly, chapter 4 suggested that rainfall might be the defining driver of vulnerability of these rain-fed agriculture dependent communities, while chapters 5 and 6 suggested that a broader range of factors are important, including social *underdevelopment*, poverty, differentiated socio-economic status of villagers, historical legacies of land gazettlements, past conservation projects, power relations, and local beliefs about drivers and impacts of climate change. Conclusions in chapter 4 were influenced by the choice of indicators and the fact that climatic conditions have significantly changed between the before – after measurements.

Thirdly, despite positive project impact presented in chapter 4 suggesting that some project activities were building capacities for learning (via provided training and knowledge platforms) and to a lesser extent capacities to self-organise (via networks), chapter 6 suggests that the project interventions probably won’t be supported beyond the project life because of their poor technical and political feasibility and thus poor chances for mainstreaming adaptation strategies into district plans.

Nevertheless, I feel that highlighting these differences provide an important contribution to the monitoring and evaluation adaptation literature and adaptation

practice. Since adaptation is a process of continual adjustment, there cannot be a clear end point or benchmark signalling that an adaptation programme is successful (Dilling et al., 2019). It will also never be achieved within a single programme cycle. This means that closer examination of its lived experiences, implications, and the lessons learned, in other words, the process by which adaptation is attempted to be reached, is equally important. The contextual, actor-oriented accounts presented in chapter 5 and 6 significantly deepened the analysis presented in chapter 4 and expanded on the vulnerability and livelihood resilience assessments. The contextual analysis elucidated divergent adaptation framings, perceptions, and goals between different project stakeholders. These accounts and narratives underpinned my understanding of how adaptation problems and solutions were framed in the project and for whom. They also shed a light on lived experiences of the project by the communities, NGOs and the local government. In this way instead of striving for absolute assessments of vulnerability and resilience the focus was shifted to understanding the differential meanings of vulnerability and adaptation across actors. I believe this can encourage adaptation projects to recognise more deliberate and flexible project designs that allow spaces for diverse epistemological and ontological ways of knowing to unfold (Balanzó-Guzmán and Ramos-Mejía, 2023; Goldman et al., 2018). As discussed in the previous section, and across the empirical chapters, such spaces are currently largely missing. In this thesis, I therefore, documented both the achievements of the project in terms of reducing vulnerability and building resilience (primarily chapter 4) and lessons learned (chapter 5, 6, 8), which adds to the emerging evidence base, especially in the context of grappling with questions of how to operationalise vulnerability and resilience in the global goals.

I conclude this theme with a reflection that objective and subjective assessments should be viewed as complementary, not mutually exclusive. Donors and project facilitators, driven by their own accountability requirements and project portfolio management needs, are likely to continue to rely on quantitative and objective assessments. However, it's crucial to also recognise the importance of complementing traditional indicator based approaches with diverse ontological and epistemological understandings of adaptation derived from the perspectives and lived experiences of project stakeholders, either in real time or ex-post (Mills-Novoa, 2023). This implies a substantial re-orientation of project accountability structures,

shifting from an upward orientation (towards donors valuing science and economic cost benefit calculations) to a downward one, focusing on the participants and addressing what they need and consider essential in the context of a changing climate (ibid.) Reflection on the influence of different methods is imperative for understanding how they shape conclusions derived from the analysis. Delving into people's perspectives, values, and worldviews, as opposed to calculating indicators, can significantly impact the analysis outcomes and conclusions. It's also crucial to consider the feedback received from the organisations regarding what they find useful and valid. Adaptation projects assessments should therefore reflect and support both objectives: assist projects in measuring their achievements for reporting to funders and stakeholders (chapter 4), while also critically examining the potential for maladaptation (chapter 5 and 6).

7.4 Historical legacies infiltrating into project design and implementation may influence maladaptive outcomes.

This theme responds to research question – *How do specific local contexts influence project adaptation processes, design and implementation?* The findings of Chapter 5 and 6 reveal that the context into which projects are implemented hold importance and influence on how projects are designed and implemented, which ultimately shape local vulnerability outcomes. The analysis shows that despite the rhetoric of integration of human needs with environmental sustainability within the integrated adaptation project in the East Usambara Mountains (GCCA+, 2017), historical legacies of past interventions (particularly legacies of injustices related to environmental degradation narratives) have reinforced the project focus on long-term ecosystem resilience at the expense of livelihood resilience. Along with limited attention to trade-offs and a failure to acknowledge negative externalities (discussed in section 7.1), this led to maladaptive project outcomes by altering access to resources in the name of long-term ecosystem resilience.

Efforts to intervene in a landscape are inevitably influenced by the unique context of the locality, shaped by social, environmental and historical settings, including the

historical legacy of prior interventions. Some studies, like that of Brooks et al. (2012) have attempted to separate the impacts of specific contextual factors, project design and community characteristics on projects' success and found little evidence that national context influences project outcomes. Other research has explicitly found that historical legacies are hurdles to project outcomes (Meer and Schnurr, 2013). My analysis, on the other hand, emphasises that the historical legacy of past interventions may infiltrate into adaptation projects design and implementation, causing new projects to differ only marginally from their predecessors. This phenomenon aligns with the concept of 'adaptation re-packaging' discussed in the adaptation literature as one of the major drivers of maladaptation (Eriksen et al., 2021). Such re-packaging or re-branding of other priorities as adaptation is frequently explored in the context of development, due to direct parallels between adaptation and development (Ayers and Dodman, 2010), however re-branding of conservation into adaptation has received less attention in the adaptation literature. This thesis found evidence that high conservation contexts with long history of past interventions and associated powerful actors, such as the context of biodiversity hotspots, might reinforce such 're-packaging' and may propagate conceptions of adaptation that echo old conservation paradigms capable of perpetuating historical injustices and maladaptation. Adaptation could therefore soon become another 'conservation fad' (Redford et al., 2013), if it is not one already. Some previous studies discussed instances where adaptation practices have been aligned with environmental management issues by organisations who overlooked their transformative potential (Beymer-Farris and Bassett, 2013; Reid, 2016; De Oña Plaza, 2018). For example, De Oña Plaza's, (2018) analysis of adaptation policies in the Tucana Volcano Biosphere Reserve on the Mexico-Guatemala border, highlighted that environmental NGOs implementing adaptation share standardised institutional arrangements promoting a similar framing of adaptation. This revolves around ecosystem-based adaptation (EbA) models, emphasising ecological restoration and ecosystem resilience. Such 'adaptation projects' enter with predefined objectives like deforestation reduction or integrated river basin management, often neglecting social and political factors underlying vulnerability (De Oña Plaza, 2018: 84). These projects are highly susceptible to perpetuating historical injustices in adaptation design and implementation influencing maladaptive outcomes. Chapter 6 showed how local communities were 'consulted' after finalising

proposals, only to seek legitimacy and collaboration without altering the underlying assumptions about what needs to be addressed and how. The 'climate-adjusted' technologies presented to the communities in the Usambara Mountains can be viewed as reminiscence of old conservation approaches with a changed name (e.g. climate smart-agriculture instead of conservation agriculture or economic group instead of co-operative) or even soil conservation schemes dating back to colonial times (chapter 5). These interventions were not suited to meaningfully reduce vulnerability in the East Usambara Mountains because they did not take into account pre-intervention capacities, differentiated vulnerability and the root causes of vulnerability embedded in the Usambara Mountains history. On the contrary, they exacerbated it through restrictive environmental policies that affected the hardest the most vulnerable groups in society, such as women, the poor and the youth.

Finally, my analysis highlighted how specific contexts (in this case the context of biodiversity hotspot) have the power to shape dominant narratives determining local policy processes. The local perception of the biodiversity hotspot as the ultimate 'conservation zone' (chapter 5) played a pivotal role in inhibiting questioning the project's 'adaptation narratives' by the local district when they first arrived (chapter 6). This lack of scrutiny was leveraged by the organisations to present the adaptation 'problem' in a manner that suited their environmental conservation objectives. However, the project's trajectory witnessed a swift closure of the 'window of opportunity' to achieve desired adaptation outcomes. This was primarily attributed to inadequately designed solutions that failed to align with the actual local adaptation needs, as detailed in Chapter 6. This observation implies a need to shift away from framing adaptation in environmental terms and instead explore approaches that more closely align with local development priorities (cf. Dupuis and Knoepfel, 2013). Paradoxically, the current trend diverges from this ideal, with environmental and development organisations predominantly prioritising techno and ecosystem-centric approaches. Unfortunately, this focus overlooks crucial links between ecology and livelihoods that should be drawn, particularly in regions like the East Usambara (cf. Gaworek-Michalczenia et al., 2019) and Tanzania more broadly.

7.5 Inclusive bottom-up mainstreaming process is necessary to achieve sustainable long terms outcomes.

The research question - *How does participation impact adaptation mainstreaming into policy at local levels?* helped me to reflect about the crucial role of communities' involvement in adaptation policy processes and its impact on long-term sustainability of adaptation programming. In Chapter 6, I focused on the project's mainstreaming component, aiming to integrate adaptation measures into routine district planning. I found that excluding local perspectives in framing, designing, and deploying adaptation solutions led to low political support of the proposed solutions, resulting in poor mainstreaming outcomes (windows of opportunity for policy change at district level closed down). This revealed important interdependencies in policymaking at local levels, suggesting that a lack of inclusivity in planning and decision-making could hinder the effectiveness and long-term sustainability of adaptation outcomes. Chapters 5 and 6 also highlight important implications for project design: simply adding a 'mainstreaming component' without fully engaging local knowledge for developing contextually relevant solutions is unlikely to achieve the desired sustainable outcomes.

These results challenge certain functionalist views of adaptation mainstreaming and policymaking, found in the literature, which depict policy processes as a bureaucratic, linear tasks of decision-making that could be alleviated by the provision of new tools, guidelines, and resources only (Mogelgaard et al., 2018; Price, 2019). Some studies try to identify barriers to adaptation in order to better grasp the constraints to adaptation policy mainstreaming and implementation (Eisenack et al., 2014; Moser and Ekstrom, 2010; Piggott-McKellar et al., 2019). Others blame lags in organisational and institutional reform (vertical and horizontal coordination), unreliable climate information, lack of planning, and sustainable funding for failure to achieve effective implementation and more sustainable outcomes (Ampaire et al., 2017). While these studies are valuable in explaining the reasons for delayed adaptation, they often overlook crucial aspects of adaptation governance that relate to complex processes of social construction involved in policymaking. These processes include framing problems and solutions, power struggles, and broader political economy issues (Macchi and Ricci 2014; Christoplos et al. 2016; Tanner and

Allouche 2011). Consequently, scholars such as Wellstead et al. (2013) and Biesbroek et al. (2015) advocate for engaging with political sciences, which can provide valuable insights for overcoming persistent implementation gaps. They suggest learning from implementation studies, such as Lipsky (1980), which demonstrates how street-level bureaucrats reinterpret policy guidelines to align with their beliefs and sense of justice. Such studies are considered more useful to practitioners than functionalist approaches or simply listing adaptation barriers.

Drawing on public policy and actor-oriented frameworks, this thesis presented a different perspective on adaptation policymaking - as an iterative process that is not linear and evidence-based but rather a political one, where actors such as NGOs and EU donors wield power to pursue their preferred outcomes. In Chapter 6 I build on the social constructivist approaches to policymaking to develop a framework that re-imagines adaptation policy through the integration of bottom-up processes. The framework assigns more central role to communities that are re-considered as active policy agents instead of passive adaptation beneficiaries. This perspective challenges the notion of adaptation mainstreaming as a top-down technical endeavour and underscores the importance of recognising the role of community engagement in shaping effective and sustainable adaptation outcomes.

In the centralised climate governance framework of Tanzania, these findings carry significant implications. The Tanzanian government often views the involvement of development partners at the local level as a solution to bridging the implementation gap in national climate policies. However, there is a prevalent tendency to overly rely on external projects. This reliance is evident in the language of the new National Climate Change Response Strategy 2021-2026, which explicitly mentions the generation and dependence on donor funds to fulfil the strategy (URT, 2021). Nevertheless, as demonstrated by the analysis presented in chapter 6 of this thesis, the sustainability of mainstreaming efforts through external projects is generally low. Various analysts suggest that the inability to transition from pilot projects to the institutionalisation of practices is to blame (Runhaar et al., 2018). In Chapter 6 I argue that greater involvement of local communities in adaptation policy processes is a crucial element needed to support such institutionalisation.

However, the existing planning system for development in Tanzania, such as the Opportunities and Obstacles to Development framework (O&OD), is ineffective in engaging with local communities because it is not being implemented. O&OD is intended to be implemented in Tanzanian villages to collect villagers' development priorities in a bottom-up participatory manner (Shemdoe, 2013). Unfortunately, the system exists only on paper, is rarely undertaken, and when it is, the funding comes from outside donors. In such an institutional environment, any attempt to integrate local priorities and needs into the process and link it to climate adaptation becomes challenging (Mdee and Mushi, 2021). In the absence of participatory processes, the preparation of plans occurs ad hoc, with external organisations wielding power to determine where priorities lie. While the Tanzanian governance system might not be structured to decentralise power effectively (Mdee and Thorley, 2016; Smucker et al., 2015), the thesis showed that the focus should be on creating new windows of opportunity rather than closing them down.

7.6 Collaborative research exploring lived experiences during project implementation can stimulate individual and institutional learning for transformative change.

The reality of global climate change requires new forms of knowledge to positively influence policy and programmes to support vulnerable populations. This research set an aim to explore lived experiences, implications and lessons learned for adaptation programming from a collaborative integrated project in rural Tanzania. In this theme, I reflect on some of the challenges and opportunities for learning presented by this research-practitioner collaboration drawn from all chapters, but more importantly how the lessons learned during the collaboration potentially stimulate institutional and individual learning for more transformative change.

New approaches to designing, supporting and implementing adaptation and transformation programmes are emerging and those approaches recognise the importance and commitment to learning. For instance, Pereira et al. (2020) analysed nine cases of co-creation of 'transformative spaces' – collaborative environments where experimentation with new configurations of social-ecological systems can occur - and concluded that focus on justice, history, power, and contested meaning is

needed, especially between Western ideas of transformation and those in Global South. Tschakert et al. (2016) on the other hand studied 'collective learning' spaces, and reflected how participation in such 'micropolitical spaces' is reliant on the existing intergroup and intragroup dynamics, which may open or close down adaptive decision-making.

The immersive character of this research also led to the emergence of what I call 'microlearning spaces' through real-life encounters and formal and informal exchanges between collaborative partners.

The first key insight from the 'microlearning' space highlights the need for examining different framings of vulnerability. Within the partnership, I encountered the dominant global discourses of adaptation and scientific Western notions of knowledge that heavily influence adaptation policy and practice. This predominant framing of vulnerability often manifested in positioning villagers in the project as less capable beneficiaries, implicitly undermining their knowledge and needs while authorising 'experts' to implement adaptation measures on their behalf (Barnett, 2020; Falzon, 2021). Examining the lived experiences of the project allowed me to witness instances of exclusion in opportunities and decision-making processes, creating a sense of participants being disciplined into specific identities and ways of being, rather than fostering a project aimed at enhancing livelihoods (chapters 5 and 6). However, on an individual level, many NGO and district government workers demonstrated a compassionate 'knowing' of vulnerability (Eriksen, 2022). This compassionate understanding enabled a shift beyond a purely biophysical understanding of vulnerability, recognising the personal and intangible aspects of it, unique to each person. This indicates that learning is occurring at the individual level, and diverse epistemologies are not entirely absent in projects (Balanzó-Guzmán and Ramos-Mejía, 2023). These alternative perspectives may simply be obscured in the struggle with global discourses. Therefore, organisational learning requires reflection from individuals within those institutions, including the researchers collaborating with those organisations, and integrating more 'affective' adaptation and reflection about our vulnerabilities and those of others (Nightingale et al., 2022).

In our discussions within the 'microlearning' space, I also gained insights into how the focus on the 'technocratic solutions' originates from the tightly defined specifications and timeframes of projects, which are easier to control than addressing the underlying structural inequalities and root causes of vulnerability. I learned that, while members of the NGO staff often acknowledge the existence of these artificial boundaries, which make issues occurring outside project scope invisible, their need to prioritise upward accountability to show efficiency (value for money), effectiveness, and success - however defined (Singh et al., 2022) - over equity (the inclusion of lived experiences of different groups) often prevents them from reflective learning (Taylor et al., 2022). However, through our collaborative efforts in the 'microlearning' space, we endeavoured to find a middle ground between evaluating project outcomes and impacts that could be reported to donors and incorporating more reflection on the suitability of the solutions from the outset.

Finally, the purpose of any co-learning or co-creation space, including the 'microlearning' space created during this collaboration, is making the relationship of knowledge production equal. First and foremost, those most affected by the potential outcomes of adaptation programmes and research must be accorded respect and agency in the knowledge production process that underpins such interventions (Pathways Network, 2022). Co-production encompasses various types of knowledge, including experiential and scientific knowledge (Klenk and Meehan, 2015), and originating from different actors such as communities, policymakers, practitioners and researchers. For instance, during the Adaptation at Scale in Semi-Arid Regions (ASSAR) project co-production contributed to learning and transformation at both personal and institutional levels by fostering cross-scalar relationships and enabling the co-creation of solutions (Morchain, 2018).

Engaging in 'microlearning spaces' during this collaboration also meant that some difficult discussions about the organisations becoming the 'subjects' of this research could not be avoided. From this research standpoint, establishing a critical enquiry was understood at a fundamental level - without incorporating any form of feedback, no individual or organisation can learn. From a standpoint of the NGOs, levelling critiques that at least do not cause harm to the reputation of the organisations is deemed fair and constructive. This shows that co-production approaches can

potentially be transformative only if they fully include diverse voices and knowledge systems.

Chapter 8 - Conclusions

8.1 Introduction

The aim of this thesis is to explore the lived experiences, implications and lessons learned for adaptation programming from a collaborative integrated adaptation project in rural Tanzania. In this final chapter, I consolidate the insights gathered from individual chapters and show how they collectively contribute to achieving this aim. This is followed by outlining the research impact and the thesis contributions to development practice and practitioners. Then I provide reflection on the research process and its limitations. I conclude by proposing avenues for future research.

8.2 Thesis contributions

This thesis is organised to ensure that the three analytical chapters (4, 5, and 6) each make distinct academic contributions while collectively allowing the thesis as a whole to contribute to and fulfil the aim of exploring the lived experiences, implications, and lessons learned for adaptation programming from the collaborative integrated adaptation project in rural Tanzania.

In Chapter 4, I make methodological contribution to the literature on adaptation monitoring and evaluation. By developing an innovative framework and associated methodology, I demonstrate how practitioners can improve their M&E approaches to gain a deeper understanding of the different dimensions of livelihood resilience impacted by their projects and in what ways. Additionally, Chapter 4 sheds light on how individual interventions interact within projects, emphasising their potential for maladaptive outcomes. These insights are particularly valuable to practitioners and evaluators involved in designing and assessing projects aimed at enhancing livelihood resilience, thus this chapter also makes a practical contribution.

Chapter 5 contributes to both the adaptation literature and the literature on conservation projects, especially those focused on biodiversity hotspots. Practically, the study underscores the inadequacy of human adaptation efforts in biodiversity hotspots, highlighting a significant risk of perpetuating historical injustices in the

design and implementation of adaptation projects in these areas that may lead to maladaptation. The chapter also cautions against the 'repackaging' of conservation as adaptation, particularly through ecosystem-centered approaches, which has received less attention in the adaptation literature than, for instance, 'repackaging' development. While the literature on biodiversity hotspots is starting to engage with adaptation, it often overlooks human vulnerability. Therefore, incorporating the lived experiences of a climate adaptation project in a biodiversity hotspot adds a diverse case study to this body of literature, making significant empirical contribution.

Chapter 6 makes theoretical contribution that adds to the literature on adaptation governance and mainstreaming. The theoretical framework and its novel elements, built upon the work of Kingdon (1995), provide a starting point for the potential reconceptualisation of the importance of bottom-up processes and the role of local communities in adaptation policymaking. Chapter 6 also contributes to critical debates on adaptation project sustainability, emphasising the limitations of mainstreaming processes if local knowledge does not guide solutions design from the outset, thus contributing to projects design in a practical way.

The thesis as a whole provides further contributions to fulfil the aim of exploring the lived experiences, implications, and lessons learned for adaptation programming from the collaborative integrated adaptation project. Firstly, the analysis in this thesis has demonstrated the advantages of using different conceptual lenses and methodologies to evaluate adaptation programmes. Delving into the lived experiences of project stakeholders complement and enhance analysis accrued with conventional project evaluation methods. This approach, as advocated by Ensor et al. (2021) and Jones and Tanner (2015), becomes imperative in addressing notions of equity and justice in adaptation and resilience assessments. The thesis encourages therefore synergistic approach, combining indicator-based objective evaluations with ethnography-based subjective accounts. This integration also serves to reorient project accountability structures, shifting from an upward orientation (towards donors) to a downward one (towards participants). The resulting insights provide valuable lessons for the improvement of adaptation programming.

The thesis also underscores the significance of community involvement in adaptation policy processes and its profound impact on the long-term sustainability of adaptation programming. It identifies issues arising from project interventions lacking support beyond their designated lifespan due to technical and political feasibility constraints, hindering effective adaptation mainstreaming. Consequently, the thesis enables a more critical engagement with adaptation policymaking, adopting a bottom-up and actor-oriented perspective. This shift aims to facilitate the transition from isolated pilot projects to the institutionalisation of practices in policy, with the potential to influence adaptation programming not only in Tanzania but also beyond.

The analysis in this thesis has also contributed to debates around specific category of adaptation programming: multi-intervention integrated projects. By examining the trade-offs between different interventions and maladaptive outcomes, the thesis underscores the need to perceive trade-offs not merely as challenges addressable through triple-win designs, but rather as outcomes of social processes and inequality (Ellis and Tschakert, 2019). This encompasses scrutinising the assumptions inherent in projects, particularly regarding vulnerability, and the framing of adaptation as a 'problem' and 'for whom'. Consequently, this thesis emphasises possible issues with simply layering technological interventions and 'plugging in' mainstreaming components into global project portfolios (Climate Funds Update, 2019). It emphasises that this approach may be ineffective in addressing trade-offs and sustainability issues unless there is a full engagement with local knowledge. The analysis underscores the importance of moving beyond a simplistic view of trade-offs and recognising them as complex social phenomena that demand a nuanced understanding of local contexts and dynamics.

Finally, this thesis extracts valuable insights for adaptation programming directly from the collaborative process it undertook. The immersive nature of the research facilitated the creation of 'microlearning spaces', fostering institutional and individual learning among project partners. Notably, the thesis observed a varied understanding of vulnerability, with a more compassionate perspectives emerging at the individual level rather than the institutional one. This implies that the root causes contributing to these issues might be situated at higher programmatic levels (e.g. in donors' agencies). Further, the thesis highlights that the design and execution of

projects indeed bind them to specific spatial and temporal frames, which may be easier to control, but are not align with the everyday lives and experiences of local communities. The thesis advocates for fully inclusive, diverse, and flexible project design, implementation, and M&E processes. However, change at higher programmatic levels might need to happen before more transformative adaptation programming is possible.

8.3 Research impact and contributions to development practice and practitioners.

One of the primary objectives of this thesis was to support the design and implementation of future adaptation projects. Central to this goal was promoting social inclusion and equity, helping communities and other local actors better navigate adaptation processes. Observing and studying the lived experiences of adaptation projects provided insights that can be used in adaptation programming to design, implement, and evaluate projects more effectively and equitably, thereby contributing to practice and development practitioners.

The recommendations developed during the research-practice collaboration were compiled into a series of reports and policy briefs. These documents outline the results and reflections that emerged throughout the research and implementation phases and can be utilised to improve adaptation programming (Gaworek-Michalczenia and Sallu, 2017; Sallu et al., 2018; Gaworek-Michalczenia et al., 2019). Below, I present the broader lessons for consideration by development practitioners, which extend the information provided in the briefs. Following this, I will outline the opportunities this research provided to enhance collaborations and partnerships in the Usambara Mountains, further contributing to development practice and amplifying learning.

8.3.1 Five lessons for development practice engaged in adaptation programming.

Lesson 1

The vulnerability of local livelihoods should be central to any climate adaptation response. Understanding how these livelihoods are conducted and sustained in the face of emerging climatic threats is crucial for successfully integrating climate

change action into development practice. The findings indicate that the vulnerability and resilience of rural livelihoods in the East Usambara are shaped by a complex interplay of environmental, social, political, and historical factors. Meaningfully addressing vulnerability requires examining the existing capacities of communities - such as time, skills, access to information and support, and their willingness to take risks - and understanding how underlying social conditions, like social learning, equity, values, governance, and trust, affect the negotiation of vulnerability and resilience in a given context.

Lesson 2

Adaptation projects should be designed and implemented through participatory processes where communities explicitly discuss potential trade-offs. Top-down policies result in maladaptive outcomes because they do not allow communities to voice potential risks during the planning stage. This research demonstrated that the absence of deliberative spaces for local participation and negotiation of agendas and resources can lead to the withdrawal of community rights to land and water in the name of adaptation. Creating such deliberative spaces requires facilitators skilled in navigating power dynamics and sympathetic to the epistemologically diverse local knowledge. It is essential to remember that participation in these projects is voluntary, and there should be no stigma attached to those who choose not to participate nor negative outcomes for them.

Lesson 3

Local communities should not unfairly carry the burden of climate policies. To achieve ecosystem resilience, the long-term benefits of environmental management (such as water ecosystem services and forest conservation) or long-term investments (like climate-smart agriculture) must be accompanied by visible and sustainable short-term co-benefits, including compensation for immediate losses. This research revealed that some farmers, particularly those from poor and vulnerable households, had already lost part of their livelihoods or faced opportunity costs due to the project. These losses were neither compensated nor offset by new income opportunities. While environmental considerations are crucial for adaptation and resilience, development practitioners should not exacerbate inequalities by pushing the burdens onto local communities.

Lesson 4

Deliberately considering what constitutes 'intended' and 'unintended' outcomes in adaptation projects is central to a more reflective approach. Not paying attention to the structural inequalities and socio-political and cultural factors that negatively impact project processes and outcomes (such as elite capture) should not simply be dismissed as 'unintended' or 'maladaptive' externalities. Rather, this represents a failure of projects to effectively anticipate risks and, consequently, undermines their broader accountability. This research shows that inequalities exist in every society, including gender-based and political inequalities that exclude the poor. However, by making vulnerability central to adaptation efforts and empowering vulnerable and marginalised individuals, adaptation can contribute to resilience, poverty reduction, and sustainable development. Without an emphasis on reducing vulnerability of those most in need, adaptation risks becoming overshadowed by other environmental and development goals.

Lesson 5

Establishing connections between ecology and livelihoods is crucial in biodiversity hotspots. These areas are biologically significant due to the ecosystem services they provide, and they are home to increasingly vulnerable populations on the frontline of climate change impacts. This research demonstrated that high biodiversity areas already bear the historical legacies of past conservation projects, which have altered resource access and impacted local livelihoods. Climate change introduces new challenges, further risking people's livelihoods. Linking livelihood and ecological resilience, and alleviating poverty through integrated interventions, requires greater effort and thoughtful consideration of how to meaningfully address trade-offs and support people's lives under climate change, especially where high-value nature is at stake. Addressing these complex issues necessitates a balanced approach that prioritises both environmental sustainability and the well-being of local communities.

8.3.2 Research impact

This thesis provided an opportunity to enhance collaborations and partnerships in the Usambara Mountains. The research findings informed the design of a new

intervention program in Tanzania's East Usambara Mountains. This new three-year USAID-funded program, led by the Tanzania Forest Conservation Group (TFCG), focuses on capacity building to achieve long-term forest connectivity, biodiversity conservation, and community development in the Amani-Nilo Corridor (CAN project). The experiences gained from the research-practice collaboration and subsequent projects, such as the AFRICAP, informed the activities and broader approaches of the CAN project, particularly in youth work, gender initiatives, and the expansion of spice cultivation.

Moreover, the research was successfully disseminated in the villages in early April 2024. Further integration of the findings is planned as part of the CCCEP funding and engagement. The University of Leeds recently secured funding to support TFCG to conduct a series of workshops and training sessions on building capacity for climate change resilience, market linkages, and gender and social inclusivity. This new collaboration provides opportunities to incorporate research evidence into community training/activities and policy dialogues aimed at improving coherence across agriculture, forestry, and energy sectors. More importantly, it enables Leeds researchers to engage with stakeholders developing management strategies for landscape-scale transformations in the Usambara Mountains. This engagement will create long-term opportunities for social science research to influence development practice and will open future avenues for research and learning.

Finally, by tracking citations from Chapter 4, I identified scholars and practitioners who have referred to my work and the assessment method developed through the collaboration to evaluate their own interventions (Berhanu et al., 2024; Kayaoglu et al., 2023; Opoku Mensah et al., 2024; Zhang et al., 2023). The articles indicate that the thesis's contributions have been applied in various fields, including adaptation, humanitarian crises, and food security, extending the research impact and practical applications beyond Tanzania and the specific context of the Usambara Mountains.

8.4 Reflections and limitations

It is important to consider the research process and its limitations.

The primary research approach employed in this study was qualitative, inherently characterised by its interpretive nature. This implies that throughout the research process, I made many subjective decisions—from developing descriptions and selecting themes to interpreting data and drawing conclusions. Despite maintaining a systematic reflection on my position within the inquiry, in line with the principles of reflexivity I mentioned earlier, it was inevitable that I filtered the data through a personal lens. This potentially introduced personal biases, values, and interests into the study and made the separation between the 'personal-self' and the 'researcher-self' particularly challenging (Creswell, 2003: 182).

I also recognise instances where my positionality could have influenced the narratives I collected. These instances are related to villagers possibly sharing stories they thought I wanted to hear, as highlighted in section 3.6, or the opposite, withdrawing certain information. To give an example, after an interview, I requested a walk through a farmer's field who enthusiastically claimed to be following the project's instructions but in fact was not implementing the technologies. After initial deception, we finally made it to the farm and only then the farmer revealed that in fact he/she did not apply the technologies. Conversations with the research assistant helped me to understand that some people might be reluctant to disclose their true feelings, fearing that 'development work' wouldn't come to their village again if they come across ungrateful. I did try to eliminate such issues as discussed in section 3.6, but according to Bernard (2006: 234) it is impossible to eliminate it completely, 'as some portion of what people say about their behaviour during an interview is often inaccurate'.

On occasions, I also encountered challenges in determining when to conclude data collection. I often found myself uncertain about whether I had gathered sufficient data to adequately address and inform my research questions, particularly as new lines of inquiry continued to emerge. Fearing the possibility of overlooking crucial storylines, I might have erred on the side of collecting excessive data, which is not

that uncommon in ethnographic research (Bernard, 2006). This became particularly challenging in the later stages of my research during the data analysis phase. Regrettably, I left some interviews unanalysed beyond initial screening, deeming them of lesser value, which may have introduced further biases into my findings.

I also would like to reflect on how my thinking was influenced by normative agendas associated with specific school of thought or paradigm. Throughout the research process, I often found myself contemplating where I 'fit in' normatively as a researcher, occasionally worrying that my work might face rejection if I didn't position myself more neatly. Similar issues were also discussed by Skelton (2021: 1) who recently highlighted the presence of 'tribal tendencies between social-scientific "schools of thought" or "paradigms"' related to climate knowledge and drew parallels with dynamics within religious orders (Skelton, 2021: 1). In examining these various orders, the author illuminated how epistemological, ontological, and methodological priorities not only fuel scientific controversies, such as defining what high-quality knowledge is and what is not, but also underscore the interconnectedness of methodological choices with ontological and epistemological positions. As a result, some scholars explicitly adhere to their orders, while others are more willing to cross such borders. Reading this piece provided me with some reassurance, knowing that I am not alone in grappling with such dilemmas.

8.5 Recommendations for future research

This thesis highlights the significant value derived from research that captures the lived experiences, implications and lessons learned from collaborative integrated adaptation projects. However, it's crucial to acknowledge that the arguments and recommendations derived for adaptation programming in this thesis are based on a single case study at a specific point in time and rely on the interpretations of one researcher. Consequently, I advocate for further research employing a similar methodology to mine (mixed methods, collaborative, social constructivist using multiple lenses). By exploring the lived experiences, impacts, and implications of integrated adaptation projects across various country contexts and with diverse intervention mixes, it becomes possible to test and expand the arguments proposed in this thesis. This broader investigation can contribute to making more

comprehensive theoretical claims about adaptation programmes more broadly. Moreover, it can facilitate critical conversations among policymakers and practitioners, enhancing the robustness of recommendations made in this thesis.

Furthermore, I propose the advancement of methodological approaches and a deeper exploration of how to effectively integrate both objective and subjective forms of evaluation. As demonstrated in this study, for adaptation projects to transcend mere measurement of outputs, critical conceptual and methodological decisions are necessary regarding what to measure, when and how to employ qualitative methods to capture diverse narratives from various project stakeholders.

The incorporation of in-depth qualitative data into the analysis enriches the investigation by revealing unexpected outcomes and bringing the project's story to life. However, conducting such inquiries, especially when following a project in real-time, as I did, is time-consuming and demands a dedicated commitment to thorough qualitative inquiry. Further research is warranted to determine the optimal point in the adaptation project cycle (ex-ante, mid-intervention, ex-post, etc.) for collecting qualitative data. From my experience, data collected by project implementers pre-intervention often remains unanalysed and does not inform design and implementation decisions. Investigation as to why that is could also form further research recommendation. Exploring these aspects will contribute to enhancing the effectiveness of future adaptation project design, implementation and evaluations.

Finally, I recommend research into grassroots policymaking and how can we leverage local networks as agents of adaptation to build local advocacy groups. Research into grassroots policymaking is essential for understanding how local communities can actively participate in shaping policies that affect them directly. As I showed in this thesis, this is necessary to implement equitable and effective adaptation strategies that will be sustainable and aligned with local priorities. Leveraging local networks as agents of adaptation involves recognising and empowering community members to become advocates for their own needs and concerns. This however may be challenging if the existing capacities are low, including ineffective communication strategies for conveying local concerns and needs to policymakers. More research to investigate how grassroots advocacy can

influence the implementation of adaptation policies at the local level is therefore needed.

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Appendices

Appendix I: Figures for chapter 4

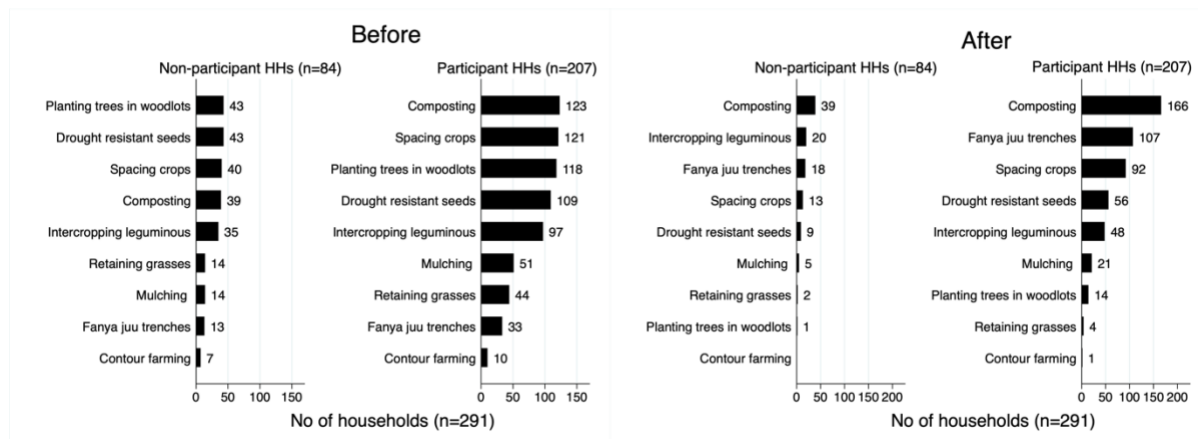


Figure A1 Breakdown of different income sources of participant and non-participant households before and after the intervention.

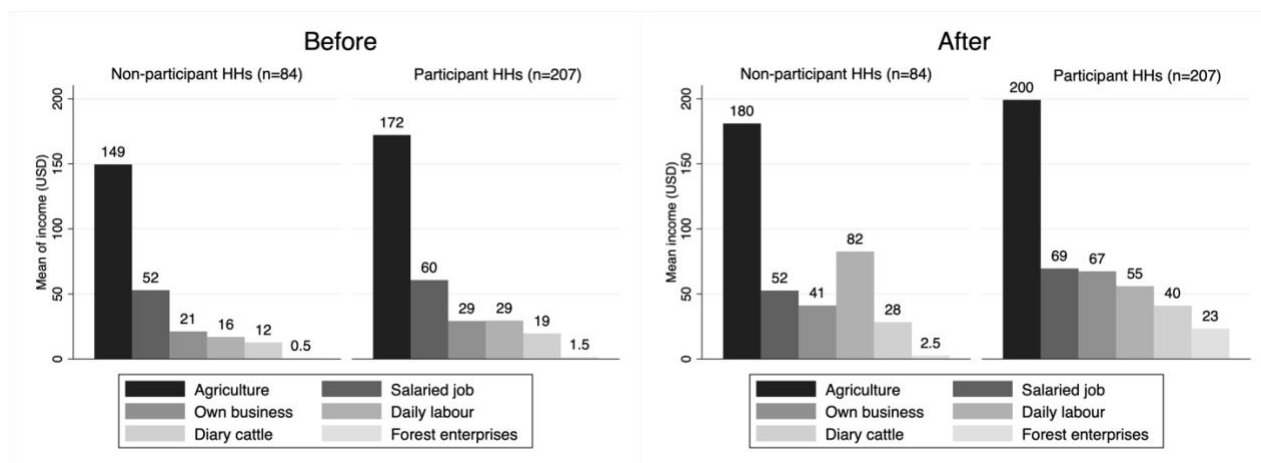


Figure A2 Climate-smart agricultural technologies practiced on private farms by participant and non-participant households before and after the intervention.

Appendix II: Regression models for chapter 4

Vulnerability context - logistic regression models

1. Crop pests and diseases

Iteration 0: log pseudolikelihood = **-332.13065**
Iteration 1: log pseudolikelihood = **-308.99596**
Iteration 2: log pseudolikelihood = **-307.09884**
Iteration 3: log pseudolikelihood = **-307.89582**
Iteration 4: log pseudolikelihood = **-307.89582**

Logistic regression Number of obs = 582
 Wald chi2(17) = 42.52
 Prob > chi2 = 0.0006
Log pseudolikelihood = **-307.89582** Pseudo R2 = 0.0730

Crop_pests	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
1.Time	-1.544753	.4468128	-3.46	0.001	-2.42049	-.6690157
1.Participation	-.1298145	.272262	-0.48	0.634	-.6634382	.4038093
Time#Participation						
1 1	.4947494	.4832104	1.02	0.306	-.4523256	1.441824
HH_size	.0128878	.0599322	0.22	0.830	-.1045771	.1303527
Working_age	.0785651	.1099028	0.64	0.521	-.1448406	.2859707
Gender						
Male	.0184567	.2447036	0.08	0.940	-.4611536	.498067
HH_head						
Male headed HHs	.1075858	.3039902	0.35	0.724	-.4883039	.7033156
Wealth_ranking						
Average	.357883	.2215007	1.62	0.106	-.0762504	.7920163
Better off	.2829209	.357373	0.79	0.429	-.4175174	.9835592
Land	.0298634	.0324677	0.92	0.358	-.0337722	.093499
Education	-.0613216	.0342644	-1.79	0.074	-.1284784	.0058353
Born_village						
Yes	-.2550484	.2223969	-1.15	0.251	-.6909383	.1808416
Has_electricity						
Yes	-.1681617	.2361224	-0.71	0.476	-.6309532	.2946297
Has_mobile						
Yes	.1197548	.2457117	0.49	0.626	-.3618312	.6013409
Has_transport						
Yes	.3796403	.2870135	1.32	0.186	-.1828959	.9421765
Has_good_house						
Yes	-.2413075	.3017086	-0.80	0.424	-.8326454	.3500304
Improved_water_source						
Yes	-.0939474	.2231365	-0.42	0.674	-.5312869	.3433921
_cons	-.3272853	.4850431	-0.67	0.500	-1.277952	.6233816

Measures of Fit for **Logit** of **Crop_pests**

Log-Lik Intercept Only:	-332.131	Log-Lik Full Model:	-307.896
D(550):	615.792	LR(17):	48.470
		Prob > LR:	0.000
McFadden's R2:	0.073	McFadden's Adj R2:	-0.023
Maximum Likelihood R2:	0.080	Cragg & Uhler's R2:	0.117
McKelvey and Zavoina's R2:	0.132	Efron's R2:	0.085
Variance of y*:	3.789	Variance of error:	3.290
Count R2:	0.747	Adj Count R2:	0.020
AIC:	1.168	AIC* _n :	679.792
BIC:	-2885.767	BIC* _c :	59.760

Predictive margins

Model VCE : **Robust**

Number of obs = 582

Expression : **Pr(Crop_pests), predict()**

	Delta-method				
	Margin	Std. Err.	z	P> z	[95% Conf. Interval]
Time#Participation					
0 0	.3843133	.0532953	7.21	0.000	.2798564 .4887702
0 1	.3550046	.0348399	10.19	0.000	.2867197 .4232895
1 0	.1215697	.0380876	3.20	0.001	.0470175 .196122
1 1	.1652512	.0259507	6.37	0.000	.1143888 .2161135

Pairwise comparisons of average marginal effects

Model VCE : **Robust**

Number of obs = 582

Expression : **Pr(Crop_pests), predict()**
dy/dx w.r.t. : **1.Time**

	Contrast Delta-method			Unadjusted
	dy/dx	Std. Err.		[95% Conf. Interval]
0.Time	(base outcome)			
1.Time				
Participation				
1 vs 0	.0729902	.0761361	-.0762338	.2222141

Note: dy/dx for factor levels is the discrete change from the base level.

2. Crop failure from drought

Iteration 0: log pseudolikelihood = **-350.64906**
Iteration 1: log pseudolikelihood = **-291.08853**
Iteration 2: log pseudolikelihood = **-288.01728**
Iteration 3: log pseudolikelihood = **-288.00015**
Iteration 4: log pseudolikelihood = **-288.00014**

Logistic regression Number of obs = 582
 Wald chi2(17) = 97.79
 Prob > chi2 = 0.0000
Log pseudolikelihood = **-288.00014** Pseudo R2 = 0.1787

Crop_failure_drought	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
1.Time	-2.262879	.4294524	-5.27	0.000	-3.10459	-1.421168
1.Participation	.0359064	.4264984	0.08	0.933	-.8008151	.871828
Time#Participation						
1 1	.3333768	.5033214	0.66	0.508	-.6531151	1.319869
HH_size	.025675	.0687871	0.42	0.673	-.0934655	.1448155
Working_age	-.3431058	.105618	-3.25	0.001	-.5501134	-.1360982
Gender						
Male	-.4482219	.2462008	-1.79	0.074	-.9227665	.0423227
HH_head						
Male headed HHs	-.5151616	.3120856	-1.65	0.099	-1.126838	.0965149
Wealth_ranking						
Average	.1153432	.2320687	0.50	0.619	-.3395031	.5701895
Better off	-.0631661	.3706296	-0.17	0.865	-.7895868	.6632547
Land	.033515	.0346295	0.97	0.333	-.0343577	.1013876
Education	-.0563108	.037282	-1.51	0.131	-.1293902	.0167525
Born_village						
Yes	.0400698	.2291858	0.17	0.861	-.4091261	.4892656
Has_electricity						
Yes	.1244818	.2400394	0.52	0.604	-.3459867	.5949503
Has_mobile						
Yes	.7495627	.2538043	2.95	0.003	.2521155	1.24701
Has_transport						
Yes	-.004894	.2959058	-0.02	0.987	-.5848587	.5750708
Has_good_house						
Yes	.0041583	.3106971	0.01	0.989	-.6047968	.6131133
Improved_water_source						
Yes	.0720639	.2186677	0.33	0.742	-.3565169	.5006447
_cons	2.669295	.5644599	4.73	0.000	1.562974	3.775617

Measures of Fit for **Logit** of **Crop_failure_drought**

Log-Lik Intercept Only:	-350.649	Log-Lik Full Model:	-288.000
D(550):	576.000	LR(17):	125.298
		Prob > LR:	0.000
McFadden's R2:	0.179	McFadden's Adj R2:	0.087
Maximum Likelihood R2:	0.194	Cragg & Uhler's R2:	0.277
McKelvey and Zavoina's R2:	0.292	Efron's R2:	0.210
Variance of y*:	4.646	Variance of error:	3.290
Count R2:	0.753	Adj Count R2:	0.148
AIC:	1.100	AIC* _n :	640.000
BIC:	-2925.558	BIC* _c :	-17.068

Predictive margins

Model VCE : **Robust**

Number of obs = 582

Expression : **Pr(Crop_failure_drought), predict()**

	Delta-method				
	Margin	Std. Err.	z	P> z	[95% Conf. Interval]
Time#Participation					
0 0	.8851658	.0348662	25.39	0.000	.8168293 .9535023
0 1	.888656	.0227734	39.02	0.000	.844021 .933291
1 0	.4728341	.0555985	8.50	0.000	.3638631 .5818052
1 1	.5594857	.035678	15.68	0.000	.4895582 .6294133

Pairwise comparisons of average marginal effects

Model VCE : **Robust**

Number of obs = 582

Expression : **Pr(Crop_failure_drought), predict()**
dy/dx w.r.t. : **1.Time**

	Contrast Delta-method			Unadjusted
	dy/dx	Std. Err.		[95% Conf. Interval]
0.Time	(base outcome)			
1.Time				
Participation				
1 vs 0	.0831614	.0764929	-.066762	.2330847

Note: dy/dx for factor levels is the discrete change from the base level.

Pairwise comparisons of average marginal effects

Model VCE : Robust

Number of obs = 582

Expression : Pr(Soil_erosion), predict()
dy/dx w.r.t. : 1.Time

	Contrast Delta-method dy/dx Std. Err.	Unadjusted [95% Conf. Interval]
0.Time	(base outcome)	
1.Time Participation 1 vs 0	.0891409 .0728619	-.0536659 .2319477

Note: dy/dx for factor levels is the discrete change from the base level.

. test 0.Participation = 1.Participation

(1) [Soil_erosion]0b.Participation - [Soil_erosion]1.Participation = 0

chi2(1) = 0.61
Prob > chi2 = 0.4339

Pairwise comparisons of average marginal effects

Model VCE : Robust

Number of obs = 582

Expression : Pr(Livestock_diseases), predict()
dy/dx w.r.t. : 1.Time

	Contrast Delta-method dy/dx Std. Err.	Unadjusted [95% Conf. Interval]
0.Time	(base outcome)	
1.Time Participation 1 vs 0	.0278951 .0528566	-.075702 .1314922

Note: dy/dx for factor levels is the discrete change from the base level.

. test 0.Participation = 1.Participation

(1) [Livestock_diseases]0b.Participation - [Livestock_diseases]1.Participation = 0

chi2(1) = 0.00
Prob > chi2 = 0.9509

5. Getting poor price for produce

Iteration 0: log pseudolikelihood = -402.91667
Iteration 1: log pseudolikelihood = -382.53261
Iteration 2: log pseudolikelihood = -382.48289
Iteration 3: log pseudolikelihood = -382.48289

Logistic regression

Number of obs = 582
Wald chi2(17) = 36.82
Prob > chi2 = 0.0036
Log pseudolikelihood = -382.48289
Pseudo R2 = 0.0507

Getting_Poor_price	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
1.Time 1.Participation	.3839061 -.3629469	.3287156 .273096	0.92 -1.33	0.355 0.184	-.3403645 -.8982052	.9481768 .1723114
Time#Participation 1 1	.1863026	.3805259	0.49	0.624	-.5595144	.9321196
HH_size Working_age	.104027 -.1647784	.0511271 .0933727	2.03 -1.76	0.042 0.078	.0038198 -.3477855	.2042342 .0182286
Gender Male	-.024421	.2110243	-0.12	0.908	-.438021	.389179
HH_head Male headed HHs	-.0147628	.2530358	-0.06	0.953	-.5107039	.4811782
Wealth_ranking Average Better off	.2172027 .0822511	.1896789 .3422329	1.15 0.24	0.252 0.810	-.1545611 -.588513	.5889666 .7530152
Land Education	.1160165 -.0501911	.0391416 .0301809	2.96 -1.66	0.003 0.096	.0393004 -.1093447	.1927327 .0089625
Born_village Yes	-.3233541	.1932188	-1.67	0.094	-.702056	.0553477
Has_electricity Yes	.067204	.2008427	0.33	0.738	-.3264404	.4608484
Has_mobile Yes	.2716524	.2143188	1.27	0.205	-.1484048	.6917095
Has_transport Yes	.1687531	.2589963	0.65	0.515	-.3388702	.6763764
Has_good_house Yes	-.0806725	.268401	-0.30	0.764	-.6067288	.4453837
Improved_water_source Yes _cons	.0954828 -.3052773	.1875183 .4413167	0.51 -0.69	0.611 0.489	-.2720462 -1.170242	.4630118 .5596875

6. Illness and/or family problems

Iteration 0: log pseudolikelihood = -403.06795
Iteration 1: log pseudolikelihood = -386.57828
Iteration 2: log pseudolikelihood = -386.53481
Iteration 3: log pseudolikelihood = -386.5348

Logistic regression

Number of obs = 582
Wald chi2(17) = 31.13
Prob > chi2 = 0.0193
Log pseudolikelihood = -386.5348
Pseudo R2 = 0.0410

Illness	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
1.Time 1.Participation	-.2675868 -.0248653	.3229355 .271127	-0.83 -0.09	0.407 0.927	-.9005287 -.5562644	.365355 .5065338
Time#Participation 1 1	-.2173586	.3762695	-0.58	0.563	-.9548333	.520116
HH_size Working_age	.0845015 -.0597733	.0501926 .0935964	1.68 -0.64	0.092 0.523	-.0138742 -.2432188	.1828773 .1236723
Gender Male	.1584715	.2128191	0.74	0.456	-.2586464	.5755893
HH_head Male headed HHs	.4124827	.2571251	1.60	0.109	-.0914732	.9164386
Wealth_ranking Average Better off	-.2231029 -.4945265	.1891169 .3371175	-1.18 -1.47	0.238 0.142	-.5937652 -1.155265	.1475595 .1662116
Land Education	.0439966 -.0230531	.0298405 .0380422	1.47 -0.77	0.148 0.443	-.0144896 -.0819347	.1824828 .0358284
Born_village Yes	.165351	.1938738	0.85	0.394	-.2146347	.5453368
Has_electricity Yes	-.2358681	.1969752	-1.20	0.231	-.6219325	.1501962
Has_mobile Yes	-.1273076	.2098759	-0.61	0.544	-.5386569	.2840417
Has_transport Yes	.076603	.2610283	0.29	0.769	-.435003	.588209
Has_good_house Yes	-.5400388	.2812737	-1.92	0.055	-1.091325	.0112476
Improved_water_source Yes _cons	-.1939671 .4686761	.187754 .4548538	-1.03 1.03	0.302 0.303	-.5619581 -.422821	.1740238 1.360173

Measures of Fit for logit of Getting_Poor_price

Log-Lik Intercept Only: -402.917
D(550): 764.966
McFadden's R2: 0.051
Maximum Likelihood R2: 0.068
McKelvey and Zavoina's R2: 0.090
Variance of y*: 3.615
Count R2: 0.595
AIC: 1.424
BIC: -2736.593

Log-Lik Full Model: -382.483
LR(17): 40.868
Prob > LR: 0.001
McFadden's Adj R2: -0.029
Cragg & Uhler's R2: 0.090
Efron's R2: 0.067
Variance of error: 3.290
Adj Count R2: 0.154
AIC+n: 828.966
BIC': 67.362

Predictive margins

Model VCE : Robust

Expression : Pr(Getting_Poor_price), predict()

	Delta-method Margin Std. Err.	z	P> z	[95% Conf. Interval]		
Time#Participation 0 0 0 1 1 0 1 1	.4884263 .4039223 .5600495 .5185074	.0550051 .0348104 .0543073 .0364724	8.88 11.88 10.31 14.22	0.000 0.000 0.000 0.000	.3806182 .3372631 .4536091 .4470228	.5962345 .4705815 .6664899 .5999921

Measures of Fit for logit of Illness

Log-Lik Intercept Only: -403.068
D(550): 773.070
McFadden's R2: 0.041
Maximum Likelihood R2: 0.055
McKelvey and Zavoina's R2: 0.070
Variance of y*: 3.537
Count R2: 0.598
AIC: 1.438
BIC: -2728.489

Log-Lik Full Model: -386.535
LR(17): 33.066
Prob > LR: 0.011
McFadden's Adj R2: -0.038
Cragg & Uhler's R2: 0.074
Efron's R2: 0.055
Variance of error: 3.290
Adj Count R2: 0.167
AIC+n: 837.070
BIC': 75.164

Predictive margins

Model VCE : Robust

Expression : Pr(Illness), predict()

	Delta-method Margin Std. Err.	z	P> z	[95% Conf. Interval]		
Time#Participation 0 0 0 1 1 0 1 1	.5374012 .5314389 .4730535 .4155241	.0554907 .0358913 .0538243 .035556	9.68 14.81 8.79 11.69	0.000 0.000 0.000 0.000	.4286415 .4610932 .3675599 .3458357	.646161 .6017846 .5785472 .4852125

Pairwise comparisons of average marginal effects

Model VCE : Robust Number of obs = 582

Expression : Pr(Getting_Poor_price), predict()
dy/dx w.r.t. : 1.Time

	Contrast Delta-method dy/dx Std. Err.	Unadjusted [95% Conf. Interval]
0.Time	(base outcome)	
1.Time Participation 1 vs 0	.0429619 .0890019	-.1314787 .2174025

Note: dy/dx for factor levels is the discrete change from the base level.

. test 0.Participation = 1.Participation

(1) [Getting_Poor_price]0b.Participation - [Getting_Poor_price]1.Participation = 0

chi2(1) = 1.77
Prob > chi2 = 0.1838

7. Land shortage

Iteration 0: log pseudolikelihood = -356.70123
Iteration 1: log pseudolikelihood = -342.27161
Iteration 2: log pseudolikelihood = -342.05151
Iteration 3: log pseudolikelihood = -342.05127
Iteration 4: log pseudolikelihood = -342.05127

Logistic regression Number of obs = 582
Wald chi2(17) = 30.53
Prob > chi2 = 0.0227
Pseudo R2 = 0.0411

Log pseudolikelihood = -342.05127

Land_shortage	Coef.	Robust Std. Err.	z	P> z	[95% Conf. Interval]	
1.Time 1.Participation	.2360296 -.0557411	.3517925 .2961657	0.67 -0.19	0.502 0.851	-.4534709 -.6362152	.9255302 .5247329
Time#Participation 1 1	-.2136747	.408171	-0.52	0.601	-1.013675	.5863257
HH_size Working_age	.0914554 -.0980035	.055086 .1013752	1.66 -0.97	0.097 0.334	-.0165111 -.2966953	.1994219 .1006882
Gender Male	.0191527	.2183897	0.09	0.930	-.4088832	.4471886
HH_head Male headed HHs	.0685462	.2734408	0.25	0.802	-.4673879	.6044802
Wealth_ranking Average	.0155068	.2037214	0.08	0.939	-.3837798	.4147934
Better off	-.3018118	.3771151	-0.80	0.424	-1.040944	.4373203
Land Education	-.0235819 .0476326	.0377589 .033294	-0.62 1.43	0.532 0.153	-.0975879 -.0176225	.0504241 .1128877
Born_village Yes	.188883	.2060897	0.92	0.359	-.2150454	.5928113
Has_electricity Yes	-.3413239	.2089894	-1.63	0.102	-.7509357	.0682879
Has_mobile Yes	.8586708	.2408193	3.57	0.000	.3866736	1.330668
Has_transport Yes	.0224132	.2837392	0.08	0.937	-.5337054	.5785319
Has_good_house Yes	-.4604205	.2861316	-1.61	0.108	-1.021228	.1003872
Improved_water_source Yes	.2363478	.2015792	1.17	0.241	-.1587401	.6314357
_cons	-1.648593	.4903786	-3.36	0.001	-2.609717	-.6874684

Measures of Fit for logit of Land_shortage

Log-Lik Intercept Only: -356.701 Log-Lik Full Model: -342.051
D(550): 684.103 LR(17): 29.300
Prob > LR: 0.032
McFadden's R2: 0.041 McFadden's Adj R2: -0.049
Maximum Likelihood R2: 0.049 Cragg & Uhler's R2: 0.069
McKelvey and Zavoina's R2: 0.076 Efron's R2: 0.045
Variance of y*: 3.559 Variance of error: 3.290
Count R2: 0.698 Adj Count R2: 0.000
AIC: 1.285 AIC+n: 748.103
BIC: -2817.456 BIC': 78.930

Predictive margins

Model VCE : Robust

Expression : Pr(Land_shortage), predict()

Predictive margins

Model VCE : Robust

Expression : Pr(Lack_info), predict()

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Livelihood resilience - linear regression models

1. Buffer capacity - trees ownership

DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS

Number of observations in the DIFF-IN-DIFF: 582

	Before	After	
Control:	84	84	168
Treated:	207	207	414
	291	291	

Report - Covariates and coefficients:

Variable(s)	Coeff.	Std. Err.	t	P> t
HH_size	2.923	1.803	1.621	0.106
Working_age	-7.656	2.885	-2.654	0.008
Gender	14.131	7.793	1.813	0.070
HH_head	-8.617	5.149	-1.674	0.095
Wealth_ran-g	10.411	5.429	1.918	0.056
Land	4.401	1.679	2.621	0.009
Education	-0.555	1.122	-0.495	0.621
Born_village	-1.053	6.580	-0.160	0.873
Has_electr-y	4.124	6.681	0.617	0.537
Has_mobile	3.613	4.854	0.744	0.457
Has_transp-t	2.361	14.349	0.165	0.869
Has_good_h-e	0.868	6.697	0.130	0.897
Improved_w-e	9.323	7.694	1.212	0.226

Outcome var.	Trees	S. Err.	t	P> t
Before				
Control	-11.576			
Treated	-8.378			
Diff (T-C)	3.198	5.964	0.54	0.592
After				
Control	-1.381			
Treated	-4.127			
Diff (T-C)	-2.745	12.035	0.23	0.820
Diff-in-Diff	-5.944	13.374	0.44	0.657

R-square: 0.08

* Means and Standard Errors are estimated by linear regression

**Robust Std. Errors

Inference: * p<0.01; ** p<0.05; * p<0.1

Measures of Fit for regress of __000001

Log-Lik Intercept Only:	-3354.809	Log-Lik Full Model:	-3330.404
D(565):	6660.808	LR(16):	48.810
		Prob > LR:	0.000
R2:	0.080	Adjusted R2:	0.054
AIC:	11.503	AIC*n:	6694.808
BIC:	3063.752	BIC':	53.053

2. Buffer capacity - livestock ownership

DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS

Number of observations in the DIFF-IN-DIFF: 582

	Before	After	
Control:	84	84	168
Treated:	207	207	414
	291	291	

Report - Covariates and coefficients:

Variable(s)	Coeff.	Std. Err.	t	P> t
HH_size	0.064	0.080	0.800	0.424
Working_age	0.332	0.169	1.962	0.050
Gender	-0.629	0.308	-2.044	0.041
HH_head	-0.699	0.318	-2.196	0.028
Wealth_ran-g	0.511	0.214	2.391	0.017
Land	0.083	0.060	1.382	0.167
Education	-0.088	0.029	-3.058	0.002
Born_village	0.135	0.249	0.540	0.589
Has_electr-y	-0.141	0.262	-0.536	0.592
Has_mobile	0.046	0.208	0.223	0.824
Has_transp-t	0.896	0.464	1.929	0.054
Has_good_h-e	-0.843	0.425	-1.985	0.048
Improved_w-e	-0.159	0.215	-0.742	0.458

Outcome var.	Lives~k	S. Err.	t	P> t
Before				
Control	0.449			
Treated	0.681			
Diff (T-C)	0.232	0.260	0.89	0.373
After				
Control	0.564			
Treated	0.888			
Diff (T-C)	0.324	0.349	0.93	0.354
Diff-in-Diff	0.092	0.447	0.21	0.836

R-square: 0.13

* Means and Standard Errors are estimated by linear regression

**Robust Std. Errors

Inference: * p<0.01; ** p<0.05; * p<0.1

Measures of Fit for regress of __000001

Log-Lik Intercept Only:	-1433.574	Log-Lik Full Model:	-1393.59
D(565):	2787.192	LR(16):	79.95
		Prob > LR:	0.00
R2:	0.128	Adjusted R2:	0.10
AIC:	4.847	AIC*n:	2821.19
BIC:	-809.864	BIC':	21.90

3. Buffer capacity - crop diversification

DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS

Number of observations in the DIFF-IN-DIFF: 582

	Before	After	
Control:	84	84	168
Treated:	207	207	414
	291	291	

Report - Covariates and coefficients:

Variable(s)	Coeff.	Std. Err.	t	P> t
HH_size	0.015	0.072	0.206	0.837
Working_age	0.187	0.129	1.452	0.147
Gender	-0.215	0.285	-0.755	0.451
HH_head	-0.592	0.340	-1.744	0.082
Wealth_ran-g	0.671	0.201	3.338	0.001
Land	0.213	0.044	4.798	0.000
Education	-0.018	0.037	-0.492	0.623
Born_village	-0.434	0.266	-1.631	0.103
Has_electr-y	-0.341	0.264	-1.293	0.197
Has_mobile	0.629	0.271	2.323	0.021
Has_transp-t	-0.238	0.358	-0.664	0.507
Has_good_h-e	0.561	0.380	1.476	0.141
Improved_w-e	-0.026	0.253	-0.101	0.920

Outcome var.	Crop~r	S. Err.	t	P> t
Before				
Control	3.450			
Treated	3.185			
Diff (T-C)	-0.265	0.357	-0.74	0.457
After				
Control	2.440			
Treated	3.834			
Diff (T-C)	1.395	0.362	3.86	0.000***
Diff-in-Diff	1.660	0.497	3.34	0.001***

R-square: 0.17

* Means and Standard Errors are estimated by linear regression

**Robust Std. Errors

Inference: * p<0.01; ** p<0.05; * p<0.1

Measures of Fit for regress of __000001

Log-Lik Intercept Only:	-1464.317	Log-Lik Full Model:	-1411.600
D(565):	2823.200	LR(16):	105.434
		Prob > LR:	0.000
R2:	0.166	Adjusted R2:	0.142
AIC:	4.909	AIC*n:	2857.200
BIC:	-773.856	BIC':	-3.570

4. Buffer capacity - total income

DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS

Number of observations in the DIFF-IN-DIFF: 582

	Before	After	
Control:	84	84	168
Treated:	207	207	414
	291	291	

Report - Covariates and coefficients:

Variable(s)	Coeff.	Std. Err.	t	P> t
HH_size	4.645	12.198	0.381	0.704
Working_age	-28.353	22.262	-1.274	0.203
Gender	21.922	52.057	0.421	0.674
HH_head	-22.281	50.617	-0.440	0.660
Wealth_ran-g	181.349	46.322	3.915	0.000
Land	24.979	11.524	2.168	0.031
Education	28.455	10.983	2.591	0.010
Born_village	-76.657	51.080	-1.501	0.134
Has_electr-y	155.181	55.138	2.814	0.005
Has_mobile	102.016	40.750	2.503	0.013
Has_transp-t	157.086	94.470	1.663	0.097
Has_good_h-e	125.605	38.585	3.255	0.001
Improved_w-e	-3.223	47.519	-0.068	0.946

Outcome var.	Incsu-D	S. Err.	t	P> t
Before				
Control	-357.287			
Treated	-408.178			
Diff (T-C)	-50.891	57.222	-0.89	0.374
After				
Control	-241.951			
Treated	-298.298			
Diff (T-C)	-56.347	72.821	0.77	0.439
Diff-in-Diff	-5.456	91.113	0.06	0.952

R-square: 0.21

* Means and Standard Errors are estimated by linear regression

**Robust Std. Errors

Inference: * p<0.01; ** p<0.05; * p<0.1

Measures of Fit for regress of __000001

Log-Lik Intercept Only:	-4536.174	Log-Lik Full Model:	-4469.403
D(565):	8938.806	LR(16):	133.541
		Prob > LR:	0.000
R2:	0.205	Adjusted R2:	0.183
AIC:	15.417	AIC*n:	8972.806
BIC:	5341.750	BIC':	-31.678

5. Buffer capacity - agricultural services

DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS

Number of observations in the DIFF-IN-DIFF: 582

	Before	After	
Control:	84	84	168
Treated:	207	207	414
	291	291	

Report - Covariates and coefficients:

Variable(s)	Coeff.	Std. Err.	t	P> t
HH_size	-0.045	0.022	-2.065	0.039
Working_age	0.093	0.040	2.325	0.020
Gender	-0.043	0.093	-0.468	0.640
HH_head	-0.181	0.110	-1.636	0.102
Wealth_ran-g	0.046	0.066	0.693	0.488
Land	-0.001	0.014	-0.063	0.950
Education	0.011	0.012	0.877	0.381
Born_village	-0.029	0.084	-0.352	0.725
Has_electr-y	0.003	0.082	0.031	0.975
Has_mobile	-0.037	0.093	-0.397	0.691
Has_transp-t	0.046	0.124	0.374	0.709
Has_good_h-e	-0.111	0.135	-0.824	0.410
Improved_w-e	0.054	0.079	0.686	0.493

Outcome var.	Agri~s	S. Err.	t	P> t
Before				
Control	0.885			
Treated	0.930			
Diff (T-C)	0.045	0.130	0.35	0.726
After				
Control	0.408			
Treated	1.035			
Diff (T-C)	0.627	0.098	6.40	0.000***
Diff-in-Diff	0.581	0.160	3.63	0.000***

R-square: 0.07

* Means and Standard Errors are estimated by linear regression

**Robust Std. Errors

Inference: * p<0.01; ** p<0.05; * p<0.1

Measures of Fit for regress of __000001

Log-Lik Intercept Only:	-785.938	Log-Lik Full Model:	-764.487
D(565):	1528.974	LR(16):	42.902
		Prob > LR:	0.000
R2:	0.071	Adjusted R2:	0.045
AIC:	2.686	AIC*n:	1562.974
BIC:	-2068.082	BIC':	58.961

6. Buffer capacity - market services

DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS

Number of observations in the DIFF-IN-DIFF: 582

	Before	After	
Control:	84	84	168
Treated:	207	207	414
	291	291	

Report - Covariates and coefficients:

Variable(s)	Coeff.	Std. Err.	t	P> t
HH_size	0.011	0.014	0.791	0.429
Working_age	0.015	0.027	0.535	0.593
Gender	-0.118	0.058	-2.034	0.042
HH_head	-0.051	0.071	-0.719	0.472
Wealth_ran-g	0.057	0.040	1.422	0.156
Land	-0.008	0.008	-0.921	0.358
Education	0.020	0.009	2.391	0.017
Born_village	0.046	0.053	0.871	0.384
Has_electr-y	-0.090	0.055	-1.647	0.100
Has_mobile	-0.021	0.059	-0.364	0.716
Has_transp-t	0.196	0.080	2.445	0.015
Has_good_h-e	-0.053	0.083	-0.634	0.527
Improved_w-e	0.092	0.054	1.709	0.088

Outcome var.	Marke~s	S. Err.	t	P> t
Before				
Control	0.142			
Treated	0.268			
Diff (T-C)	0.126	0.072	1.75	0.080*
After				
Control	0.537			
Treated	0.500			
Diff (T-C)	-0.037	0.075	0.49	0.627
Diff-in-Diff	-0.162	0.103	1.58	0.114

R-square: 0.12

* Means and Standard Errors are estimated by linear regression

**Robust Std. Errors

Inference: * p<0.01; ** p<0.05; * p<0.1

Measures of Fit for regress of __000001

Log-Lik Intercept Only:	-547.372	Log-Lik Full Model:	-547.372
D(565):	1022.461	LR(16):	42.902
		Prob > LR:	0.000
R2:	0.117	Adjusted R2:	0.088
AIC:	1.815	AIC*n:	1562.974
BIC:	-2574.595	BIC':	58.961

7. Buffer capacity - financial services

DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS

Number of observations in the DIFF-IN-DIFF: 582

	Before	After	
Control:	84	84	168
Treated:	207	207	414
	291	291	

Report - Covariates and coefficients:

Variable(s)	Coeff.	Std. Err.	t	P> t
HH_size	-0.010	0.018	-0.550	0.582
Working_age	0.039	0.033	1.170	0.243
Gender	-0.066	0.071	-0.932	0.352
HH_head	0.058	0.094	0.617	0.537
Wealth_ran-g	0.116	0.049	2.357	0.019
Land	0.012	0.012	1.011	0.312
Education	0.020	0.010	2.046	0.041
Born_village	-0.108	0.066	-1.644	0.101
Has_electr-y	0.114	0.071	1.611	0.108
Has_mobile	0.169	0.072	2.359	0.019
Has_transp-t	0.244	0.089	2.743	0.006
Has_good_h-e	-0.040	0.087	-0.457	0.648
Improved_w-e	0.032	0.065	0.499	0.618

Outcome var.	Finan~s	S. Err.	t	P> t
Before				
Control	0.437			
Treated	0.379			
Diff (T-C)	-0.059	0.090	-0.65	0.516
After				
Control	0.072			
Treated	0.621			
Diff (T-C)	0.549	0.087	6.30	0.000***
Diff-in-Diff	0.607	0.123	4.93	0.000***

R-square: 0.17

* Means and Standard Errors are estimated by linear regression

**Robust Std. Errors

Inference: * p<0.01; ** p<0.05; * p<0.1

Measures of Fit for regress of __000001

Log-Lik Intercept Only:	-671.625	Log-Lik Full Model:	-618.887
D(565):	1237.774	LR(16):	105.476
		Prob > LR:	0.000
R2:	0.166	Adjusted R2:	0.142
AIC:	2.185	AIC*n:	1271.774
BIC:	-2359.282	BIC':	-3.612

8. Self-organisation - networks

DIFFERENCE-IN-DIFFERENCES WITH COVARIATES

DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS

Number of observations in the DIFF-IN-DIFF: 582

	Before	After	
Control:	84	84	168
Treated:	207	207	414
	291	291	

Report - Covariates and coefficients:

Variable(s)	Coeff.	Std. Err.	t	P> t
HH_size	-0.026	0.042	-0.619	0.536
Working_age	0.254	0.095	2.676	0.008
Gender	0.112	0.165	0.677	0.499
HH_head	-0.084	0.162	-0.519	0.604
Wealth_ran-g	0.018	0.119	0.153	0.879
Land	-0.005	0.025	-0.192	0.848
Education	0.035	0.021	1.642	0.101
Born_village	0.086	0.146	0.589	0.556
Has_electr-y	0.042	0.170	0.245	0.806
Has_mobile	0.280	0.126	2.218	0.027
Has_transp-t	0.586	0.263	2.227	0.026
Has_good_h-e	-0.114	0.174	-0.658	0.511
Improved_w-e	0.453	0.151	2.995	0.003

Outcome var.	Netwo~s	S. Err.	t	P> t
Before				
Control	-0.453			
Treated	-0.390			
Diff (T-C)	0.063	0.114	0.55	0.581
After				
Control	-0.701			
Treated	1.516			
Diff (T-C)	2.218	0.189	11.76	0.000***
Diff-in-Diff	2.155	0.220	9.80	0.000***

R-square: 0.37

* Means and Standard Errors are estimated by linear regression

**Robust Std. Errors

Inference: * p<0.01; ** p<0.05; * p<0.1

Measures of Fit for regress of __000001

Log-Lik Intercept Only:	-1237.425	Log-Lik Full Model:	-1104.850
D(565):	2209.701	LR(16):	265.150
		Prob > LR:	0.000
R2:	0.366	Adjusted R2:	0.348
AIC:	3.855	AIC*n:	2243.701
BIC:	-1387.355	BIC':	-163.287

9. Self-organisation – cooperation

DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS

Number of observations in the DIFF-IN-DIFF: 582

	Before	After	
Control:	84	84	168
Treated:	207	207	414
	291	291	

Report – Covariates and coefficients:

Variable(s)	Coeff.	Std. Err.	t	P> t
HH_size	-0.034	0.014	-2.358	0.019
Working_age	0.053	0.049	1.083	0.279
Gender	0.071	0.060	1.186	0.236
HH_head	-0.005	0.068	-0.081	0.935
Wealth_ran-g	0.049	0.052	0.943	0.346
Land	-0.000	0.008	-0.023	0.981
Education	0.001	0.009	0.094	0.925
Born_village	-0.007	0.055	-0.123	0.902
Has_electr-y	-0.094	0.064	-1.480	0.139
Has_mobile	0.029	0.053	0.541	0.589
Has_transp-t	-0.055	0.084	-0.654	0.513
Has_good_h-e	0.006	0.071	0.086	0.931
Improved_w-e	0.211	0.060	3.535	0.000

Outcome var.	Coeff~n	S. Err.	t	P> t
Before				
Control	0.179			
Treated	0.232			
Diff (T-C)	0.054	0.068	0.79	0.428
After				
Control	0.055			
Treated	0.046			
Diff (T-C)	-0.009	0.071	0.13	0.900
Diff-in-Diff	-0.063	0.098	0.64	0.522

R-square: 0.05

* Means and Standard Errors are estimated by linear regression

**Robust Std. Errors

Inference: * p<0.01; ** p<0.05; * p<0.1

Measures of Fit for regress of __000001

Log-Lik Intercept Only:	-570.204	Log-Lik Full Model:	-555.280
D(565):	1110.560	LR(16):	29.848
		Prob > LR:	0.019
R2:	0.050	Adjusted R2:	0.023
AIC:	1.967	AIC*n:	1144.560
BIC:	-2486.496	BIC':	72.015

11. Capacity for learning – information sources

DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS

Number of observations in the DIFF-IN-DIFF: 582

	Before	After	
Control:	84	84	168
Treated:	207	207	414
	291	291	

Report – Covariates and coefficients:

Variable(s)	Coeff.	Std. Err.	t	P> t
HH_size	-0.115	0.063	-1.832	0.068
Working_age	0.073	0.105	0.689	0.491
Gender	0.247	0.255	0.968	0.333
HH_head	-0.292	0.302	-0.965	0.335
Wealth_ran-g	-0.305	0.182	-1.682	0.093
Land	0.003	0.043	0.069	0.945
Education	-0.015	0.037	-0.398	0.691
Born_village	-0.302	0.235	-1.288	0.198
Has_electr-y	0.185	0.250	0.739	0.460
Has_mobile	0.333	0.246	1.354	0.176
Has_transp-t	0.022	0.337	0.065	0.948
Has_good_h-e	0.644	0.277	2.326	0.020
Improved_w-e	-0.163	0.233	-0.699	0.485

Outcome var.	Info~s	S. Err.	t	P> t
Before				
Control	2.141			
Treated	2.725			
Diff (T-C)	0.584	0.188	3.10	0.002***
After				
Control	2.273			
Treated	5.550			
Diff (T-C)	3.278	0.351	9.34	0.000***
Diff-in-Diff	2.694	0.386	6.97	0.000***

R-square: 0.29

* Means and Standard Errors are estimated by linear regression

**Robust Std. Errors

Inference: * p<0.01; ** p<0.05; * p<0.1

10. Self-organisation – self-reliance

DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS

Number of observations in the DIFF-IN-DIFF: 582

	Before	After	
Control:	84	84	168
Treated:	207	207	414
	291	291	

Report – Covariates and coefficients:

Variable(s)	Coeff.	Std. Err.	t	P> t
HH_size	-0.008	0.021	-0.410	0.682
Working_age	0.077	0.034	2.252	0.025
Gender	-0.024	0.073	-0.322	0.747
HH_head	0.188	0.107	1.756	0.080
Wealth_ran-g	0.047	0.052	0.899	0.369
Land	0.003	0.011	0.276	0.783
Education	-0.006	0.012	-0.525	0.600
Born_village	0.100	0.070	1.428	0.154
Has_electr-y	-0.021	0.074	-0.287	0.774
Has_mobile	0.045	0.076	0.589	0.556
Has_transp-t	0.053	0.112	0.474	0.635
Has_good_h-e	-0.208	0.106	-1.951	0.052
Improved_w-e	-0.011	0.063	-0.169	0.866

Outcome var.	Self~e	S. Err.	t	P> t
Before				
Control	0.675			
Treated	0.727			
Diff (T-C)	0.052	0.121	0.43	0.666
After				
Control	1.251			
Treated	1.221			
Diff (T-C)	-0.030	0.083	0.36	0.721
Diff-in-Diff	-0.082	0.144	0.57	0.570

R-square: 0.14

* Means and Standard Errors are estimated by linear regression

**Robust Std. Errors

Inference: * p<0.01; ** p<0.05; * p<0.1

Measures of Fit for regress of __000001

Log-Lik Intercept Only:	-706.188	Log-Lik Full Model:	
D(565):	1321.825	LR(16):	
		Prob > LR:	
R2:	0.144	Adjusted R2:	
AIC:	2.330	AIC*n:	
BIC:	-2275.231	BIC':	

12. Capacity for learning – commitment to learning

DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS

Number of observations in the DIFF-IN-DIFF: 582

	Before	After	
Control:	84	84	168
Treated:	207	207	414
	291	291	

Report – Covariates and coefficients:

Variable(s)	Coeff.	Std. Err.	t	P> t
HH_size	-0.187	0.061	-3.061	0.002
Working_age	0.158	0.121	1.305	0.192
Gender	0.137	0.255	0.537	0.592
HH_head	-0.266	0.264	-1.010	0.313
Wealth_ran-g	0.122	0.179	0.683	0.495
Land	0.056	0.042	1.341	0.181
Education	-0.013	0.034	-0.390	0.697
Born_village	-0.118	0.230	-0.511	0.610
Has_electr-y	-0.214	0.262	-0.819	0.413
Has_mobile	0.177	0.221	0.802	0.423
Has_transp-t	0.503	0.370	1.360	0.174
Has_good_h-e	0.462	0.243	1.902	0.058
Improved_w-e	0.571	0.216	2.640	0.009

Outcome var.	Commi..	S. Err.	t	P> t
Before				
Control	-0.232			
Treated	-0.304			
Diff (T-C)	-0.073	0.097	-0.75	0.453
After				
Control	-0.357			
Treated	3.037			
Diff (T-C)	3.394	0.287	11.81	0.000***
Diff-in-Diff	3.467	0.300	11.55	0.000***

R-square: 0.36

* Means and Standard Errors are estimated by linear regression

**Robust Std. Errors

Inference: * p<0.01; ** p<0.05; * p<0.1

Measures of Fit for regress of __000001				Measures of Fit for regress of __000001			
Log-Lik Intercept Only: -1446.332		Log-Lik Full Model: -1345.824		Log-Lik Intercept Only: -1461.023		Log-Lik Full Model: -1330.936	
D(565): 2691.647		LR(16): 201.017		D(565): 2661.872		LR(16): 260.173	
		Prob > LR: 0.000				Prob > LR: 0.000	
R2: 0.292		Adjusted R2: 0.272		R2: 0.360		Adjusted R2: 0.342	
AIC: 4.683		AIC*n: 2725.647		AIC: 4.632		AIC*n: 2695.872	
BIC: -905.408		BIC': -99.153		BIC: -935.184		BIC': -158.310	

13. Capacity for learning – experimentation

DIFFERENCE-IN-DIFFERENCES ESTIMATION RESULTS

Number of observations in the DIFF-IN-DIFF: 582

	Before	After	
Control:	84	84	168
Treated:	207	207	414
	291	291	

Report – Covariates and coefficients:

Variable(s)	Coeff.	Std. Err.	t	P> t
HH_size	0.096	0.049	1.955	0.051
Working_age	-0.044	0.088	-0.504	0.614
Gender	0.292	0.195	1.492	0.136
HH_head	0.067	0.228	0.295	0.768
Wealth_ran~g	0.139	0.137	1.012	0.312
Land	0.096	0.034	2.812	0.005
Education	0.026	0.027	0.966	0.334
Born_village	-0.296	0.174	-1.706	0.088
Has_electr~y	-0.370	0.182	-2.038	0.042
Has_mobile	0.463	0.187	2.471	0.014
Has_transp~t	0.422	0.225	1.877	0.061
Has_good_h~e	0.181	0.246	0.737	0.462
Improved_w~e	0.156	0.182	0.855	0.393

Outcome var.	Exper~t	S. Err.	t	P> t
Before				
Control	1.680			
Treated	1.870			
Diff (T-C)	0.190	0.297	0.64	0.523
After				
Control	0.116			
Treated	1.093			
Diff (T-C)	0.977	0.211	4.63	0.000***
Diff-in-Diff	0.787	0.357	2.21	0.028**

R-square: 0.16

* Means and Standard Errors are estimated by linear regression

**Robust Std. Errors

Inference: * p<0.01; ** p<0.05; * p<0.1

Measures of Fit for regress of __000001			
Log-Lik Intercept Only: -1253.227		Log-Lik Full Model: -1201.345	
D(565): 2402.690		LR(16): 103.763	
		Prob > LR: 0.000	
R2: 0.163		Adjusted R2: 0.140	
AIC: 4.187		AIC*n: 2436.690	
BIC: -1194.366		BIC': -1.900	

Appendix III: Ethical Approval

The Secretariat
University of Leeds
Leeds, LS2 9JT
Tel: 0113 343 4873
Email: ResearchEthics@leeds.ac.uk



UNIVERSITY OF LEEDS

Marta Gaworek-Michalczenia
School of Earth and Environment
University of Leeds
Leeds, LS2 9JT

ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee University of Leeds.

Dear Marta

Title of study: The dynamics of local adaptation processes and the role of external interventions in mediating vulnerability and livelihood resilience in mountainous agricultural communities of Tanzania.

Ethics reference: AREA 17-049

I am pleased to inform you that the above research application has been reviewed by the ESSL, Environment and LUBS (AREA) Faculty Research Ethics Committee and I can confirm a favourable ethical opinion as of the date of this letter. The following documentation was considered:

Document	Version	Date
AREA 17-049 Leeds_Ethical_Review_Form_Marta_Gaworek-Michalczenia.doc	1	09/11/17
AREA 17-049 Appendix 1_Project_Information_Sheet_and_Consent Form_Marta Gaworek-Michalczenia.pdf	1	09/11/17
AREA 17-049 Appendix 2_Research_Summary_Stakeholder_Meeting_Marta Gaworek-Michalczenia.pdf	1	09/11/17
AREA 17-049 Appendix 3_Agreement Letter_Leeds_TFCG.pdf	1	09/11/17
AREA 17-049 Appendix 4_Agreement_Letter Leeds_ONGAWA.pdf	1	09/11/17
AREA 17-049 Appendix 5_Risk Assesment_Marta Gaworek-Michalczenia.pdf	1	09/11/17
AREA 17-049 Appendix 6_Approval of Risk Assessment.pdf	1	09/11/17

Committee members made the following comments about your application:

General comments		
A well thought-through and comprehensive application – thanks!		
Application section	Comment	Response required/ amended

		application required/ for consideration
A10	In terms of advice on getting consent for participant observation work – the reviewers suggest that you need to be up front about your status as a researcher when anyone asks, or when you have an opportunity to communicate that, and that you need to treat this data with care when it comes to anonymity, but you should not ask for permission from village chief (this is in any case not in his/ her power).	For consideration

Please notify the committee if you intend to make any amendments to the information in your ethics application as submitted at date of this approval as all changes must receive ethical approval prior to implementation. The amendment form is available at <http://ris.leeds.ac.uk/EthicsAmendment>.

Please note: You are expected to keep a record of all your approved documentation and other documents relating to the study, including any risk assessments. This should be kept in your study file, which should be readily available for audit purposes. You will be given a two week notice period if your project is to be audited. There is a checklist listing examples of documents to be kept which is available at <http://ris.leeds.ac.uk/EthicsAudits>.

We welcome feedback on your experience of the ethical review process and suggestions for improvement. Please email any comments to ResearchEthics@leeds.ac.uk.

Yours sincerely

Jennifer Blaikie

Senior Research Ethics Administrator, the Secretariat

On behalf of Dr Kahryn Hughes, Chair, [AREA Faculty Research Ethics Committee](#)

Appendix IV: Research Project Information Sheet and Consent Form

Research Project Information Sheet

Name of the research project: The Role of Integrated Climate-Development projects in Mediating Vulnerability and Livelihood Resilience in rural communities of Tanzania.

Lead researcher: Marta Gaworek-Michalczenia, The University of Leeds, United Kingdom.

Contact: E-mail: eemfgm@leeds.ac.uk, WhatsApp: +44 (0)758 796 2570,
Phone (Tanzania): +255 (0) 752 487 984

Introduction

You are being invited to take part in a research project about adaptation to climatic changes. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What is the purpose of this research?

I am a Doctorate student at the University of Leeds in the United Kingdom. The purpose of my research is to explore the factors and conditions that enable or constrain local adaptations in the East Usambara Mountains and the impacts experienced by local communities during their engagement with the adaptation project that is being implemented under the GCCA programme. The collection of primary data for this research will take place between January and December 2018. This research is expected to be completed by January 2021, however preliminary findings from the results will be available before that date.

Why is this research needed?

Fulfilling this research will provide empirical case study on how different kinds of adaptation interventions can best support the reduction of vulnerability and building of long-term livelihood resilience of communities in Tanzania. This in turn will enable to design effective programmes in the future that are locally inclusive and sustainable in the longer term.

Who will be involved in the research and where will the research take place?

This research will be undertaken predominantly in the village of Kazita and Zirai in the East Usambara Mountains. Local government (at village, district and ward level) and NGO staff will also be invited to participate in this research.

How will the research be carried out?

This research will be carried out by observing and taking notes about the life in the village, by interviews and focus group discussions with families and key informants in the villages and by interviews with local authorities and NGOs.

What will happen with the information that you will provide?

The information collected during interviews will be securely kept and not discussed with others. Names of participants will be replaced with pseudonyms so that they can not be identified in the research outputs. The anonymised data will then be shared with the project partners to provide feedback during the programme implementation. The data will be analysed and the results published in academic journals. After the research is finished the data will be securely stored in a special archive for use in future research.

Participant Consent Form

Name of the research project: The Role of Integrated Climate-Development projects in Mediating Vulnerability and Livelihood Resilience in rural communities of Tanzania. Lead researcher: Marta Gaworek-Michalczenia, University of Leeds, United Kingdom.	Add your initials next to the statement if you agree (e.g. MM)
I confirm that I have read and understood the research project information sheet, dated November 2017. I have had the opportunity to ask questions about the project and that I have received contact numbers to the research team.	
I understand that my participation in this research is voluntary and that I am free to withdraw (up to the date of the submission of the outputs for publication) without giving any reason and without there being any negative consequences. Should I not wish to answer any particular question or questions, I am free to decline. I understand that after my successful withdrawal from the study the data that I have provided will be destroyed.	
I understand that my responses will be kept confidential. I give permission for members of the research team and the research collaborators to have access to my anonymized responses, and to directly quote me. I understand that my name will not be linked with the research materials, and I will not be identified or identifiable in the report or reports that result from the research.	

I agree for the data collected from me to be used in future research. I understand that the data will be safely stored and archived in a specially designated repository.	
I agree to take part in the above research project and will inform the lead researcher should my contact details change during the project and, if necessary, afterwards.	

Name of participant	
Participant's signature	
Date	
Name of lead researcher	
Researcher signature	
Date	