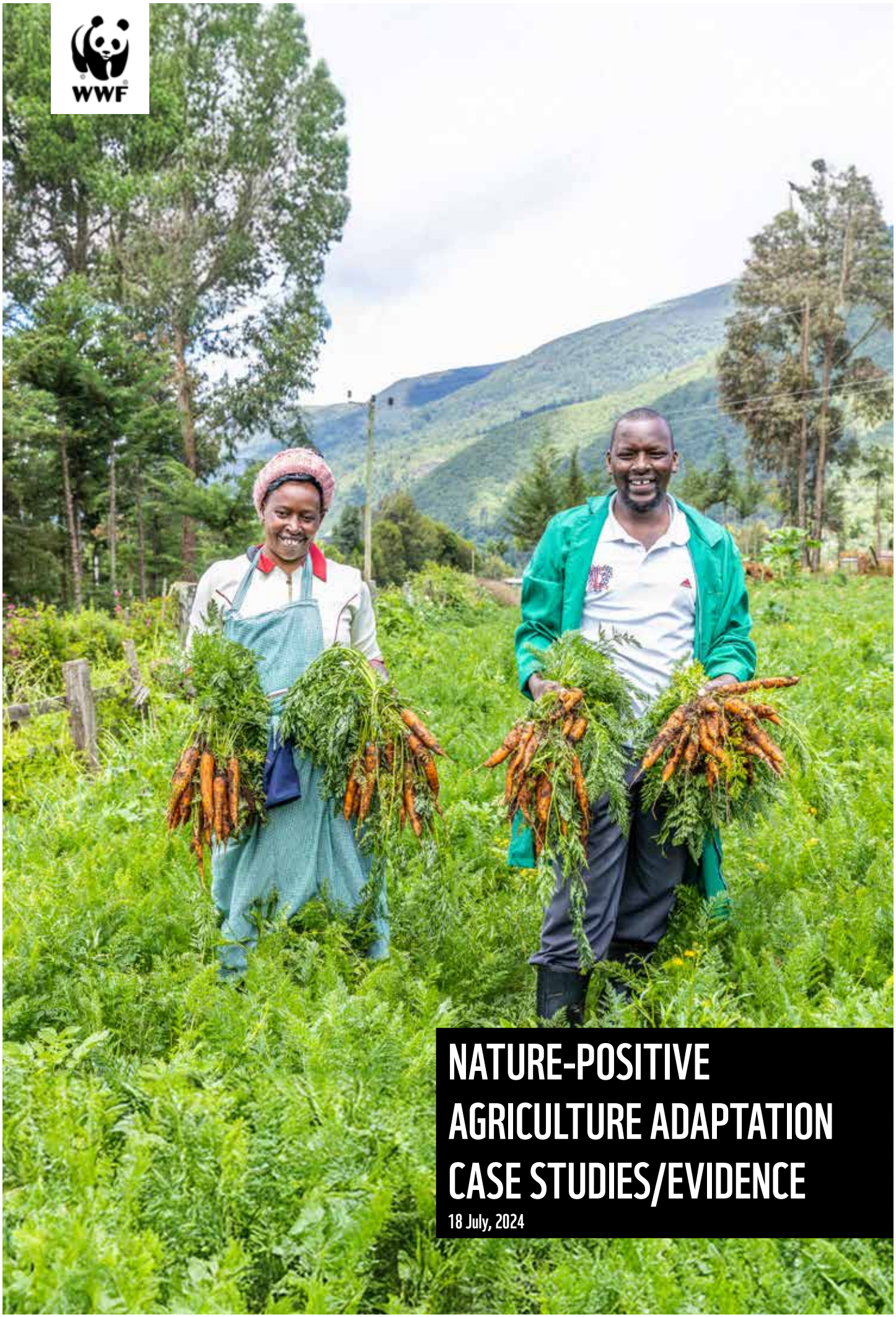
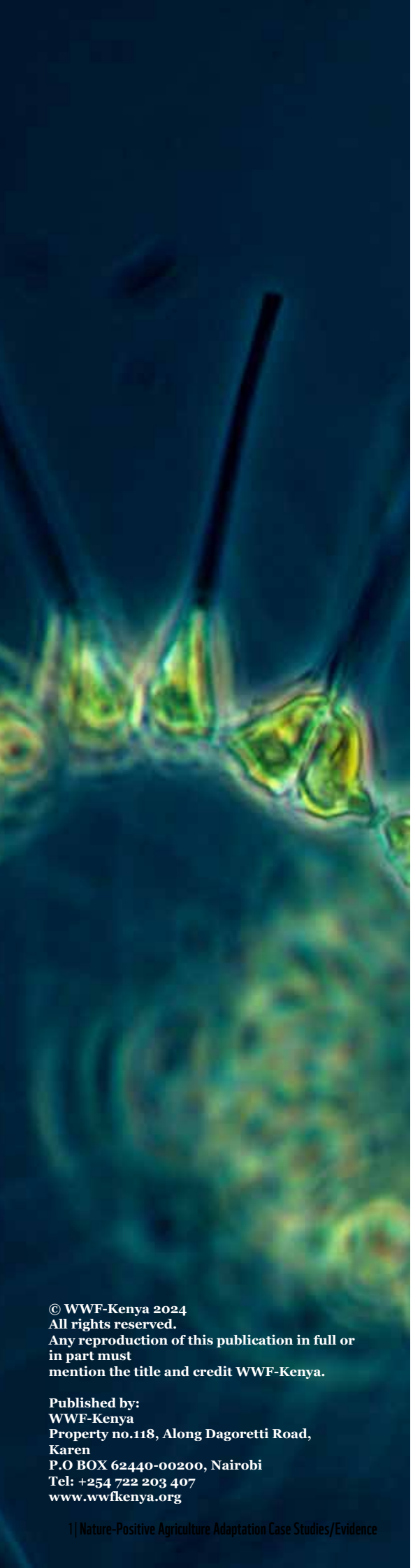


NATURE-POSITIVE AGRICULTURE ADAPTATION CASE STUDIES/EVIDENCE

18 July, 2024



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The above notwithstanding, Brightpath Consulting takes responsibility for the contents of this report.

Acronymns

BMU	Beach Management Unit
CASSCOM	County Agriculture Sector Steering Committee
CFA	Community Forest Association
FGDs	Focus Group Discussions
FMNR	Farmer Managed Natural Regeneration
GHG	Greenhouse Gas
KALRO	Kenya Agricultural and Livestock Research Organization
KEMFRI	Kenya Marine and Fisheries Research Institute
KFS	Kenya Forest Service
KIIs	Key Informant Interviews
NAPs	National Adaptation Plans
NAPO	Nature and People as One
NDCs	Nationally Determined Contributions
NPP	Nature-Positive Production
NRM	Natural Resource Management
NRT	Northern Rangelands Trust
PELIS	Plantation Establishment and Livelihood Improvement Scheme
PFM	Participatory Forest Management
PFMP	Participatory Forest Management Plan
SDGs	Sustainable Development Goals
WRUA	Water Resource Users Association
WWF	World Wide Fund for Nature

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Contents

Acknowledgements 1

Acronymns 1

Section 1: Introduction 1

1.1 Background and context 3
1.2 Objectives and scope 5
1.3 Sampling and case study selection 6
1.4 Assessment Methodology 6

Section 2: Framework for NPP documentation 7

2.1 Defining NPP 7
2.2 Problem description 8
2.3 Interventions to address the problem 9
2.4 Nature-Positive Production Outputs 10
2.5 Impacts 12
2.6 Lessons 13
2.7 Reflections on application of the framework 13

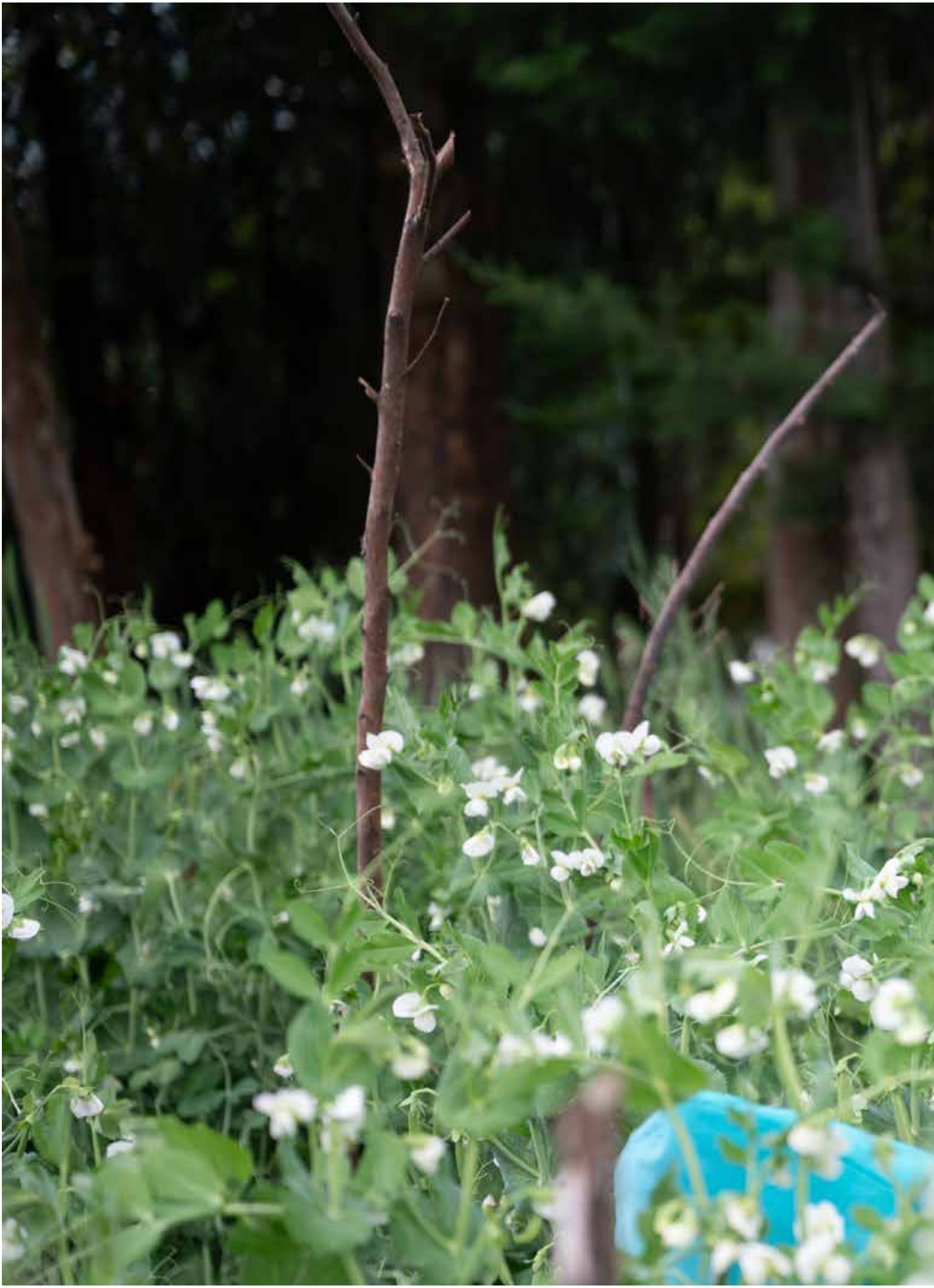
Section 3: Case study documentation 15

Case Study 1: Integrating inclusive agricultural value chain development and landscape restoration in Naivasha – Western Aberdare sub-landscape in Kenya 15
Case Study 2: Supporting processes for shaping on-farm and catchment- conservation and restoration across different scales in Eastern Mau-Nakuru 22
Case Study 3: Nature-Positive practices for on-farm and catchment conservation across different scales in Amboseli, Southern Kenya Landscape, Kajiado 28
Case Study 4: Role of WRUAs and lead farmers in catchment protection and livelihood diversification in Bomet, Kenya 38
Case Study 5: Working with communities, to implement co-management approaches for healthy marine and terrestrial ecosystems in Kenya's coastal landscape 43
Case Study 6: Protecting mangroves for enhanced livelihoods for fisherfolks in coastal Kenya (the Vanga blue carbon project) 48
Case Study 7: Supporting Forest and Landscape Restoration for improved livelihoods and climate resilience in Gonja, Kwale County 53
Case Study 8: Community conservancies in ecosystem protection in Northern Kenya 59
Case Study 9: Community-led Restoration of Dryland Forests and Rangelands in Marsabit, Northern Kenya Landscape 64

Section 4: Summary of Practices, Lessons and Opportunities 69

4.1 Introduction 69
4.2 Nature of the problem in agro ecosystem conservation 69
4.3 Profile of best practices that have supported community resilience during climate extremes 69
Emerging gaps and challenges; 71

References 72



Section 1: Introduction

1.1 Background and context

The world is not on track to achieve the 2030 Agenda for Sustainable Development and its Sustainable Development Goals (SDGs) by 2030. A preliminary assessment of around 140 targets reveals only 15% are on course, while nearly half are moderately or severely off track. Alarmingly, 30% of the targets have seen no progress or have regressed below the 2015 baseline . Several factors, such as environmental degradation, climate change, biodiversity loss, and the triple burden of malnutrition, hinder the achievement of the SDGs.

As critical resources such as water, energy, and land become scarcer and food demand rises due to population growth and other mega trends — there is an increasing recognition that food systems must be both sustainable and adapting to climate change. Food systems, responsible for a third of global greenhouse gas (GHG) emissions and a major driver of biodiversity loss, need to radically transform to re-introduce biodiversity in agricultural landscapes and become emission-neutral.

In recent years, significant progress has been made in Nature-Positive Production (NPP), which improves ecosystem functions in agricultural areas affected by degradation while improving livelihoods and other socio-cultural benefits. NPP involves protecting nature, restoring degraded agroecosystems, and managing agriculture in ways that support biodiversity. In agricultural landscapes, NPP can improve soil health, enhance carbon sequestration, protect water quality, and boost biodiversity, while maintaining agricultural productivity and reducing environmental impact, thus aligning food production with climate and biodiversity goals.

> *NPP emphasizes that land that is used to produce food needs to be managed in such a way that agriculture enhances the richness and abundance of biodiversity and ecosystem functions, reduces GHG emissions, and enhances resilience to climate change. It supports farmers in restoring biodiversity at both the farm and landscape levels, creating functional habitats, increasing carbon sequestration, and boosting resilience to climate shocks, all while ensuring sustainable livelihoods.*

WWF is advancing efforts to ensure food security by protecting biodiversity to support socio-economic growth. Its work on food systems transformation seeks to protect key resources that support both food production and biodiversity. This food systems-based approach acknowledges the complex synergies and trade-offs between food security, nutrition, livelihoods, and environmental sustainability. WWF emphasizes that agricultural land must be managed to restore biodiversity, reduce GHG emissions, enhance resilience to climate change, and provide sustainable income for farmers.

While various NPP models have emerged, agroecology offers a practical approach that addresses conservation, climate, and socio-economic objectives while maintaining productive agricultural systems . Agroecology is now recognized as a transdisciplinary, participatory, and action-oriented approach that embraces three dimensions (Figure 1.1).

A transdisciplinary science – the integrative study of the ecology of the entire food system, encompassing ecological, economic and social dimensions.

Set of practices - aimed at improving agroecosystems by harnessing natural processes, creating beneficial biological interactions and synergies among their component.

Social movement that strengthens the economic viability of rural areas based on short marketing chains, and safe food production. It supports diverse forms of smallholder food production, food sovereignty, local knowledge, social justice, local identity and culture, and indigenous rights for seeds and breeds.

Figure 1.1: Dimensions of agroecology

In order to raise awareness and scale up agroecology, it is crucial to document and disseminate locally successful practices that enhance food and nutrition security in an environmentally and socially inclusive way. Sharing scientifically sound information can help improve extension services and foster learning among stakeholders, including farmer field schools (FFS) and agroecological demonstration centers.

Driving this scaling effort forward, WWF's Africa Food Future Initiative (AFFI) was created to integrate sustainable production models across WWF's conservation landscapes. AFFI aims to establish scalable, sustainable food systems and support resilient livelihoods through three work streams: (i) integrated land- and water-use planning and management; (ii) agroecology; and (iii) sustainable and inclusive value chains, with a cross-cutting focus on policy enhancement. AFFI seeks to generate evidence that facilitates the implementation of these pillars, with a particular focus on developing case studies that define NPP models within the agroecology work stream. These case studies will provide the foundation for engagement with key stakeholders and guide Africa toward a long-term, ecologically sustainable development path.

1.2 Objectives and scope

The objectives of the project were to:

1. Document unique agroecological practices in a publishable academic case study to support the definition of Nature-Positive Production (NPP). Case studies involving private-sector partnerships as part of sustainable business models were of particular interest.
2. Develop a profile of best practices that have strengthened community resilience during climate extremes.
3. Identify gaps in the implementation of these best practices that require further investment, linking them to National Adaptation Plans (NAPs) and Nationally Determined Contributions (NDCs). This aimed to highlight opportunities to integrate NPP into NAPs and NDCs and help prioritize NPP investment.
4. Collaborate with stakeholders to review and scientifically develop principles for defining NPP, including adaptation indicators.

1.3 Sampling and case study selection

Ecosystems across the country were identified based on agroecological diversity, geographical distribution, and the presence of distinctive practices. The selected locations are:

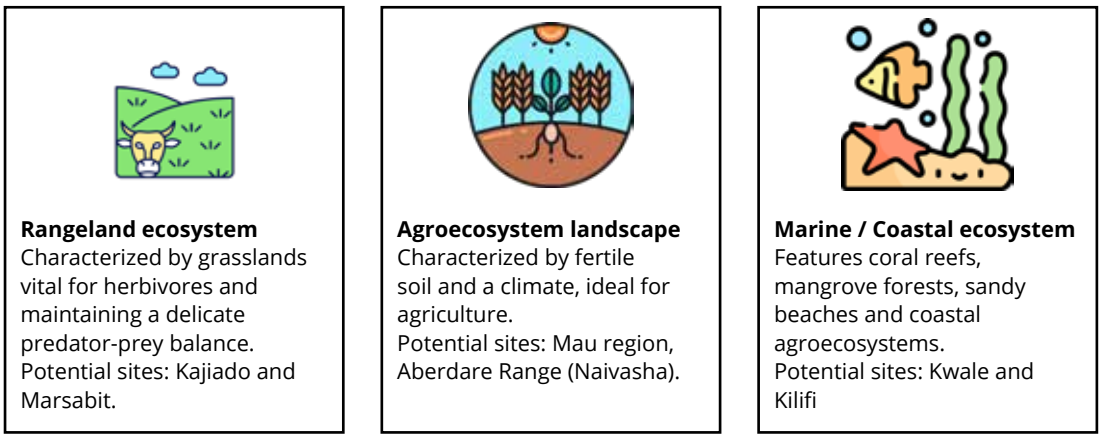


Figure 1.2: Sampling and Case Study Selection

Due to the complexity of identifying NPPs and best practices, multiple criteria were employed. Key informant interviews and a literature review were conducted to rank the NPPs essential for addressing challenges in each ecosystem. Based on this ranking, at least two NPPs from each ecosystem were documented.

Table 1.1: Overview of the case studies developed

Landscape	Location	Title of case
Southern Kenya	Bomet	Farmer-led catchment protection and livelihood production
	Bomet	Governance of integrated community ecosystem conservation
	Amboseli	
Kenya Rift Lakes	Naivasha	Certification of vegetable traceability systems –KS1758
	Nyandarua	
	Njoro	Agroecology
Coastal	Malindi	Working with communities, to implement co-management approaches for healthy marine and terrestrial ecosystems in Kenya's coastal landscape
	Malindi	Vanga Blue Carbon project in Vanga, Kwale
Northern Kenya		

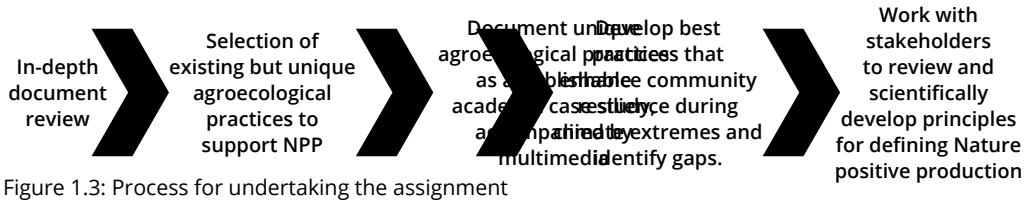


Figure 1.3: Process for undertaking the assignment

1.4 Assessment Methodology

To meet the project objectives, a phased approach was adopted to ensure that activities aligned with the scope of work (Figure 1.3).

1. In-Depth Document Review: An extensive review of documents on agroecological practices and Nature-Positive Production (NPP) identified key categories and success factors. A framework for selecting and documenting case studies was developed, along with tools for focus group discussions (FGDs) and key informant interviews (KIIs).
2. Selection of Unique Agroecological Practices: In-depth interviews and FGDs with stakeholders practicing relevant agroecological methods were carried out, building on ongoing documentation efforts. Based on the established criteria and field results, suitable cases across crops, livestock, agroecological, and geographic zones were selected for documentation.
3. Document Unique Agroecological Practices: Unique agroecological practices were documented as publishable academic case studies, complemented by multimedia materials supporting the definition of NPP. Field data collection involved observations, KIIs, and FGDs, enhanced with video and multimedia techniques. This stage resulted in academically publishable case study manuscripts.
4. Profile of Best Practices for Community Resilience: A profile of best practices that support community resilience during climate extremes was developed. Using resilience criteria derived from the literature and KIIs, cases were ranked, and linkages to NAPs and NDCs were identified, highlighting opportunities for integration.
5. Development of NPP Principles: Collaboration with stakeholders led to the review and development of principles for defining Nature-Positive Production.

Section 2: Framework for NPP documentation

This section provides a summary of the conceptual elements for understanding and analyzing Nature-Positive Production (NPP).

2.1 Defining NPP

Current food production systems drive land degradation, water resource depletion, soil health decline, and biodiversity loss, compromising sustainability (IPCC, 2019; IPBES, 2019). In response to these complex and interconnected challenges, stakeholders are calling for radical systemic transformations. However, due to the contextual nature of these issues, no single solution exists. Various approaches have been proposed at regional and global levels (Dengerink et al., 2021), often following a systemic perspective.

Recently, the term "nature-positive food systems" has gained traction, highlighting the reciprocal relationship between food systems and nature. However, its interpretation can be unclear, potentially hindering meaningful change [3]. To address this, we explored how "nature-positive production" can be effectively defined to support food system transformation.

Our approach involved reviewing existing definitions in the literature to identify common elements applicable to the NPP concept and developing a framework for measurement and analysis (Table 2.1). Our review revealed that while the term "NPP" is increasingly used in both scientific and grey literature, its meaning varies by context. Common themes across definitions emphasize:

- Halting biodiversity loss
- Embracing offsetting measures
- Promoting regeneration
- Embodying the incremental essence of being 'positive'

These definitions highlight that a nature-positive food system should not only avoid depleting natural resources but also actively contribute to their restoration and enhancement. Additionally, some definitions incorporate actionable components, stressing the importance of ecosystem-centric design and collaborative efforts among key stakeholders. These elements are crucial for defining "NPP."

Table 2.1: Some existing NPP definitions

Author	Title	Definition
World Economic Forum, 2020	The Future Of Nature And Business (New Nature Economy Report II)	"A nature-positive built environment shares space with nature, putting whole ecosystems rather than humans alone at the centre of design" "Nature-positive extractive processes have the potential to minimize destructive land management practices and enhance conservation efforts to offset biodiversity impacts that cannot be either avoided or mitigated" "A nature-positive energy transition has the potential to further both global climate and nature goals"
IUCN, 2020	World Conservation Congress Resolution 116	"... an equitable, nature-positive and net zero world [would] ensure there is more nature globally in 2030 than there was in 2020, by halting and reversing the loss of nature to put nature on a path to recovery for the benefit of all people and the planet by 2030, as well as tackle climate change, achieve the Sustainable Development Goals, and enable people and communities to thrive in a healthy and stable future"

3 Wageningen University Background Report: Defining Nature-Positive Food System, available from https://edepot.wur.nl/649384

CGIAR, 2022	Just launched: CGIAR Initiative on Nature-Positive Solutions	What makes up a nature-positive approach? This holistic concept focuses on ensuring that agriculture helps us stay within planetary boundaries through: 1. Conservation of biodiversity 2. Management of biodiversity and natural resources to provide ecosystem services 3. Avoiding further degradation and restoring nature when necessary 4. Better management of waste and a circular economy.
UNEP, 2021	Adapt To Survive: Business Transformation in a Time of Uncertainty (Global Environmental Outlook for Business)	"A Nature-positive Economy [is] an economy that is regenerative, collaborative and where growth is only valued where it contributes to social progress and environmental protection"
Wageningen, 2024	Defining Nature-Positive Food Systems	We refer to nature-positive food systems as food systems that have nature at the heart of decision-making and that will lead to increased biodiversity and improved ecosystem functioning through collective understanding and action.
Hodson et al., 2023	Boost Nature-Positive Production	Nature-positive food systems are characterized by a regenerative, non-depleting and non-destructive use of natural resources. This is based on stewardship of the environment and biodiversity as the foundation of critical ecosystem services, including carbon sequestration and soil, water, and climate regulation. Nature-positive food systems refer to the protection, sustainable management and restoration of a productive system. Finally, nature-positive food systems cover the growing demand for food in a sufficient way and include sustainable and healthy nutrition.

The framework integrates the 13 principles of agroecology with the pillars of Nature-Positive Production (protect, manage, and restore) to link agricultural inputs with outputs and impacts. It begins by identifying ecosystem problems (e.g., drought changes, livestock mortality, or food insecurity). Interventions addressing these issues are considered inputs. The agroecology principles map these inputs to food system challenges at the farm, field and landscape levels. The NPP framework maps outputs, while impacts are assessed at three levels – people, nature and climate.

2.2 Problem description

The assessment focuses on land use and natural ecosystems (water, forests, grasslands etc.) that support food production and livelihoods. These ecosystems face threats that impact the sustainability of the food system. The analysis is guided by the WWF conservation standard[4], which examines direct threats, their underlying drivers, and stressors. Direct threats include unsustainable farming practices, while indirect threats encompass cultural, social, economic, or institutional factors contributing to these actions, such as lack of knowledge. Stressors are natural or human-induced pressures causing measurable changes to ecosystem functioning, like rising sea levels.

Table 2.2 shows examples of direct and indirect threats and stressors across three ecosystems – agroecosystems, rangelands and marine ecosystems.

Table 2.2: Examples of the problem analysis based on direct threats, indirect threats and stressors

Direct threats	Indirect threats	Stressors
Unsustainable farming practices	Limited knowledge on good agricultural practices	Land degradation
Unsustainable logging	Lack of enforcement mechanism	Soil erosion and sedimentation of rivers and streams
Illegal hunting	Increased population pressure	
Climate change	Changes in consumption patterns	Rising sea levels

2.3 Interventions to Address the Problem

The analysis of interventions (inputs) for ecosystem challenges is guided by agroecology, which emphasizes natural processes, efficient use of farm inputs, and promoting closed cycles with minimal negative externalities. This approach values local knowledge and participatory processes that develop practices through experience and conventional scientific methods while addressing social inequalities (HLPE, 2019).

The agroecological transition pathway is based on 13 key agroecological principles (Figure 2.1), which closely align with the Food and Agriculture Organization's (FAO) 10 elements of agroecology.

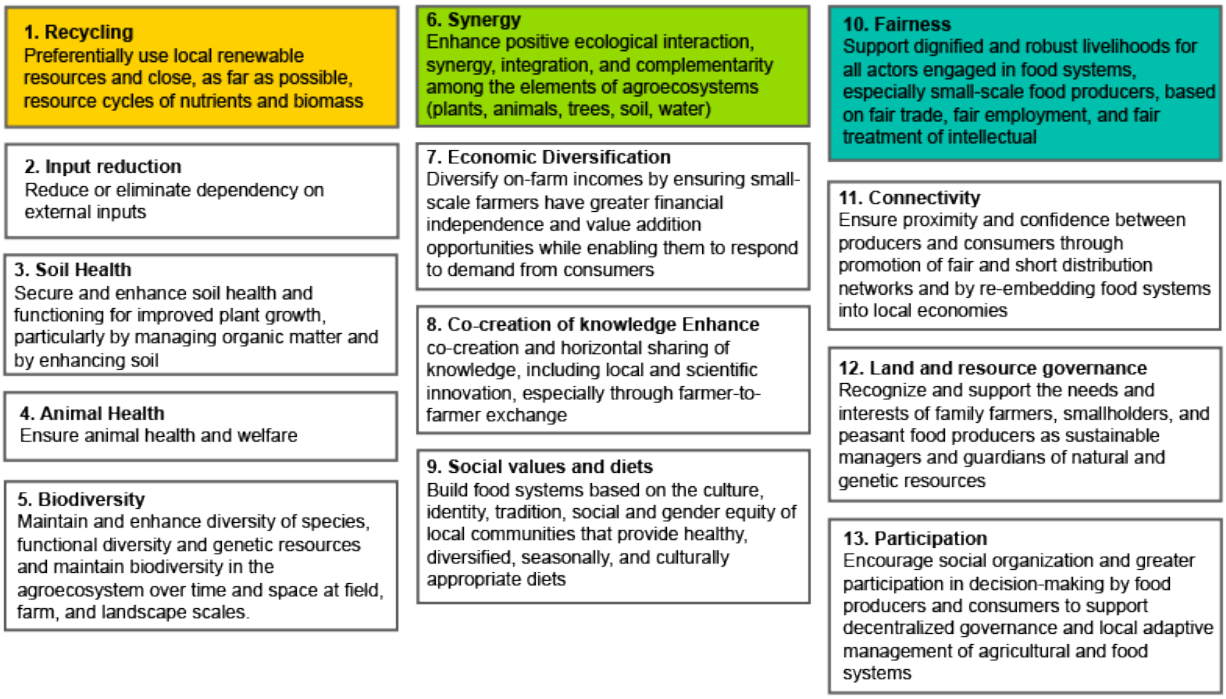


Figure 2.1: Agroecology principles

The assessment of agroecology principles in interventions can leverage the Tool for Agroecology Performance Evaluation (TAPE), which provides a framework for gathering evidence on sustainability across environmental, social, economic, health, nutrition, and governance aspects (FAO, 2019). While TAPE offers a strong foundation, it uses a limited set of performance indicators linked to the SDGs, which may not align with local objectives such as farmers' agency, resilience, and well-being (Mottet et al., 2020).

To enhance TAPE, we incorporate NPP practices relevant to key ecosystems (soil, forests, water management) and social factors like governance participation and economic development (Simelton et al., 2021). Through interviews, FGDs, and observations, we identified farm, field, or landscape-level practices (Table 2.4) that correspond to the 13 principles derived from scientific literature (Mottet et al., 2020; CIFOR-ICRAF, 2023) and highlighted in the UN High-Level Panel of Experts report on agroecology (HLPE, 2019; Wezel et al., 2020).

Table 2.3: Typical indicators for operationalization of the principles.

Principles	Examples of indicators
Recycling	Recycling of biomass and nutrients, water saving, management of seed and breeds;
Input reduction	Use of locally produced inputs, use of organic inputs (biofertilizers, biopesticides etc.);
Soil health	Soil conservation (cover crops, contour planting, terraces, grass strips, shrubs for conservation;
Animal health	Good livestock husbandry (feeding, stocking, hygiene etc.); use of biological agents for pest and disease management;
Biodiversity	Increased farm diversity (crop, livestock);
Synergy	Crop, livestock, aquaculture integration;
Economic diversification	Access to alternative livelihood opportunities; mechanisms that improve resilience of livelihoods;
Co-creation of knowledge	Access to agroecological information and knowledge, mechanism for horizontal knowledge sharing;
Social values and diets	Women/youth empowerment; local or traditional food cultures;
Fairness	Fair distribution of benefits, especially to smallholder farmers and other marginalized groups;
Connectivity	Local producers' access to markets; mechanisms or models increasing market access for local products; Products and services marketed locally;
Land and resource governance	Participation of producers and associations in resource governance;
Participation	Participation in decision making, policy making processes.

2.4 Nature-Positive Production Outputs

The evaluation of intervention outputs is based on NPP principles, which focus on protecting, conserving, restoring, sustainably using, and managing natural and modified ecosystems. These outputs effectively address social, economic, and environmental challenges while enhancing human well-being, ecosystem services, resilience, and biodiversity.
This framework is built on three main principles:

1. Protect natural ecosystems against new conversions for food and feed production;
2. Manage existing food production systems sustainably, to the benefit of both nature and people;
3. Restore and rehabilitate degraded ecosystems and soil function for sustainable food production.

NPP outputs are complemented by 10 core criteria derived from the TAPE tool, many linked to SDG indicators, which generate a multidimensional performance assessment of agroecology:

1. Secure land tenure (or mobility for pastoralists)
2. Productivity (and stability over time)
3. Income (and stability over time)
4. Added value
5. Exposure to pesticides
6. Dietary diversity
7. Women's empowerment
8. Youth employment
9. Agricultural biodiversity
10. soil health (Table 2.5).

Table 2.5: Typical indicators for operationalization of the NPP outputs

NPP pillar	Indicators
Protect	Reduced loss and degradation of the remaining ecosystems reflected in; • Reduced conversion of forests (other intact natural ecosystems for food production areas) into agricultural land; • Production systems and incentives to farmers and supply chain actors towards reduced conversion – increased productivity, resource use efficiency through rainwater harvesting, watershed management, water use efficiency, food loss and waste reduction etc; • Models that support multifunctional landscapes for food production and conservation such as integrated resource management (forest, water, wildlife, marine. These include CFAs, Water Resource Users Associations (WRUAs), Beach Management Committees (BMUs) etc; • Incentives, just and inclusive benefit sharing regimes that support natural habitat management on farmland and protected areas.
Manage	Sustainably managed agroecosystems reflected in; • Improved soil health, crop and livestock productivity; • Promotion of indigenous people's knowledge and food systems; • Systems that improve rights to access resources (collective or individual); • Improved crop, livestock diversity and other foods e.g. blue food value chains, relatives of crop and animals; • Business models for supporting agrobiodiversity (BDS, PPPs, public procurement, market niche, value addition); • Enhanced circularity in food systems - Processes to support circularity (4Rs).
Restore	Restore degraded areas into healthy natural or productive ecosystems reflected in; • Improved ecosystem functioning – provision of ecosystem services arising from ecosystem restoration; • Enhanced food and nutrition security; • Enhanced biodiversity; presence of Farmer Managed Natural Regeneration (FMNR, check dams, tree cover, terraces; • Improved soil health and fertility; • Increased recharge of the water table; • Diversified livelihoods; • Integrated management of invasive and alien species; • Restoration of fragmented pastoral range lands.

2.5 Impacts

The impacts of NPP are assessed across three dimensions: people, nature, and climate. Applying agroecology principles to agroecosystem challenges aims to foster an equitable society where essential needs are met, protect and restore ecosystem health, and limit global warming to 1.5°C while supporting community adaptation to climate change (Table 2.6). This approach seeks to identify synergies and trade-offs among various NPP policies and practices, comparing their impacts to baseline conditions and alternative interventions.

Table 2.6: Examples of indicators for operationalization of the NPP impacts 2.6 Lessons

Dimensions	Indicators/Impacts
People (Socioeconomic)	• **Social dimension:** Encompasses cultural, political, and governance factors, alongside women's empowerment and gender equity. • **Economic dimension:** Includes indicators related to livelihood enhancement, income, job creation, food and nutrition benefits, and avoided costs resulting from NPP implementation. • **Agroecological resilience:** As outlined by Tittonell (2020), resilience can be assessed using criteria like self-regulation, connectivity, functional diversity, response diversity, spatial and temporal heterogeneity, building of natural capital, social self-organization, reflective learning, human capital, autonomy, and local interdependency. These criteria provide tools to guide transitions and monitor agroecosystem resilience over time.
Nature (Environment)	• **Environmental dimension:** Biodiversity conservation and ecosystem services. • Reduction in cropland expansion, forest protection, increased water flows, reduction in food led deforestation, farmers leaving space for connectivity not using riparian areas or settling on wildlife corridors. • Soil quality (soil organic carbon and nitrogen), subsurface water availability, and pollinator populations. • Land use/cover, soils, vegetation, and nutrients. • Changes in various proximate1 drivers of ecosystem services. For example, (provision services (e.g., food, fibers, chemicals, and wood), regulation services (e.g., plant pollination, and disease and pest controls, precipitation and drought, coastal flooding, and species), cultural services (e.g., recreational, educational, religious, or aesthetic-landscape activities), and supporting services (e.g., nutrient cycling, soil formation, and seed dispersal). • Monetary valuation of ecological changes for ecosystem services.
Climate (Social, Economic Environment)	• Reduced climate risks for people and ecosystems e.g. Individual or subpopulation experiences from exposure to climate-related hazards: exposure to temperature change, changes in labour productivity, exposure to floods, exposure to drought, changes in the incidence and geographic range of climate-sensitive infectious diseases, and food security and under-nutrition generally measured as stunting. • All-cause and cause-specific morbidity and mortality associated with other extreme weather events. The capacity of individuals, communities, and health systems to manage increases in the frequency and intensity of extreme weather and climate events and changing burdens of climate-sensitive health outcomes. • GHG emission reductions from the practices and systems put in place.

2.6 Lessons

This section analyzes the conditions under which NPPs achieve triple wins for people, nature, and climate. Identifying the key factors for success helps facilitate scaling or replicating these practices. Drawing from a recent WWF report, Key Levers for Food System Transformation Include Natural Resource Governance, Institutions, Education, Technology, Trade, and Finance (Table 2.7). These levers, shaped by context, support food system transformation in various ways, emphasizing that successful NPPs require adaptation to specific local conditions.

Table 2.7: Food system transformation levers

Lever	Definition and indicators
Natural resource governance, technology	Interventions that directly aim to enhance NNP to reduce environmental impact and increase ecosystem services. Indicators include; • optimizing land use to feed people, preserve ecosystem functions and contribute to ecosystem resilience; • restore biodiversity; • increase carbon storage; • increase food agrobiodiversity.
Governance and institutions	Interventions which improve governance and institutions. Indicators include interventions which; • support smallholders; • improve land tenure; • strengthen commitment and implementation; • iv) foster multi-stakeholder collaboration.
Education and knowledge	Interventions which increase awareness of NPP practices and ensure that they thrive. The indicators include; • Strengthen research science and development; • improve data collection and measurement; • increase public awareness, and • iv) promote health, sustainable and traditional foods.
Trade	Interventions and processes which promote trade of sustainable and healthy foods. Indicators include; • develop Nature-Positive supply chains; • support health food imports and exports.
Finance	Interventions which repurpose finance towards healthier foods and nature-positive farming practices. Indicators include; • re-direct subsidies and increase derisking investments; • finance school food and public procurement programs; • provide financial incentives and taxes to improve sustainable consumption.

2.7 Reflections on Framework Application

The framework is adaptable across different ecosystems, food systems, and scales, allowing assessments at farm or household levels, while considering both lower (e.g., plot, herd) and higher levels (e.g., landscape, community). It can be applied qualitatively for a snapshot or quantitatively for detailed transitions toward NPP. However, its success depends on tailoring it to specific local environmental and socio-economic contexts rather than adopting a one-size-fits-all approach.

Multidisciplinary expertise enhances its effectiveness.

Sampling can be stratified or purposive, focusing on territorial snapshots where units within the same area share similarities. Field observations should involve at least three independent assessors, who later validate the data through triangulation. For in-depth assessments, TAPE criteria are recommended, using descriptive scales (0 to 4) for elements like crop, animal, and tree diversity.

Outputs are assessed based on immediate changes (e.g., production system shifts), while impacts are inferred from these outputs, especially when direct assessment is difficult due to timing or baseline data limitations.

Bundling levers (e.g., governance support with agroecological science or combining supply chain, finance, and trade innovations) can enhance impact. Continuous refinement of the framework, stronger feedback loops, and integrating diverse data (including technology like artificial intelligence or remote sensing) will improve its application over time.

Section 3: Case study documentation

Case Study 1: Integrating inclusive agricultural value chain development and landscape restoration in Naivasha – Western Aberdare sub-landscape in Kenya

Integrating inclusive agricultural value chain development and landscape restoration in Naivasha –Western Aberdare Sub-landscape.	**Case study summary box: Case Study 5**	
	Landscape	Kenya Rift Lakes
	Sub-Landscape	Naivasha – Western Aberdare
	Ecosystem	Forests, water and farmlands
	Sectors	Forestry, water and agriculture
	Region	Moi Ndabi (Naivasha)
	Type of initiative	• Forest land restoration • Certification under the Horticulture Industry Code of Practice (KS1758) • Use of protected horticultural production systems (greenhouse technology) • Water harvesting
	Products	• Increased income due sale of quality and safe food • Reliable and guaranteed supply of fresh produce all year round • Community cohesion • Reduced pests and diseases • Enhanced livelihoods through access to water for production and food availability.
	Nexus	• Integrating inclusive agricultural value chain development into landscape restoration initiatives
	Key agroecological principles	• Economic diversification; resilience; soil health; input reduction; synergies; land and natural resource governance; participation; connectivity and; co-creation of knowledge
	Summary of Initiatives	• The case illustrates the use of champion farmers to pilot and promote agroecological practices, supporting the agroecological transition. It reflects on the experience of attaining a safe code of conduct for smallholder producers in Naivasha. Through the adoption of agroforestry, farmers maximize land utilization and enjoy its associated benefits

Background

The Lake Naivasha Basin (LNB) in Kenya's Eastern Rift Valley spans around 3,400 km², covering the upper, middle, and lower water catchment areas. Most farmers are smallholders. Moi Ndabi, in the lower basin, hosts over 1,000 households at 6,000 feet elevation, about 44km from Naivasha town. This arid to semi-arid area faces frequent droughts, flash floods, strong winds, pests, and weeds. Repeated droughts (2014-2023) have severely impacted livelihoods and agro-ecosystem resilience, limiting households' ability to manage climate hazards. The case showcases champion farmers promoting safe farming practices and agroforestry to support agroecological transitions.

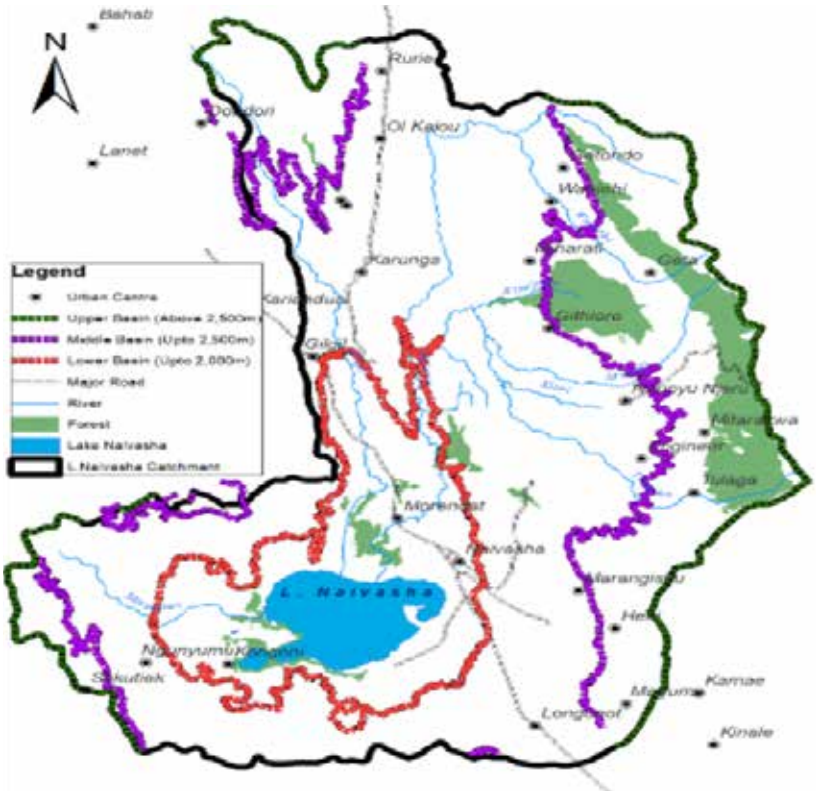


Figure 1.1: Lake Naivasha Basin catchment zones

The Problem

Moi Ndabi, a semi-arid area, faces environmental challenges like deforestation and soil erosion, which threaten its natural resources. Recurring droughts have led to frequent crop failures, severely affecting agriculture—a key livelihood for many households. Deforestation and timber extraction have worsened drought conditions, leading to water shortages, with community members walking up to 10km to find water. This often keeps children from attending school. Rainfall variability has caused low soil moisture, crusting, and erosion, especially in bare soils, resulting in poor crop and pasture productivity. Flash floods from Narok North have increased due to bare grounds, further degrading the land. Food shortages were observed, with people traveling up to 70km to find food. Maize yields are very low, at 2-5 bags per acre, compared to the potential of 35kg per bag. Poor market linkages and limited knowledge of suitable agroecological practices further worsen the situation.

Table 1.1 outlines the indirect and direct threats, along with stresses.

Indirect threats	Direct threats	Stresses
Rising population, weak incentives for conservation and poverty	Deforestation (cutting down of trees for settlement, firewood and timber)	Degradation of habitats, increased runoff and soil erosion in shallow soils during the rains
Limited knowledge on suitable agroecological practices and poor linkage to markets	Use of unsustainable agricultural practices	Degradation of soils, reduced productivity and, food insecurity
Limited capacity for adaptation, lack of social safety nets and eroded resilience of agri-food systems	Climate change	Increased frequency of drought and water stress

Key Interventions

The Momaki Green Horticulture Group, based in Moi Ndabi, began receiving support from the World Wide Fund (WWF) in 2007. Formed during tribal clashes in 1992, the group initially had 18 members but has since reduced to 10 (8 females and 2 males) following training and certification. They prioritized the tomato value chain, which is ecologically suitable for the area and offers high returns on investment. WWF selected this women's group for its training and mentorship program, enhancing their business skills, fostering partnerships with markets and stakeholders, and increasing their capacity to adapt to climate change, generate income, and improve food security. Three entry points for the agroecological transition have been identified: (1) inclusive agricultural value chain development, (2) enhancing the resilience of crop-livestock systems through water harvesting and other agroecological practices, and (3) strengthening restoration efforts of the commons through an institutional lens.

Inclusive agricultural value chain development
Agroecology is gaining recognition as a promising alternative for sustainable food systems . In the Moi Ndabi area, sustainable tomato production has been prioritized through efficient water use, greenhouse technology, pest management alternatives, and enhanced market access via certification standards. This approach aims to adopt sustainable practices while strengthening farmers' networks and market linkages, creating inclusive business models within value chains. The selection of tomatoes was based on participatory mapping and value chain analysis by the community, considering the presence of upscale tourist hotels as a premium market opportunity.

A participatory assessment identified ways to enhance competitiveness in the tomato market. With WWF's support, community members received training in agronomy, pest management, and greenhouse operation, as well as leadership and business planning. They collectively agreed to use the same input brands, enhancing economies of scale and facilitating information sharing. The use of greenhouses has reduced chemical usage for pest control, resulting in safer produce that commands higher prices.

Although individually owned, the greenhouses operate collectively within the Momaki group, ensuring year-round planting. Members plant at staggered intervals to avoid oversupply and guarantee a steady tomato supply. The Anna F1 variety is planted once a year, yielding an eight-month harvest. Each week, about 66kg of tomatoes are harvested, selling for 80 to 120 Kenyan Shillings per kg. Each greenhouse, capable of supporting 480 plants, requires 500 liters of water daily, with irrigation adjusted based on soil moisture levels.

Certification under the Horticulture Industry Code of Practice has been crucial for accessing high-value markets. Many agricultural value chains in Kenya struggle with inconsistent supply. Members of the Momaki group attained the safe code of conduct under the Kenya Standard 1758:2016 (KS 1758), which outlines sanitary and safety criteria for producing and selling fruits and vegetables . The standard focuses on food safety, good agricultural practices, worker welfare, and environmental care, aligning well with the agroecological transition.

Following certification, Momaki members have become more environmentally conscious. With a contract to supply safe tomatoes to local hotels, scaling up these interventions is essential for smallholder producers who struggle with consistent product supply. Additionally, new business models are being explored to enhance farmer inclusion and promote local products (vegetables, dairy) within the local food system.

Promoting Agroecological Practices through Champion Farmers Model
Utilizing champion farmers to pilot and promote agroecological practices is another key entry point for supporting the agroecological transition. Following training and capacity-building support from WWF, farmers in the Moi Ndabi area have significantly enhanced their knowledge of agroecological practices (Box 1.1).

Box 1.1.

Alex Lemayian (Lead Farmer)

Alex Lemayian is a lead farmer cultivating cabbage, maize, beans, tomatoes, kales, onions, tree tomatoes, French beans, sweet potatoes, fruit trees, and raising dairy and poultry (chickens and ducks) on 1.5 acres. He utilizes water from a water pan constructed by WWF, which has alleviated previous water shortages caused by prolonged drought. Previously, Alex walked 2km after work to fetch water for domestic use and livestock. He also faced high pest and disease prevalence from open-field production. Today, by adopting various agroecological practices, Alex has significantly increased his production, water accessibility, and income. He diversifies through crop, forestry, and livestock farming and is one of the 10 certified members of the Momaki group. He uses animal manure for crop production and harvests rainwater from a water pan built in 2012 for irrigation. Alex plants maize as windbreaks and for pest control, practices crop rotation, and utilizes a four-year-old greenhouse that reduces pesticide use. He also employs polythene fencing around his farm to act as windbreaks and protect against animals, while planting onions as a pest management technique. As a result of these practices, the quality of his produce has improved; he now sells tomatoes for KSh 80 per kg, up from KSh 30.

Water Harvesting for Resilient Production Systems and Livelihood
To tackle water access challenges, the Momaki group, with support from WWF, constructed rainwater harvesting pans that ensure water availability throughout the year. Farmers collaborated to excavate water pans for one another on a rotational basis, while WWF supplied essential dam liners and pumps. This initiative has enhanced water availability, enabling continuous vegetable production year-round and aiding in flood mitigation by reducing surface runoff and erosion. Focus group discussions revealed that community members view water scarcity as a major constraint on ecological resilience and livelihood options.

Agroforestry and Carbon Credit Incentives for Forest Restoration
Agroforestry involves intentionally growing trees alongside food crops and livestock, enabling mutual benefits for all three enterprises. Smallholder farmers often face challenges in land utilization and food security, but agroforestry allows them to maximize their land and its benefits. Despite their small landholdings, Kenyan farmers can contribute to the national goal of 10% forest cover, with agroforestry as a viable approach . In Moi Ndabi, deforestation is a primary cause of drought, prompting farmers to adopt the Forest Landscape Restoration (FLR) initiative. This initiative takes two forms: first, through agroforestry, farmers plant trees along farm boundaries, in crop lands, and in homesteads, using species like Grevillea robusta for timber and various fruit trees for food and income. Second, woodlots are established on larger plots, with tree selection tailored to agroecological zones and farmer needs, often favoring indigenous species. Through various interventions, a number of agroecological principles were promoted (Table 1.2).

Box 1.2

Enai Bor Ajijik Group (Narok-Naivasha Border)

According to group members, most farmers cultivate maize, beans, and wheat on land exceeding 20 acres and typically keep at least 50 cattle per household. Drought, largely caused by deforestation for settlement and charcoal production, is a major challenge. Farmers have adopted control measures like terracing and grass planting to reduce soil erosion. Diversification is increasing, with households now growing three-four types of crops. Members are also planting trees, incorporating both agroforestry and woodlot practices, with each household planting over 30 trees, including acacia and grevillea. They have fenced their farms to protect against animal damage and planted Kakamega 2 grass variety along terraces to further combat erosion. Farmers expect to benefit from timber availability and future carbon credits from carbon sequestration, with 168 farmers registered in the program. Other positive impacts include increased rainfall, improved soil fertility, and cleaner air. The project's success is attributed to strong community participation and WWF follow-ups.

Table 3.1.2: Applicable agroecology principles

Principle	Initiative
Economic diversification	• Farmers have embraced diverse crop and livestock enterprises; - planting maize, beans, tomatoes, fruit trees and vegetables, dairy farming, keeping of small livestock e.g. rabbits, chicken, ducks, doves etc. • Adoption of carbon markets as a complementary financial strategy for the agroecology transition. • New business models to improve inclusion of small-scale farmers and marketing of local products (vegetables, dairy) within the local food system.
Resilience	• More resilient production systems made possible through water harvesting and other ecological interventions. • Use of greenhouses making it possible to harvest throughout the season, market linkages, and certification all lead to increased incomes and resilience.
Input reduction	• Farmers use greenhouses to control pests and diseases for reduced pesticides applications. • Increased use of certified seeds, which are sourced from certified agrovets leading to reduced cases of pests and diseases hence less use of agro-chemicals. • Certification of the farmer's produce facilitates appropriate use of agrochemicals. • Farmers rotate crops grown on different plots each season as a mechanism for pests and diseases control to reduce the use of chemicals. • Stakeholders have assigned priority to improving resource-use efficiency and resilience as well as water management.
Soil Health	• Mulching using farm waste from pruned crops to cover the ground and around the fruit trees leading to moisture retention. • Cover cropping - farmers plant sweet potatoes and pumpkin leaves to reduce soil erosion due to water run-off. These crops also help in retaining moisture, while suppressing weeds. • Farmers embrace the use of farmyard and organic manure. • Households have embraced *fanya chini* terracing, where the soil is heaped on the lower side of the terrace. This allows water to flow into the terrace, and the heaped soil aids in blocking overflow.
Connectivity	• There is regular interaction with local hotels in supply of tomatoes. The group also has access to certified inputs providers.
Synergies	• Dried bean leaves and twigs are crushed and used as fodder alongside hay and nappier grass. Manure from livestock production is also used for crop production

Recycling	• Recycling old construction materials for greenhouse construction. • Use of solar energy to pump water from the water pans for irrigation.
Land and natural resource governance	• Institutional set-up and governance within the group by partnering with WWF and other organizations to allow other groups to benchmark. • Having in place by-laws to govern activities as well as collaboration with other relevant government agencies (Agriculture and Food Authority (AFA), County Government and the Kenya Forest Service (KFS).
Participation	• Organized group for both inputs sourcing, accessing markets and training, where members actively participate in decision making. Participatory processes, embraced throughout the value chain stages including empowerment of the single women within the community. • The selection of tomato was informed by participatory mapping and analysis of value chains by the community members. The presence of upscale tourist hotels in the area was also a key consideration given its potential in influencing accessibility of markets.
Co-creation of knowledge	• Members of the group have collaboratively agreed to use the same type of inputs, making it easier for them to source from the same agrodealers and share information on what is working well in their farms.

Outputs based on NPP pillars

The interventions have delivered multiple NPP outputs (protect, manage and restore).

Table 1.3 presents a summary of NPP outputs;

Pillar	Description
Protect	• Reduced encroachment of protected forest ecosystems • Improved incentives for regenerative agriculture
Manage	• Reduced incidence of pests and diseases • Increased sharing and utilization of indigenous knowledge • Improved access to high value markets for safe and fresh vegetables • Increased participation of stakeholders in nutrition sensitive value chains
Restore	• Improved soil health and nutrition • Innovative agricultural and extension advisory services

Impacts

The aforementioned interventions have impacted the lives of the residents in Moi Ndabi economically, socially, and environmentally. Economically, farmers reported an increase in their incomes due to access to high value markets through contractual agreements and seed multiplication (potatoes and tomatoes). The high prices are due to product quality and safety. There is also reduced pests and disease infestation, and the planting is done all year round. Socially, there has been cohesion in the community (people easily meet and interact with each other). Community structures have been strengthened (CFAs and WRUAs) through information sharing, and the people have a sense of pride for sharing the knowledge with others from different parts of the country. Ecologically, air pollution and soil erosion have decreased, while soil fertility and natural resource efficiency have improved through rainwater harvesting.

Lessons

- Contextualization of NPPs: Promote locally contextualized NPPs within a broader climate resilience framework that addresses underlying socio-economic drivers and development needs.
- The champion farmers' model effectively inspires others by integrating traditional knowledge and provides baseline insights on restoration techniques. These cases could be compiled into a comprehensive NPP/agroecology manual for farmers and extension officers.
- Incentive Design: The case highlights successful models for reconciling incentive incompatibilities in conservation efforts. Tailored incentives should align with the interests of diverse stakeholders while balancing individual and group needs. For instance, allocating seedlings

in group nurseries or offering financial rewards and skill-building opportunities based on contributions can foster collaboration.

The lessons learned offer various pathways for enhancing food system transformation (Table 1.4.)

Table 3.1.4: Food systems transformational levers

Cluster	Levers
Natural Resource Management (NRM)	• Increasing the resilience of crop-livestock systems through water harvesting and other agroecological practices as well as restoration efforts of the commons have been strengthened through institutional lens.
Education and Knowledge	• Extension: Training (capacity building); the members were trained on leadership, business plan, disease and pests management with regular follow-ups from WWF. o Extension workers visit the farmers 2-3 times a month o Farmers work closely with the ward agricultural officers. o Market linkages through contractual agreements. • The case also demonstrates the promise of training and exposure for women, who are the majority of the group members. • Group sourcing: The group uses the same chemicals across all the members, sources from the same dealer and shares information with each other on what is working well in their farms.
Governance Institutions	• Good governance: There are group by-laws which are effectively applied to all the members. • Active participation by the members of the community. The members work as a team.
Financing	• A number of the interventions were demand driven; having been identified and prioritized through participatory processes. Farmers tend to embrace practices or approaches where the return on investment is higher when the interventions are owned.

Case Study 2: Supporting processes for shaping on-farm and catchment-conservation and restoration across different scales in Eastern Mau-Nakuru

Case Study title:	Case study summary box: Case Study 2	
Supporting processes for shaping on-farm and catchment-conservation and restoration across different scales in Eastern Mau-Nakuru	**WWF Landscape name**	Kenya Rift Lakes
	Sub-Landscape	Eastern Mau-Nakuru
	Ecosystem	Forests, water and farmland
	Sector	Forestry, water and agriculture
	Region	Mauche, Basiriat Village, Teret (Njoro)
	Type of initiative	Forest and Riparian land restoration and protection using champion farmers to support the agroecological transitions
	Key Agroecological Principles	Economic Diversification, synergies, soil health, recycling, co-creation and sharing of knowledge, resource governance and social values and diets.
	Product (s) /Impacts	**People:** 6.7km of the riparian land restored and protected. **Nature:** two water springs identified and protected to serve eight villages. **Climate:** Enhanced livelihoods through increased production.
	Nexus	Processes for shaping on-farm and catchment-scale conservation and restoration.
	Summary of Initiatives	The case illustrates the implementation of restoration and conservation initiatives at various scales, including on-farm, catchment, and forest landscapes.

Background

The Mau Forest Complex is the largest closed-canopy montane ecosystem in Eastern Africa, comprising seven forest blocks: Mau Narok, Maasai Mau, Eastern Mau, Western Mau, Southern Mau, South West Mau, and Transmara . This area serves as the region's main water tower, acting as the primary catchment for 12 rivers that flow into Lake Baringo, Lake Nakuru, Lake Turkana, Lake Natron, and the Trans-boundary Lake Victoria (Kundu et al., 2008). However, over the past three decades, the Mau Forest Complex (MFC) has experienced significant land use changes driven by a growing human population requiring land for settlement and subsistence agriculture. This encroachment has resulted in severe land fragmentation, deforestation of headwater catchments, and the destruction of wetlands in fertile upstream areas. The impact of these anthropogenic activities is evident in decreasing river discharges during low flow periods

and declining water quality due to pollution from both point and non-point sources.

The Eastern Mau Forest block, one of the two largest in the Mau Complex, spans approximately 66,000 hectares, of which 35,300 hectares were excised by 2001 for settlements (UNDP, 2008) . Located about 30 km south of Nakuru, it includes the forest stations of Sururu, Likia, Teret, Nessuit, Elburgon, Mariashoni, Kiptunga, and Bararget. It borders Naivasha Division to the east and Narok District to the south, covering the Divisions of Mauche, Mau-Narok, Njoro, Elburgon, and Kiringet to the west. This case study focuses on the Teret area in Mauche Division, where most residents moved between 1992 and 1997. Land ownership ranges from 1 to 5 acres, with smallholder farmers primarily cultivating maize, legumes (beans, French beans, etc.), potatoes,

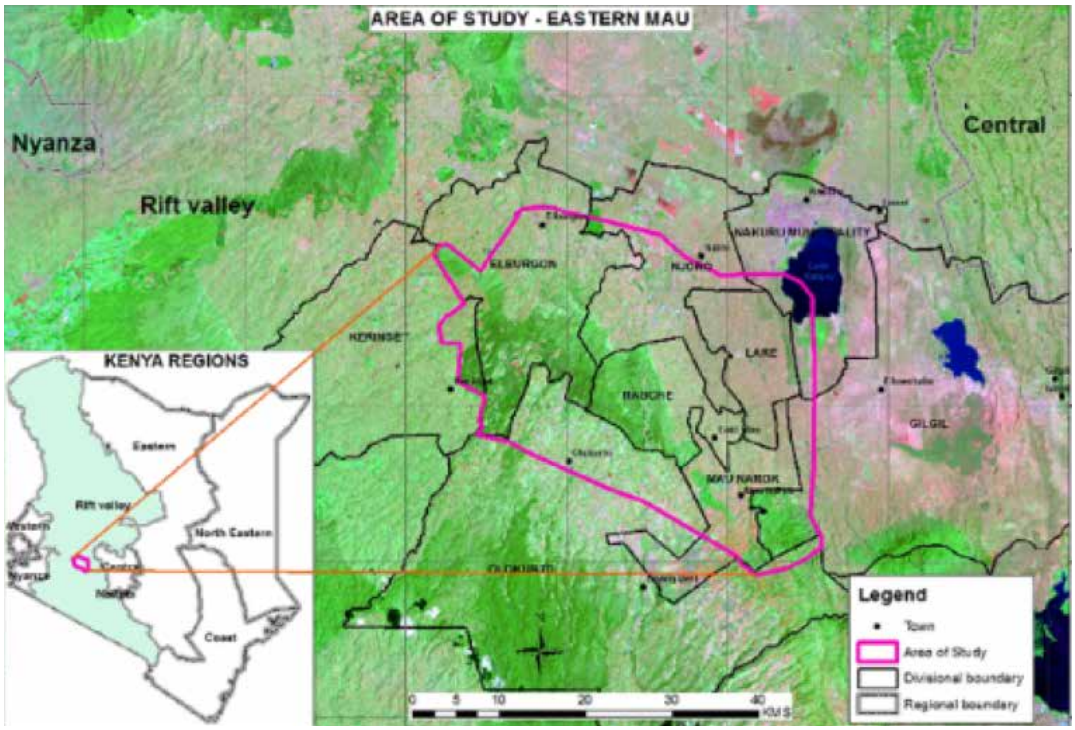


Figure 2.1: Eastern- Mau Area

and vegetables for subsistence and commercial use. The area is predominantly inhabited by the Maasai, Ogiek, and Kipsigis ethnic groups, all of whom heavily rely on forest resources.

Problem/Main Challenge

The landscape /area (Teret) was mainly forest land before conversion into settlements and farmlands.

> *"Forest destruction has led to less rainfall, changed rainfall patterns, and more frequent dry spells in the area, problems that didn't exist when people first settled here," noted a local resident.*

Many people began drilling boreholes without the necessary permits, leading to over-exploitation that affected the water table. Flash floods became common in lower Teret, causing significant damage to crops and homes due to runoff from higher ground. At that time, only one spring served the community, as others had dried up due to forest destruction. Prolonged dry seasons, land degradation, and frequent conflicts reduced crop yields and livestock productivity (milk). In response, farmers increased their use of chemicals like DAP, fungicides, herbicides, and pesticides, further degrading the soil. Additionally, conflicts over shared forest resources among the three ethnic groups have been a persistent challenge in the Teret area.

Table 3.1.5 Contextual analysis of the problem (Indirect threat, direct threats and stresses)

Indirect threats	Direct threats	Stresses
Rising population, weak incentives for conservation and poverty.	Conversion of forest land into settlements and farmlands.	Degradation of habitat, increased runoff and flash floods.
Limited knowledge on suitable agro-ecological practices.	Uncontrolled abstraction of water and application of unsustainable agricultural production practices.	Water scarcity, pressure on the natural resource base and resource use conflicts.

Limited options for diversification of livelihoods and eroded resilience to climate change impacts.	Climate change.	Increased frequency of drought and water stress and reduced crop and livestock (milk) productivity.

Key interventions

On-Farm Level: Promoting Agroecological Transition Using the Champion Farmers Model

- The 'champion landscape farmers' implemented various interventions, including crop diversification, over 30 different crops, contouring, micro catchments (small structures for rainwater runoff), minimum tillage, increased manure use, liming, timely planting, and terracing (fanya juu/fanya chini) with grass planting on the terraces. One farmer, Nathan Langat, exemplifies the potential of agroecology (Box 2.1).
- A WWF project trained farmers on minimum tillage to minimize soil disturbance. Many farmers also practice terracing and plant grasses (Kakamega 1 and Bracharia, which also serves as livestock feed) to reduce water runoff. Water harvesting techniques are utilized, with five farmers collecting rainwater—three using water pans and two using tanks. Instead of focusing solely on a few crops, farmers embrace diversification, planting maize, beans, and other crops like French beans and avocados on a rotational basis to mitigate pests and diseases.

Box 2.1

Nathan Langat- Lead Farmer

Nathan began farming two years ago, cultivating a diverse range of crops and livestock, including maize, yellow beans, cabbages, tomatoes, AIVs, onions, potatoes, and fruits like tamarillo, peak oranges, passion fruits, dragon fruits, kiwi, loquats, grafted apples, bananas, and avocadoes.

Initially, Nathan faced waterlogging due to clay soils, which caused crop failures. He also focused solely on maize and beans without diversifying.

With WWF's support, Nathan adopted agroecological practices through on-farm experimentation. He introduced nitrogen-fixing plants like lucerne, diversified his crops, and grafted plants for disease resistance. He also engaged in tree planting (e.g., Prunus africana, Jacaranda), cover cropping with pumpkins and sweet potatoes, and recycling old materials to build structures, including a greenhouse. For water harvesting, he uses water pans and tanks and employs indigenous methods to preserve pumpkins underground, keeping them fresh for up to two years.

Nathan is a proud farmer who employs six young people from the community. His income from crop sales has increased, enabling his children to attend good boarding schools. He enjoys visits from various individuals and institutions, and most importantly, he has achieved food security, providing a variety of food options for his family year-round.

Agroecological practices enhance natural biological processes above and below ground by minimizing soil tillage and optimizing the use of external inputs, such as agrochemicals and mineral supplements, without disrupting biological functions. This approach improves ecosystem functioning, reduces reliance on external inputs, and promotes long-term climate resilience and profitability.

Key interventions include using certified seeds, like Wanjiku potatoes and Hass avocados, and constructing roadside dams to collect rainwater and prevent soil erosion. These dams also help irrigate crops by allowing water to percolate into the soil.

Catchment level

Njoro Water Resources Authority and Kenya Forest Services (KFS) have restored 6.7 km of riverbanks out of a 20km target. WWF-Kenya uses the River Health Assessment Framework (RHAF) to monitor water resources, engaging local communities in the process. Two springs have been protected to provide water to eight villages.

Photo: Members of the Mara Water Resource Users Association conducting river health

Photo: Spring Protection, Teret

Forest restoration

This involved careful selection of indigenous plant species adapted to the local conditions. In forest restoration, tree planting, with the emphasis on the assorted species of indigenous trees is made - Grevillea, Olea europaea ssp. africana locally known as Mutamaiyo, bamboo, Dombeya torrida (D. goetzenii) locally called Silibwet. To manage the forest resource use, the Participatory Forest Management Plan (PFMP) - a legal document that is required for one to engage in the forest activities and resource extraction is used as a guide. There is also the concept of community organized groups and community driven projects, where there is a Project Steering Committee (PSC) in place to ensure the project(s) is implemented as expected. Capacity building is also done on which crops to plant in the forest and how to care for the trees. Institutional set-up and governance in the CFAs and RUAs are also strengthened to ensure that they actively participate in the projects that are implemented.

Photo: Forest Restoration, Teret

Table 2.2: Applicable agroecology principles

Principle	Initiative
Recycling	Using crop waste and food leftovers for farmyard manure, and repurposing old materials for greenhouse construction.
Input Reduction	Increased use of certified seeds reduces pests and pesticide use. Organic and farmyard manure replace inorganic fertilizers.
Soil Health	Farmers use farm manure, cover crops, and nitrogen-fixing crops, improving soil conditions.
Synergies	Integration of crops, trees, and livestock is common, with Bracharia and Kakamega grasses used for fodder. Water pans are used for fish farming.
Economic Diversification	Farmers grow diverse food and commercial crops (e.g., maize, avocados, and French beans) alongside livestock.
Co-Creation and Knowledge Sharing	Farmers receive capacity building and share indigenous knowledge. WWF partnerships provide information access, and farmer experimentation, such as grafting grapes with loquats, enhances adaptability.

Land and Resource governance	Governance frameworks like the River Health Assessment Framework (RHAF) and the PFMP guide resource use, supported by strong institutional setups in CFAs and WRUAs.
Social values and diets	Traditional food storage methods, like underground pumpkin storage, help during dry seasons and maximize profits.
Connectivity	Farmers have market access through contracts, such as supplying potatoes to Nakuru Potato Cooperative Union.

Outputs based on NPP pillars

The interventions have delivered multiple NPP outputs (protect, manage and restore), these include:

Table 2.3: Outputs based on NPP Pillars

Principle	Initiative
Recycling	Using crop waste and food leftovers for farmyard manure, and repurposing old materials for greenhouse construction.
Input Reduction	Increased use of certified seeds reduces pests and pesticide use. Organic and farmyard manure replace inorganic fertilizers.
Soil Health	Farmers use farm manure, cover crops, and nitrogen-fixing crops, improving soil conditions.
Synergies	Integration of crops, trees, and livestock is common, with Bracharia and Kakamega grasses used for fodder. Water pans are used for fish farming.
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Land and Resource governance	Governance frameworks like the River Health Assessment Framework (RHAF) and the PFMP guide resource use, supported by strong institutional setups in CFAs and WRUAs.
Social values and diets	Traditional food storage methods, like underground pumpkin storage, help during dry seasons and maximize profits.
Connectivity	Farmers have market access through contracts, such as supplying potatoes to Nakuru Potato Cooperative Union.

Impacts

In Teret, Eastern Mau, the interventions have had notable impacts on people, nature, and climate.

On people:

- Increased income: Farmers earned more through crop sales and supplying 8,000 seedlings to WWF at KSh 35 each. WWF also paid farmers for labor in planting.
- Pest and disease control: Crop rotation and diversification led to reduced pests, increased yields, and year-round income, enhancing food security.
- Market access: Farmers have contracts with Nakuru Potato Cooperative Union and have joined cooperatives, like Njoro Fruit Growers for avocado marketing.
- Conflict reduction: Community collaboration has reduced conflicts as they work together on forest restoration.
- Higher crop production: Maize yields increased by over 50% due to manure use, soil testing, and terracing. Certified seeds like Wanjiku potatoes have also boosted output. For example, some farmers harvested 7 tonnes of potatoes per acre in one season under the Plantation Establishment and Livelihood Improvement Scheme (PELIS)program.
- Improved resilience: Growing drought-resistant crops like dragon fruit has strengthened resilience.

For Nature:

Reduced soil erosion: Soil fertility improved with manure use, water run-off reduction, and liming.

Increased biodiversity: Farms now have diverse crops, with some cultivating 30 types of crops on two acres.

- Restored water springs: Reforestation of riverbanks has helped restore springs, ensuring water availability.
- Forest restoration: Indigenous trees like Olea europaea (Mutamaiyo), Bamboo, and Dombeya torrida (Silibwet) have been planted, helping restore forests.
- Reduced forest encroachment: Livelihood diversification has minimized forest reserve encroachment.

On Climate:

- Carbon sequestration: Over 80,000 indigenous trees were planted, with a 90% survival rate, contributing to GHG emission reductions.
- Agroecological practices: Agroforestry, cover cropping, and reduced inorganic inputs also help lower GHG emissions.

Lessons

The case study highlights several key lessons:

- Systemic Vulnerabilities: Farmers face multiple vulnerabilities from environmental degradation and climate change. Responses need to be multifaceted, addressing both on-farm practices and broader socio-economic and environmental factors.
- Scaling NPP: Implementing Nature-Positive Practices (NPP) requires robust extension services and addressing institutional and socio-economic barriers to achieve large-scale impact.
- Champion Farmer Model: Local champion farmers serve as effective role models, showcasing successful agroecology practices. Their experiences can be compiled into an NPP/agroecology manual for wider adoption by farmers and extension officers.

Food transformation levers

Several key levers (both external and internal) explain the successful implementation of the interventions:

Table 2.4: Food systems transformational levers

Principle	Initiative
Recycling	Using crop waste and food leftovers for farmyard manure, and repurposing old materials for greenhouse construction.
Input Reduction	Increased use of certified seeds reduces pests and pesticide use. Organic and farmyard manure replace inorganic fertilizers.
Soil Health	Farmers use farm manure, cover crops, and nitrogen-fixing crops, improving soil conditions.
Synergies	Integration of crops, trees, and livestock is common, with Bracharia and Kakamega grasses used for fodder. Water pans are used for fish farming.
Economic Diversification	Farmers grow diverse food and commercial crops (e.g., maize, avocados, and French beans) alongside livestock.
Co-Creation and Knowledge Sharing	Farmers receive capacity building and share indigenous knowledge. WWF partnerships provide information access, and farmer experimentation, such as grafting grapes with loquats, enhances adaptability.
Land and Resource governance	Governance frameworks like the River Health Assessment Framework (RHAF) and the PFMP guide resource use, supported by strong institutional setups in CFAs and WRUAs.
Social values and diets	Traditional food storage methods, like underground pumpkin storage, help during dry seasons and maximize profits.
Connectivity	Farmers have market access through contracts, such as supplying potatoes to Nakuru Potato Cooperative Union.

Case Study 3: Nature-Positive practices for on-farm and catchment conservation across different scales in Amboseli, Southern Kenya Landscape, Kajiado

Nature-Positive practices for on-farm and catchment conservation across different scales in Amboseli, Southern Kenya Landscape, Kajiado	**Case Study Summary Box: Case Study 3**	
	Landscape	Southern Kenya – Northern Tanzania (SOKNOT)
	Sub-Landscape	Amboseli-Chyulu
	Ecosystem	Forests, water, farmland, grassland
	Sector	Forestry, water, agriculture and grassland
	Region	Kimana -Amboseli
	Type of initiative	**Nature-Positive** practices for restoration of forests, farmlands and grasslands
	Key Agroecological Principles	Recycling, synergies, soil health, biodiversity, co-creation and sharing of knowledge, economic diversification, social values and diets, and resource governance
	Product (s) / Impacts	**People:** Improved incomes, especially for women through sale of grass, milk and tree seedlings; Reduced wildlife conflict **Nature**: Enhanced farm and forest biodiversity; Restoration of 70ha of forests, springs and grasslands **Climate**: On-farm agroecological practices and growing of 70,000 trees in the Oloitoktok forest has the potential to sequester GHG emissions and improve climate resilience.
	Nexus	Processes for shaping on-farm and catchment-scale conservation and restoration.
	Summary of the case	• The case focuses on recent efforts to restore the Amboseli ecosystem to address increasing vulnerability of the population and intensity of human-wildlife conflicts. • It demonstrates processes and approaches for empowering communities to implement collaborative management approaches across the landscape (from forest, farmland and grassland restoration) for household resilience and managing human-wildlife conflict • The case describes the application of innovative approaches to enhancing the conservancy model in Amboseli through integrated tree and grass model nursery, revamping Water Resource User Associations, women empowerment and collective action to enhance conservancy model

Background

The Amboseli landscape in Kenya spans over 500,000 hectares, including the 392km² Amboseli National Park (ANP), surrounded by six Maasai group ranches: Mbirikani, Kuku (now ALOCA), Olgulului, Rombo, and Eselengei (Figure 8.1).

This region is a cultural and economic hub for Maasai pastoralism, with diverse wildlife and migratory corridors, particularly for elephants, extending across community ranches . These group ranches provide critical habitats due to their communal land tenure and pastoral practices . Amboseli NP, along with its wildlife corridors, links ecologically to Tanzania and Tsavo West, making it a major tourist destination .

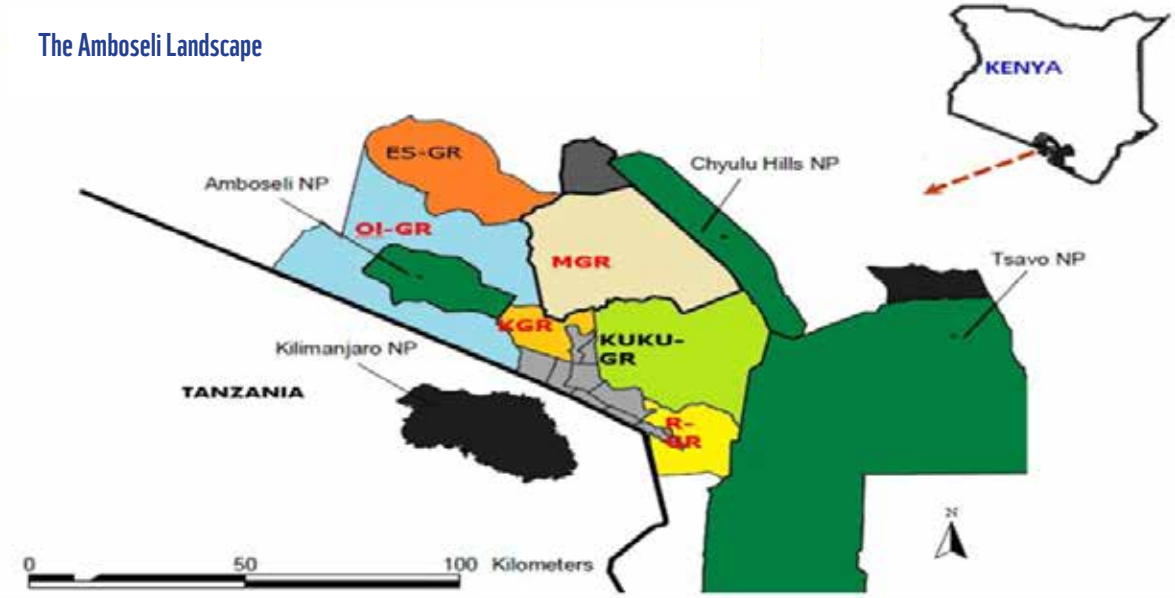


Figure 3.1: Amboseli-Chyulu sub-landscape

Problem/Main Challenge

The Amboseli landscape has faced long-standing conservation and development challenges, largely due to land tenure changes leading to the subdivision of group ranches . Key issues include:

- Rising Settlements: Since the 1980s, increasing settlements in the upper and middle catchments have intensified agricultural activities, especially around Kimana Forest and wetlands.
- Land Use Shifts: The transition from pastoralism to crop farming and mining has strained wildlife conservation, reducing pasture availability for both livestock and wildlife.
- Habitat Loss: Development of settlements and tourism facilities in fragile habitats has fragmented wildlife corridors, especially between Amboseli and neighboring protected areas.
- Resource Exploitation: Poaching, illegal logging, and deforestation have escalated, causing soil erosion and declining productivity.
- Wetland Degradation: Kimana swamp has been fragmented into farmlands, becoming a hotspot for human-wildlife conflict.
- Rangeland Degradation: Continuous grazing, climate change, and invasive species have diminished drought-resistant pastures, increasing habitat degradation.
- Water Resource Competition: Springs from Mt. Kilimanjaro, vital for both wildlife and farming, are under pressure due to the rise in irrigated agriculture, threatening ecosystem balance.

Table 3.1 Contextual analysis of the problem (Indirect threat, direct threats and stresses)

Indirect threats	Direct threats	Stresses
Rising population leading to land subdivision mainly for crop farming	Massive degradation of the forest, water and rangeland ecosystems	Degradation of the ecosystem, reduced pasture availability
Poor governance on management of forest, water and grassland ecosystems	Continuous grazing and presence of invasive species	Low land productivity
Limited options for diversification of livelihoods	Climate change	Fragile livelihood options, food insecurity and eroded resilience of communities

Key interventions

This case study highlights a basin approach to restore the Amboseli ecosystem, focusing on forest areas near Mt. Kilimanjaro, adjacent farmlands, and pastoral rangelands.

Photo: Model tree nursery, Oloitoktok forest station

Working with community members to undertake forest restoration.

The Oloitoktok CFA has partnered with the Kenya Forest Service (KFS) to sustainably manage the degraded forest ecosystem. Through PELIS, community members grow crops on degraded plots while nurturing new trees, enhancing both forest restoration and local food security . With support from WWF, over 2,000 Oloitoktok CFA members have been trained in tree nursery management and care. As of March 2024, they had planted more than 20,000 seedlings in degraded forest areas, following the planting of 50,000 seedlings in 2023. To further enhance sustainability, WWF and KFS established a model nursery featuring a mix of exotic and indigenous trees, fruit trees, and grass seed banks.

The initiative encourages local communities to grow diverse tree species and fruits to enhance nutrition in neighboring households. Community members receive a few free seedlings and can also purchase more.

The model nursery, equipped with a solar-powered irrigation system, can produce 500,000 seedlings and currently houses over 30 tree species, as well as brachiaria and Kakamega grass. Farmers can collect splits for pasture production. As observed by one of the Kenya Forest service's officers;

"Brachiaria grass is a very good grass species appreciated by farmers around here. The community is expected to come buy grass splits, as KFS officers, we know farmers who take their livestock to graze in the forest and we know that this grass will go an extra mile to provide pasture to farmers with large herds of cattle. We are hopeful that by planting this grass species, it will reduce pressure on the Oloitoktok Forest.

As a way of encouraging tree growing in their own farms, some women groups and church led faith-based organizations have been trained and taken up our tree nursery as a business. This ensures that they are supported towards economic empowerment and to participate in environmental conservation in the area.

On-Farm Interventions: Advancing Agroecological Transition through Farmer Groups

Farmers in the study area have been trained in agroecological practices through WWF, implementing methods like composting, organic fertilizers, surface planting, terracing, fruit tree integration, and biological pest control. Eight women's groups, averaging 12 members each, learned tree nursery management, grass propagation for dairy production, crop diversification, and terracing. One group leader highlighted that women manage households well and benefit from fruits and dairy products, emphasizing the need for gender integration in agroecological transitions.

The farms showcased diversification with avocado and banana trees, Napier and Kakamega grass, and dairy production, enhancing household resilience against extreme weather shocks, as observed in the Naramatisho Women's Group. The project partners with the Kenya Agricultural and Livestock Research Organization (KALRO) to improve dairy farming with better breeds. Additionally, rainwater harvesting and grass planting on terraces reduce runoff and provide livestock feed.

Box 3.1: Landscape Restoration Case Study: Naramatisho Women Group (20 Members)

Over the past decade, farms in Oloitoktok's upper catchment have experienced erosion, resulting in significant fertility loss. Members of the Naramatisho Women Group received training in nursery preparation and terrace construction, implementing agroecological practices. A focus group discussion revealed that more than half of the members established terraces through a cost-sharing arrangement, with WWF covering half the costs.

The group has successfully propagated three grass varieties—Boma Rhode, Maasai Love Grass, and Cenchrus ciliaris (Buffel-grass)—doubling pasture production. Additionally, they launched the Naramatisho Environmental Project, cultivating over 60,000 exotic and indigenous tree seedlings and earning 2 million Kenya Shillings in 2023. Members now integrate fruit trees into their farms, with the group's chairlady planting over ten fruit trees. They also incorporate sunflowers into their maize fields to produce oil, deter birds, and attract bees for bean pollination.

Restoration of fresh water ecosystem
To tackle competition for water resources, the WRUA in Kimana has established rules and enforcement mechanisms for water use. As the chair of a water users committee noted,

"So, the key water governance structure here, to me, at the grassroots level, is the furrow committee because we have agreed on a timetable on how water will be distributed, how water will be used amongst the various water users, then also to ensure that we have some water that is left, these flows, for wildlife and other livestock use" – Chair of Water Users Furrow Committee, Kimana.

WWF has trained local farmers in water use efficiency, leading many to adopt drip irrigation instead of traditional flood methods. In 2023, WWF developed a master plan for natural resource coordination and initiated discussions to establish a cross-border water coordination platform. Collaborating with national and county governments, they are repairing water channels and gates. Enforcement of water use among upstream and midstream users is crucial for ensuring adequate supply for downstream conservancies, as unsustainable practices have led to human-wildlife conflicts, including armed clashes over water scarcity.

Restoration of Livestock-Wildlife Grassland System
The Amboseli ecosystem's lowlands are primarily used for crops, livestock, and wildlife. Since 2021, WWF has partnered with the Amboseli Landowners Conservancies Association (ALOCA) to promote drought-resistant crops and tree species, such as Melia volkensii. They are also setting up a demonstration farm for high-value dragon fruit.

A key initiative involves strengthening a women-led cooperative in the rangelands near Kimana, focusing on pasture production, improved animal husbandry, and selecting appropriate livestock breeds. The cooperative promotes grass species like Cenchrus ciliaris, Chloris roxburgiana, and Eragrostis superba. These efforts have increased livestock numbers due to improved pasture availability, and women are now harvesting and selling grass seeds, providing an additional income source (Box 3.2).

Box 3.2: Women Milk Dairy Cooperative Board near Kimana (200 women).

In June 2023, WWF and KALRO trained 200 women from 15 groups in the Kimana rangelands on resilient pasture and forage species, as well as dairy livestock production. Following the training, many women established these pasture species on their farms and purchased improved livestock breeds due to increased pasture availability. As a result, milk productivity has nearly doubled, leading to contracts for milk sales with hotels in Kimana. Notably, two women were included in the grazing committee for the first time, allowing them to participate in planning and grazing management.

WWF's key intervention in the area focuses on restoring grasslands and managing grazing systems that benefit both wildlife and livestock. Partnering with Just Dig It, WWF aims to restore 300 hectares of degraded rangelands by developing soil bunds.

Local communities are also supported in creating 10 hectares of seed banks for reseeding. Training has been provided to local youth on grassland restoration, targeting 150 acres with specific grass species like Cenchrus ciliaris and Chloris roxburgiana. To combat erosion, water conservation measures, such as trenches and terraces (fanya juu), have been implemented. A managed grazing system has been established to protect restored areas, using branches from shrubs to prevent livestock and wildlife grazing.

Photo: Aloka Grassland restoration and managed grazing

The livelihoods of a Maasai community in Manyatta village, near Amboseli National Park, have been severely impacted by high levels of degradation. Limited pasture availability has led to increased wildlife attacks on livestock, heightening their vulnerability and contributing to rising malnutrition rates.

To support this community, WWF trained women in vegetable gardening and beekeeping. Previously, community members spent KES 1,400 traveling to Kimana for vegetables, but kitchen gardens have alleviated this challenge. The women also established beekeeping enterprises, which protect their gardens from elephant damage. These initiatives have generated income and helped reduce malnutrition levels in the community.

Photo: Vegetable gardening in Engong, Narok, Amboseli

Bee keeping by a women group in Enkong Narok, Amboseli

Table 3.2: Applicable Agroecology Principles

Principle	Initiative
Recycling	Farmers are converting crop waste and food leftovers into farmyard manure and compost.
Input Reduction	The increased use of organic farmyard manure and compost reduces reliance on inorganic fertilizers.
Soil Health	Utilizing organic fertilizers, cover crops, and biopesticides, along with terracing, enhances soil fertility, structure, and overall health.
Synergies	Farmers are integrating crops, trees, and livestock, creating mutual benefits. Crops receive shade and nutrients from agroforestry species, while Bracharia and Kakamega grasses improve livestock feed.
Economic Diversification	Farmers in the upper catchment are diversifying into pasture seed and tree cultivation for income. In 2023, members of one women's group earned an average of KES 8,000 from tree seedling sales. Additionally, women who previously relied on spouses are now engaged in collective dairy farming for income.
Co-Creation and sharing of knowledge	Farmers have received training in agroecological practices through partnerships with WWF and other organizations, fostering collaboration between farmers and experts.
Biodiversity	Agroecological practices have enhanced farm biodiversity and increased forest cover in the Kimana Forest. Women's groups are also cultivating bees, contributing to a rising bee population.
Land and Resource governance	Efforts are underway to strengthen co-management frameworks for forests, water, and rangelands. With WWF's support, the Oloitoktok CFA developed the PFMP to guide forest co-management with KFS. A master plan for natural resource coordination has also been established, uniting local communities, government agencies, and NGOs.
Social values and diets	WWF's interventions in the livestock value chain recognize the social dynamics of milk ownership, promoting women's inclusion in grazing committees in an increasingly patriarchal area.
Connectivity	Increased pasture access has enhanced milk market opportunities. A women's group in Kimana has secured a contract to supply milk to local hotels, strengthening short value chains and benefiting the community, particularly women.
Participation	Partnerships for ecosystem governance have been established, including the Amboseli Ecosystem Trust (AET) and the Big Life Foundation (BLF).

Outputs based on NPP pillars

The intervention has delivered multiple NPP outputs (protect, manage and restore), these include;

Table 3.3: Outputs based on NPP Pillars

Pillar	Description
Protect	• Reduced degradation of the Oloitoktok forest; reduced encroachment on wetlands in Kimana; • Models that promote multi-functional landscapes have been implemented such as PFM.
Manage	• There is increased restoration of degraded lands through practices such as agroforestry, diversity and soil and water conservation Increased adoption of agroecology principles • Increased adoption of diversified livelihoods which support adoption of sustainable practices on -farm and household resilience • There is increased resource use efficiency (especially water) which has reduced the pressure on underground water and Kimana wetlands
Restore	• The Oloitoktok forest has been restored; the process of restoring the rangelands near Kimana have begun and increased adoption of agroecological practices by local farmers has begun to improve soil health.

Impacts

The interventions in Amboseli, Kajiado, have led to significant positive outcomes for people, nature, and the climate.

People:

- **Increased Income**: Farmers and pastoralists have enhanced their earnings through improved productivity and diversified income from milk and pasture sales, including seedlings sold to WWF and others.
- **Pest and Disease Reduction:** Crop rotation and diversification have reduced pest infestations, improved yields, and bolstered food security.
- **Market Access:** Women's groups have successfully accessed milk markets through collective efforts, including a cooperative contract to supply milk in Kimana.
- **Reduced Conflicts:** Collaborative restoration of forests and rangelands has decreased human-wildlife and human-human conflicts, aided by established water use regulations.
- **Women's Empowerment:** Increased income from seedling and milk sales has empowered women.
- **Sustainable Systems:** Initiatives in pasture production and managed grazing enhance the sustainability of livestock-wildlife systems in Amboseli's rangelands.

Nature:

- **Biodiversity Enhancement:** Agroecological practices have increased biodiversity in farms and forests.
- **Soil Improvement:** Enhanced soil fertility from reduced erosion and effective manure use has improved soil health.
- **Crop Diversity:** A two-acre farm now supports 30 different crop types, increasing biodiversity.
- **Water Spring Restoration:** Tree planting has aided in restoring local water springs.
- **Forest Restoration:** The use of indigenous trees has supported forest recovery, while encroachment into reserves has significantly declined due to livelihood diversification efforts by WWF.

Climate:

- Tree Planting: More than 70,000 tree seedlings have been planted in Oloitoktok forest, contributing to potential GHG sequestration.
- Agroecological Practices: Implementing agroecological methods will mitigate GHG emissions, positively affecting the climate.

Lessons and transformational levers

The case has demonstrated that several levers are at play in informing the success of the interventions (Table 3.4).

Table 3.4: Food systems transformational levers

Pillar	Description
Protect	• Reduced degradation of the Oloitoktok forest; reduced encroachment on wetlands in Kimana; • Models that promote multi-functional landscapes have been implemented such as PFM.
Manage	• There is increased restoration of degraded lands through practices such as agroforestry, diversity and soil and water conservation Increased adoption of agroecology principles
	• Increased adoption of diversified livelihoods which support adoption of sustainable practices on -farm and household resilience • There is increased resource use efficiency (especially water) which has reduced the pressure on underground water and Kimana wetlands
Restore	• The Oloitoktok forest has been restored; the process of restoring the rangelands near Kimana have begun and increased adoption of agroecological practices by local farmers has begun to improve soil health.

Case Study 4: Role of WRUAs and lead farmers in catchment protection and livelihood diversification in Bomet, Kenya

The interventions in Amboseli, Kajiado, have led to significant positive outcomes for people, Women's Empowerment: Increased income from seedling and milk sales has empowered women.

Role of WRUAs and lead farmers in catchment protection and livelihood diversification in Bomet, Kenya	**Case study Summary Box: Case study 4**	
	Landscape	Southern Kenya
	Sub-Landscape	Greater Mara
	Ecosystem	Mara River Basin
	Sector	Forestry, water and agriculture
	Region	Bomet East
	Type of initiatives	• Farmer-led catchment protection • Agroforestry • Riparian land protection • Good agricultural practices
	Products	• Increased spring protection • Increased agroforestry farmer-led conservation • Enhanced governance for farm and forest biodiversity • Livelihood diversification
	Nexus	• Community-led processes and systems for shaping on-farm and catchment-scale conservation and restoration
	Key Agroecological Principles	• Land and resource governance; diversity; resilience; co-creation and sharing of knowledge
	Summary of Initiative	• The case demonstrates the role of WRUAs and lead farmers to pilot and promote agroecological practices including catchment protection, agroforestry, riparian land protection and good agricultural practices. Use of community-based models to manage ecosystems are potentially more efficient, cost-effective and sustainable.

Impacts

The interventions in Amboseli, Kajiado, have led to significant positive outcomes for people, nature, and the climate.

People:

- Increased Income: Farmers and pastoralists have enhanced their earnings through improved productivity and diversified income from milk and pasture sales, including seedlings sold to WWF and others.
- Pest and Disease Reduction: Crop rotation and diversification have reduced pest infestations, improved yields, and bolstered food security.
- Market Access: Women's groups have successfully accessed milk markets through collective efforts, including a cooperative contract to supply milk in Kimana.
- Reduced Conflicts: Collaborative restoration of forests and rangelands has decreased human-wildlife and human-human conflicts, aided by established water use regulations.
- Women's Empowerment: Increased income from seedling and milk sales has empowered women.
- Sustainable Systems: Initiatives in pasture production and managed grazing enhance the sustainability of livestock-wildlife systems in Amboseli's rangelands.

Nature:

- Biodiversity Enhancement: Agroecological practices have increased biodiversity in farms and forests.
- Soil Improvement: Enhanced soil fertility from reduced erosion and effective manure use has improved soil health.
- Crop Diversity: A two-acre farm now supports 30 different crop types, increasing biodiversity.
- Water Spring Restoration: Tree planting has aided in restoring local water springs.
- Forest Restoration: The use of indigenous trees has supported forest recovery, while encroachment into reserves has significantly declined due to livelihood diversification efforts by WWF.

Climate:

- Tree Planting: More than 70,000 tree seedlings have been planted in Oloitoktok forest, contributing to potential GHG sequestration.
- Agroecological Practices: Implementing agroecological methods will mitigate GHG emissions, positively affecting the climate.

Lessons and transformational levers

The case has demonstrated that several levers are at play in informing the success of the interventions (Table 3.4).

Table 3.4: Food systems transformational levers

Cluster	Levers
Natural Resource Management (NRM)	• Addressing farmers' vulnerability to degradation and climate change requires an integrated approach that tackles challenges across forests, farmlands, and rangelands. • Resilience of crop-livestock systems is enhanced through participatory land, forest, and grassland restoration efforts.
Education and Knowledge	• Community members received training in leadership, business planning, and pest management, supported by ongoing follow-ups from WWF. • The program highlights the benefits of training and exposure for women, who form the majority of the groups. • Robust extension programs must introduce NRM concepts to farmers, with consistent follow-ups.

Governance Institutions	• Scaling up NRM initiatives requires addressing institutional and socio-economic constraints, such as women's empowerment and equitable water sharing. • Effective governance is demonstrated through group by-laws that apply across ecosystems—forests, water, and grasslands. • Active community participation, particularly by women, is vital for enhancing livelihoods and supporting conservation efforts. • Strengthening women-led cooperatives in rangelands is crucial for household management and food security. • Interventions have shifted community perceptions, enabling women to take on leadership roles, including positions in grazing committees.
Financing	• Many interventions were demand-driven, such as cost-sharing for terracing, agroecological practices, and livestock improvements. • Farmers are more likely to adopt practices with higher returns on investment when they feel a sense of ownership over the interventions.

Case Study 4: Role of WRUAs and lead farmers in catchment protection and livelihood diversification in Bomet, Kenya

Role of WRUAs and lead farmers in catchment protection and livelihood diversification in Bomet, Kenya	**Case study Summary Box: Case study 4**	
	Landscape	Southern Kenya
	Sub-Landscape	Greater Mara
	Ecosystem	Mara River Basin
	Sector	Forestry, water and agriculture
	Region	Bomet East
	Type of initiatives	• Farmer-led catchment protection • Agroforestry • Riparian land protection • Good agricultural practices
	Products	• Increased spring protection • Increased agroforestry farmer-led conservation • Enhanced governance for farm and forest biodiversity • Livelihood diversification
	Nexus	• Community-led processes and systems for shaping on-farm and catchment-scale conservation and restoration
	Key Agroecological Principles	• Land and resource governance; diversity; resilience; co-creation and sharing of knowledge
	Summary of Initiative	• The case demonstrates the role of WRUAs and lead farmers to pilot and promote agroecological practices including catchment protection, agroforestry, riparian land protection and good agricultural practices. Use of community-based models to manage ecosystems are potentially more efficient, cost-effective and sustainable.

Background

The Southern Kenya landscape forms part of the Southern Kenya – Northern Tanzania (SOKNOT) transboundary area, covering 134,000km² from Lake Victoria to the Indian Ocean. This region includes vital wildlife habitats such as the Mara-Serengeti, Amboseli-Kilimanjaro, and Tsavo-Mkomazi sub-landscapes, supporting over 2 million people through tourism, livestock, and agriculture. The Greater Mara Sub-Landscape is particularly rich in biodiversity, housing over 60% of Kenya's wildlife. The Mara River Basin features diverse ecosystems, including forests, grasslands, wetlands, and floodplains, with upland forests serving as the River Mara's critical headwaters.

Bomet County, which borders the Mau Complex Forests—Kenya's most significant water tower—plays a crucial role in conservation efforts. This indigenous forest supports various species and is intersected by important rivers such as Kipsonoi, Chemosit, Nyongores, and Amalo. However, agricultural transformation driven by a growing human population has led to significant conversion of forests and grasslands into farmland, particularly in the upper and middle parts of the basin.

The devolution of water resource management in Kenya has facilitated collaborative management of natural resources, empowering communities to manage their water resources responsibly. This policy established WRUAs, allowing stakeholders to cooperatively manage and conserve shared water resources. WWF has supported the formation and strengthening of over 22 WRUAs in the Mara River basin, showcasing how these associations can enhance biodiversity conservation sustainably.

Figure 4.1: Map of Kenya showing Bomet County
Source: https://hendersonsattenwek.com/tenwek-hospital/

Figure 4.2: Mara River and its main tributaries and the Masai Mara and Serengeti protected areas

The Problem

The Mara River ecosystem faces significant challenges due to human encroachment into the Mau Forest, leading to decreased water quality and quantity downstream, adversely affecting both people and nature. Increased charcoal production from riverine trees, poor agricultural practices, and the release of pollutants (fertilizers, chemicals, and wastewater) into the river have exacerbated soil erosion and siltation, particularly in the Amala River.

Upstream households suffer from soil loss and declining farm productivity, while poor governance has led to illegal water abstractions and encroachment on riparian lands. The upper basin is grappling with over-abstraction, unsustainable agricultural practices, degraded lands, deforestation, and climate change, which have all contributed to reduced river flow. This decline impacts the migration patterns of wildebeest in the Maasai Mara-Serengeti ecosystem and threatens the livelihoods of local communities in the basin (Table 4.1).

Table 4.1 Contextual analysis of the problem

Indirect threats	Direct threats	Stresses
Rising population, weak incentives for conservation and poverty	Deforestation and invasion of riparian land.	Degradation of habitat, increased runoff and soil crusting and erosion
Poor governance on management of forest, water and grassland ecosystems	Continuous grazing, farming and destruction of riparian land	Low productivity
Limited knowledge on suitable agroecological practices and poor linkage to markets	Use of unsustainable agricultural practices	Degradation of soils, reduced productivity and food insecurity
Limited capacity for adaptation, lack of social safety nets and eroded resilience of agri-food systems,	Climate change	Increased frequency of drought and water stress

Key interventions

Since 2003, WWF has collaborated with local farmers and communities on ecosystem restoration activities, including:

Community governance of water resources through WRUAs.
WWF established and strengthened 23 WRUAs in the Mara River basin, enabling communities to effectively manage water resources. With limited national support, WWF facilitated the development of sub-catchment management plans (SCMPs) to oversee conservation, control water abstraction, and improve land management practices. The Amala WRUA exemplifies successful collaboration with village leaders and institutions to protect ecosystems by replacing farming with productive tree planting and promoting alternative livelihoods, such as dairy goat

Photo: Amala river near Mulot town (June 2024)

farming.

Farm conservation planning

WWF assisted WRUAs and farmer groups in creating farm conservation plans tailored to each farm's unique characteristics. These plans outline conservation objectives, helping farmers align land use goals with the protection of natural resources (Figure 4.3). Local agricultural extension officers supported this planning process.

Figure 4.3: Farm conservation plans Credit: William Langat and Joseph Kones.

Water catchment protection

A flagship activity focused on restoring riparian lands and protecting water catchments, with WRUAs and farmers rehabilitating Esei and Amalo rivers. Farmers planted diverse tree species to stabilize soil, provide habitat, and reduce erosion. Notably, lead farmer Joseph Kones restored a spring with a three-acre forest buffer, benefiting over 500 households by managing siltation and flooding.

Photo: Rehabilitated spring by Mzee Joseph Kones, the Chairman of Esei WRUA in Bomet County

Photo: Forested area protecting the rehabilitated spring by Joseph Kones, from Esei WRUA in Bomet

Livelihood diversification
The project facilitated the identification of income-generating activities (IGAs) that integrate water resource management. Avocado farming emerged as a high-potential activity for ecosystem conservation and income generation. Initial free seedlings transitioned to a cost-sharing model, encouraging responsible practices. Training in agronomy and beekeeping further enhanced income and pollination on farms.

Silviculture: Integration of crop, livestock, and forestry management
Farmers learned sustainable practices such as cover cropping, organic manure use, and nitrogen fixation systems. The project promoted agroforestry tree planting while utilizing riparian lands sustainably. Soil testing ensured suitability for different crops, supported by training from agricultural extension officers. Demonstration centers showcased successful practices to enhance knowledge uptake among farmers.

Knowledge sharing and cooperative establishment
WRUAs facilitated vertical and horizontal knowledge sharing networks, enhancing information transfer and good practices. Demonstration centers showcased agroecological benefits, while cooperatives were formed to support avocado marketing, agronomy training, access to credit, and collective selling.

Overall impact

These interventions have fostered the adoption of agroecological practices, promoting biodiversity, mitigating climate change, and enhancing economic diversity. Table 4.2 shows several principles that have been achieved.

Table 4.2: Interventions and Agroecological practices

Principle	Practices
Land and Resource governance	Strengthened WRUAs foster sustainable water use by uniting village leaders, schools, and various local institutions. They collaborate with county governments and agencies for effective biodiversity conservation.
Diversity	WRUAs promote diversified farming, including agroforestry (avocado, trees), vegetables and dairy. Households now report higher incomes from varied sources.
Co-creation of Knowledge	Collaboration between WRUAs, farmer groups, and cooperatives enhances knowledge sharing on agricultural practices, market access, and resource governance.
Synergy	Integration of crops, trees, and livestock boosts farm productivity, with agroforestry providing shade, fodder, and soil nutrients through farmyard manure and nitrogen-fixing crops like desmodium.
Biodiversity	Land restoration and agroforestry boost bee populations, supporting household beekeeping and enhancing pollination services.
Connectivity	WRUAs have set up cooperatives linking farmers to avocado markets, including exports, reducing transaction costs and raising incomes.

Participation	WRUA and farmer representatives actively engage in local decision-making through platforms like the County Agriculture Sector Steering Committee (CASSCOM).
Input Reduction	Increased use of organic compost, farmyard manure, and pest traps reduces reliance on chemical fertilizers and pesticides.
Soil Health	Organic fertilizers, cover crops, biopesticides, and terracing improve soil fertility and structure, promoting long-term soil health.

Outputs based on NPP pillars

Following the interventions, a number of NPP outputs (protect, manage and restore) have been realized (Table 4.3).

Table 4.3: Outputs based on NPP pillars

Pillar	Description
Protect	• Reduced encroachment of protected forest ecosystems • Reduced water runoff • Improved safeguarding of water sources and river flows • Improved incentives for regenerative agriculture
Manage	• Improved crop and livestock diversity • Increased sharing and utilization of indigenous knowledge • Improved incomes • Improved collaborative governance model
Restore	• Improved soil health and nutrition • Innovative agricultural and extension advisory services • Improved management of water resources • Improved management of riparian banks and buffers

Impacts

The interventions in Bomet have significantly benefited people, nature, and climate. For households, diversified livelihoods—avocado, tree, and sustainable dairy farming—have increased incomes. In 2023, over 2,000 avocado farmers in Kembu Ward earned 30 million Kenya Shillings, with prices rising from 30 to 100 Kenya Shillings per kilogram. Employment opportunities for women and youth in fruit and tree nurseries have also increased. Improved access to water is saving time for women and girls, while modern stoves reduce firewood use, helping prevent deforestation.

On the environmental side, interventions have protected water resources and enhanced regenerative agriculture through practices like integrated pest and nutrient management, leading to improved soil health and water flow. Over 500 households now have better access to water, and 10km of river has been restored. Forest restoration efforts, including agroforestry, have reduced erosion on 100 acres and improved the area's forest cover.

In terms of climate, increased forest cover has improved rainfall and helped sequester carbon. Agroecological practices, such as reduced use of inorganic inputs and cover cropping, are reducing GHG emissions.

Lessons

- Farmer groups and centers of excellence are essential for encouraging agroecology practices.
- WRUAs and lead farmers play a critical role in engaging government support, particularly through platforms like CASSCOM.
- Providing incentives, such as co-payment for seedlings, motivates farmers to participate in restoration activities, combining conservation with income generation.
- Empowering WRUAs to offer value-added services, like nurseries, promotes sustainability.

- Collective action strengthens market linkages and information dissemination on agroecology.
- Greater collaboration is needed between WRUAs and the government on Forest and Land Restoration (FLR) programs.
- Youth engagement in activities like seedling production should be incentivized by local governments purchasing seedlings from them.
- Planning is needed for potential flood damage due to peak water flows.
- SCMPs should be more locally driven to integrate community knowledge and needs.
- FLR impacts are uneven, often affecting poorer people. An audit of how WRUAs share benefits with vulnerable communities is necessary for equity**.**

In summary, the lessons identified have potential to promote food systems transformation through the following levers (Table 4.4).

Table 4.4: Food systems transformational levers

Cluster	Lever
Knowledge and Education	• Collective action key for linkages to better markets and dissemination of agroecological information • Need for more localized participation to ensure that integration of local knowledge and priorities in plans is bottom-up • Use of WRUAs and farmer centers of excellence for horizontal creation and transfer of knowledge and good practices.
Natural Resource Management (NMG)	Agroforestry and tree planting is undertaken as a measure of the forest and riparian land restoration
Governance Institutions	Working with WRUAs and lead farmers who can influence governance is critical for harnessing support and collaborations from the government.

Case Study 5: Working with communities, to implement co-management approaches for healthy marine and terrestrial ecosystems in Kenya's coastal landscape

Working with communities, to implement co-management approaches for healthy marine and terrestrial ecosystems in Kenya's coastal landscape	**Case study summary box: Case Study 5**	
	Landscape	Coastal Kenya
	Ecosystem	Forests (coastal mangrove), and marine (oceans and vast terrestrial waters)
	Sector	Forestry, water and fisheries
	Region	Kilifi County, Malindi Sub County
	Type of initiative	Restoration of the coastal mangrove forest ecosystem
	Product (s)	Improved mangrove carbon sequestration. Preservation of fish breeding sites, leading to increased fish populations. Enhanced livelihoods through crab farming, apiculture, and ecotourism. Successful community-driven mangrove restoration, rehabilitating 30 hectares via PFM.
	Nexus	Co-management of forest and marine protected areas.
	Key Agroecological Principles	Economic diversification, recycling, synergies, participation, biodiversity, connectivity, knowledge co-creation, resource governance, and social values.
	Summary of the case	The case highlights empowering coastal Kenya communities to collaboratively manage natural resources across water, forests, wildlife, and marine sectors. Innovative crab farming using KEMFRI's cage system supports **sustainable income** and conservation, recognized globally. The Crab Shack - Board Walk Restaurant turns crab farming into a successful **ecotourism** venture, boosting local economies. DCCG strengthens **ecosystem protection** through surveillance and local scouts, preventing illegal activities and safeguarding mangroves and marine life.

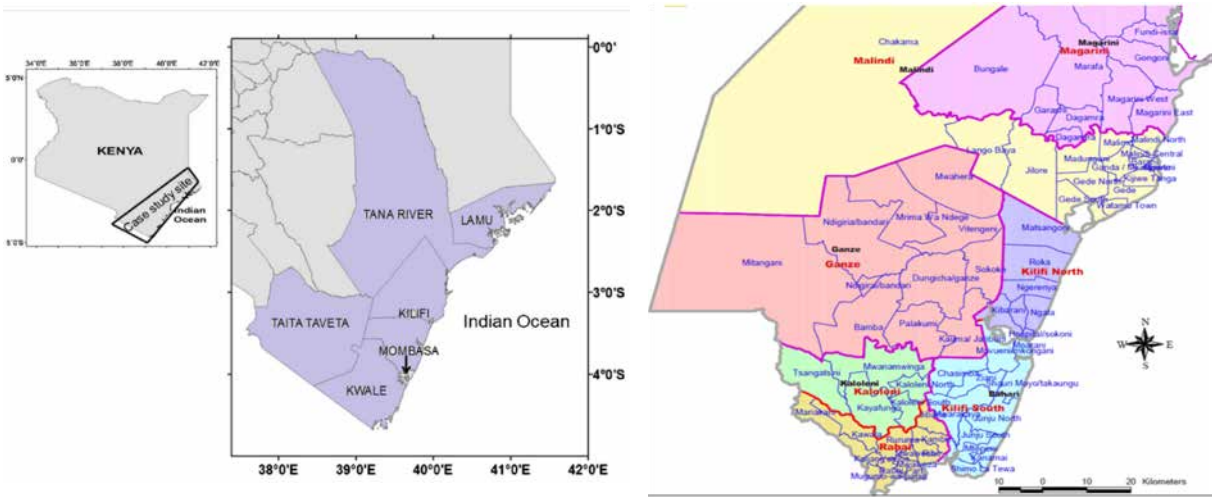


Figure 5.1: Spatial distribution of the Kenya's coastal region

The Problem

Marine ecosystems face threats from mangrove loss, overfishing, pollution, population growth, climate change, and development pressure. These factors degrade habitats, harming marine life, and reducing long-term sustainability. Overexploitation, unsustainable fishing, and limited livelihood options worsen the situation.

Table 5.1 Contextual analysis of the problem (Indirect threat, direct threats and stresses)

Indirect threats	Direct threats	Stresses
Rising population, high dependence of mangroves for livelihoods and poverty	Massive degradation of the mangrove forest due to over extraction (illegal harvesting and forest encroachment)	Degradation of habitat and deteriorated fish catch
Poor governance on management of mangrove forests which hinders long-term investments on conservation	pollution from plastics to oil spills to agrochemicals	Degradation of habitat and fish loss/depletion and flooding during heavy rains
Limited options for diversification of livelihoods	Climate change	Fragile livelihood options, food insecurity and eroded resilience of communities

Key Interventions

The Dabaso Creek Conservation Group (DCCG), in collaboration with partners like KEMFRI, KWS, KFS, and WWF, has been working to restore and protect the coastal mangrove ecosystem in Kilifi County, Kenya. This community-based organization (CBO) was formed in response to severe mangrove degradation and declining fish stocks, which had long supported local livelihoods. Traditional activities such as artisanal fishing and mangrove harvesting were central to the community's economy. The CBO operates on principles of community participation, voluntary membership, and collaborative decision-making, with the belief that people actively protect resources they value. Key interventions include:

Crab farming
To address income challenges, DCCG introduced crab farming using bamboo cages with technical support from KEMFRI. The initiative uses small crabs from by-catch, contributing to sustainable fisheries. This project has provided significant financial benefits, increased local income, and gained national and international recognition.

Eco–tourism for food connection
The group created the Crab Shack - Board Walk Restaurant, located on the Dabaso shoreline. Initially designed to access crab cages, it evolved into a popular restaurant serving locally farmed crabs. It has attracted tourists and boosted the local economy.

Habitat restoration and ecosystem protection
The group, with community participation, leads both mangrove and terrestrial tree planting efforts in the creek and nearby lands, restoring 30 hectares of degraded sites. Using the PFM model, they involve local stakeholders through the Community Forest Association (CFA) to ensure sustainable ecosystem management. Surveillance by local scouts prevents illegal activities like logging, with incidents reported to relevant authorities such as Kenya Fisheries Service and Kenya Forest Service.

Establishment of waste management value chain
In Mukoroshoni, Shanzu Ward, a group established a waste management value chain to protect coastal ecosystems and support community livelihoods. Collaborating with BMUs, they collect, sort, and sell waste, addressing the harmful impact of plastic debris on mangroves and marine life. Regular cleanups and educational campaigns help preserve fish breeding sites. With WWF support, the group plans to expand into garbage recycling, organic fertilizer production, and vegetable farming.

Table 5.2: Applicable agroecology principles

Principle	Dimension within the initiative
Recycling	• Established a value chain for waste collection, sorting, and selling waste for recycling. • The recycling of the waste into bio fertilizer that is used by the farmers.
Economic Diversification	• Diverse economic activities including crab farming using cage, beekeeping and hospitality business.
Reduction in external input use;	• Planting of local tree varieties. Local tree varieties are often better adapted to the local climate and soil conditions, requiring less water and contributing to the recycling of water within the ecosystem. • Use of fish offal's to feed the crabs. This practice reduces reliance on commercial feed, which often involves long supply chains and additional resource extraction, thereby promoting a more sustainable and closed-loop system.
Biodiversity	• Trees planted for forest conservation. • Forest protection activities e.g. patrols by community members. • The conservation of mangrove for fish breeding. • Waste collection allows fish to grow.
Co creation and knowledge sharing	• Working with KEMFRI and other partners to optimize design of cages. • Working with KFS to optimize forest rehabilitation. • Strong ownership of the initiative which was managed by the locals. • Many of the members had worked in the hospitality sector – the requisite experience was critical for success.
Participation	• The group has a mix of the demographic dividend–old, youth and women. • The group has developed policies that reduce inequality and promote equity among its members and employees of the initiative. • Gender mainstreaming.
Connectivity	• Products are marketed locally. • Sourcing of fingerings from the local fisher folk. • The fish /crab is sold in local hotels. • Networks are well established.
Synergies	• Bycatch is nurtured and introduced into the food chains – mainly hotels.
Resource governance and social values and diets	• KEMFRI trained DCCG members on how to carry out the research activities especially in feeding the crabs in cages and data entry as stipulated in data entry forms. • Management of the ecosystem is done through the PFM model.

Outputs based on NPP pillars

The interventions have delivered multiple NPP outputs (protect, manage and restore), these include;

Table 5.3: Outputs based on NPP pillars

Pillar	Description
Protect	• Reduced encroachment of mangrove ecosystems. • Improved safeguarding and conservation of fish breeding sites.
Manage	• Improved fish stocks. • Increased sharing and utilization of indigenous knowledge in translating science into transformative food system actions. • Emergence of inclusive governance systems for conservation of marine ecosystems.
Restore	• Mangrove ecosystem has been restored (rehabilitated 30 hectares of degraded sites)

Impacts

The interventions have generated positive impacts on people, nature, and climate.

People:
the initiative has improved livelihoods for over 100 families who no longer rely on mangrove forests for survival. Increased fish catch due to protected breeding sites has boosted household income and food security. Crab farming and eco-tourism have created jobs for community members, employing 11 men, 18 women, 13 youth, and 3 people with disabilities. The group includes elders, women, youth, and marginalized groups like the Sanya tribe. Youth work in various roles, such as waiters, canoe riders, and crab farm attendants. The group promotes gender equality through gender mainstreaming and women empowerment, ensuring women are represented in governance and activities. Collaborative approaches have united stakeholders in sustainable natural resource management.

Nature:
the initiative has restored the mangrove ecosystem, enabling natural regeneration and providing protection against climate impacts like strong winds. Beach cleanups have further rehabilitated the environment. Crab fattening, based on bycatch, supports biodiversity conservation.

Climate:
mangroves sequester carbon, helping mitigate climate change by storing CO2 in their biomass and soil. The sustainable practices of crab farming support the health of mangroves, enhancing their carbon sequestration ability. Mangrove roots also stabilize shorelines, reducing erosion and providing natural protection against storm surges and rising sea levels.

Lessons

The initiative has shown promising results and potential for scale-up. Key takeaway include:

- **Broad applicability:** This model can be replicated in diverse ecosystems (aquatic, forest, savannah), showing the value of linking restoration with livelihood generation to sustain community interest in conservation.
- **Collaborative success:** Multi-sectoral partnerships (WWF, KFS, KWS, KEMFRI, etc.) and active community involvement have proven effective in restoring ecosystems. Collaboration between research institutions, government agencies, communities, and markets is essential for translating scientific knowledge into practical, locally tailored solutions.
- **Inclusive governance:** Transforming science into action requires inclusive governance systems, engaging youth and women, and supportive policies that incentivize communities to adopt nature-positive practices.

In summary, the lessons identified have potential to promote food systems transformation through the following levers (Table 5.4):

Table 5.4: Food systems transformational levers

Cluster	Levers
Natural Resource Management (NMG)	• NPP transformation extends beyond agroecosystems, applying to aquatic, freshwater, marine, forest, and savannah ecosystems.
Governance Institutions and Knowledge	• Collaboration between stakeholders (WWF, KFS, KWS, KEMFRI, etc.) shows the power of multi-sector partnerships in restoring biodiversity and ecosystem function. • These partnerships have helped scale up crab farming from trials, establish market links, and provide training in project and business management, essential for the knowledge-intensive crab aquaculture process.
Trade	• NPP introduces a variety of products that need market integration, particularly in marine ecosystems. • Crab farming, if managed well, can be profitable but requires careful planning, management, and adherence to environmental regulations for sustainability.

Case Study 6: Protecting mangroves for enhanced livelihoods for fisherfolks in coastal Kenya (the Vanga blue carbon project)

Vanga blue carbon project in vanga	Case Study Summary Box: Case Study 6	
	Landscape	Kenya Coast
	Ecosystem	Forests (coastal mangrove), and marine (oceans and vast terrestrial waters)
	Sector	Forestry, water and fisheries
	Region	Kilifi County, Malindi Sub County
	Type of initiative/ intervention	Restoration of the coastal mangrove forest ecosystem.
	Key Agroecological Principles employed	Input reduction, Synergies, Economic diversification, biodiversity, co-creation and sharing of knowledge, connectivity, social values, participation
	Product (s)/impacts	**People:** Incomes from carbon credit sales; Enhanced livelihood options through various user rights; food security through increased fish harvesting and other sea food such as crustaceans **Nature:** Preservation of fish breeding sites and improved fish population **Climate:** Improved sequestration capacity of mangroves
	Nexus	Co-management approaches in forest and marine ecologies
	Summary of case	The case illustrates the integration of collaborative governance systems, bringing together community members through the CFA, KFS, and WWF to protect and manage 4,428 hectares of mangrove forest. The CFA engages in diversified livelihood activities like fishing, beekeeping, and conservation projects, enhancing livelihoods and environmental conservation, and explores carbon sales to further benefit the community.

Background

The interventions have generated positive impacts on people, nature, and climate.

Kenya's mangrove forests cover 61,000 hectares along its 600 km coastline, with Vanga serving as a crucial food ecosystem. Mangroves support diverse fish species, including molluscs and crustaceans, and 98% of Vanga's population relies on them for energy and wood—54% for firewood, 44% for poles, and 2% for timber (Omondi, 2016). Mangroves also host various wildlife, sequester carbon, regulate climate, and protect coasts from strong winds and waves . These forests provide breeding grounds for marine fish, nutrients for estuarine fauna, and stabilize coastal land by trapping sediment. Located near Kisite Mpunguti Marine National Park, they also support tourism through snorkeling and coral reef attractions.

The Vanga, Jimbo and Kiwegu Mangrove forests are located in a good tourism location. They are close to the Kisite Mpunguti Marine National Park which is a major tourist attraction for snorkeling. Besides these direct benefits, the coastal communities and the nation as a whole have benefited from coral reefs through touristic attraction that the coral reefs offer.

Figure 6.1 Map of Vanga, Jimbo and Kiwegu mangrove ecosystem
Source: KMFRI Blue Forest project 2017

Problem

Vanga's mangrove forests have been declining by 1.34% annually over the past 30 years, driven by overexploitation, illegal harvesting, forest encroachment, and poor farming practices. This rate exceeds the global average. Population growth has increased demand for forest products, both legally and illegally extracted. Climate change impacts, including rising sea levels, altered rainfall, and storms, further threaten the ecosystem.

Destructive harvesting, illegal charcoal burning, and poor agricultural practices worsen erosion, damaging mangroves. Flooding, worsened by mangrove loss, has led to artificial seawall construction, trapping water and increasing village flooding. Overpopulation and poverty (with a poverty index of 0.25, above the national average) exacerbate these challenges, with high unemployment (30%) fueling dependence on degrading mangrove resources (GoK, 2013). Although mangrove ecosystems have tremendous value for coastal communities and biodiversity, they are being destroyed at alarming rates.

Table 6.1 Contextual analysis of the problem (Indirect threat, direct threats and stresses)

Indirect threats	Direct threats	Stresses
Rising population, high dependence of mangroves for livelihoods and poverty	Degradation of the mangroves / over extraction of mangrove wood products (overexploitation of mangrove wood resources, illegal harvesting, forest encroachment)	Degradation of habitat and fish loss/depletion and flooding during heavy rains
Poor governance on management of mangrove forests which hinders long-term investments on conservation	Unsustainable or poor agricultural practices	water scarcity and pressure on the natural resource base and reduced agricultural productivity
Limited options for diversification of livelihoods	Climate change	Increased frequency of drought and water stress and altered precipitation patterns.

Key Interventions

The Vanga, Jimbo, and Kwegu villages collectively manage 4,428 hectares of mangrove forest through the CFA, formed by groups like Mwagugu Self Help Group, Mwambiweje Women Group, and Jimbo Environmental Group. In 2019, the CFA signed a Forest Management Agreement with the KFS, granting them rights to sustainably manage the forest. The CFA's 100 members (60 women, 40 men, and 20 youths) engage in fishing, beekeeping, woodlot management, and forest product harvesting, while also participating in conservation efforts like the Vanga Blue Forest project.

The VAJIKI Participatory Mangrove Forest Management Plan (2019-2023) covers 2,049 hectares of mangrove forest in Kwale County, focusing on sustainable livelihoods, biodiversity protection, and ecotourism. This plan uses a collaborative approach to address community needs and promote long-term forest conservation.

Role of WWF included; improve local awareness of biodiversity, identify research and monitoring needs for effective management, support the communities to implement viable and appropriate IGAs.

Other measures undertaken include;

- Supported community-based aquaculture in mangrove areas by identifying key fish breeding zones and implementing BMU guidelines.
- Promoted the use of natural sea walls (mangrove trees) to prevent village flooding from water overflow.
- Encouraged villagers to plant woodlots on their farms for firewood and timber, reducing reliance on forest resources.
- The CFA planted over 20 million mangrove trees, preserved 750,000 more, and restored 5 acres of encroached land, promoting biodiversity and participating in carbon credit schemes.
- Developed community action plans, including cleanups and mapping areas for aquaculture.
- Established mangrove surveillance outposts for routine patrols and community policing.

Table 6.2: Applicable agroecology principles

Principle	Dimension within the initiative
Input reduction	• The local communities are incorporating organic fertilizers in neighboring farms to reduce agrochemical inflows into mangrove ecosystems.
Synergy	• There is the integration of trees, fisheries and crops to support livelihoods in the Vanga area.
Economic Diversification	• Economic diversification is undertaken to reduce overdependence on mangrove forest products and to reduce overfishing.

Co-creation and knowledge sharing	• There is the implementation of the Participatory Forest Management agreement with KFS where communities are involved in tree nursery development and conserving mangrove resources in partnership with KFS. • The group is working with KEMFRI and other partners to optimize the design of fish cages in the sea (integrated aquaculture).
Connectivity	• Products from the group are marketed locally. • Sourcing of the fingerings is done from the local fisher folk. • Marketing networks are well established by the group.
Biodiversity	• The conservation of mangrove is undertaken to ensure a conducive environment for fish breeding. • CFA planted five acres in an area where the trees had been destroyed/encroached. Terrestrial, over 2000. • Clean-up exercises are done by the local communities to allow fish to grow and fish breeding sites to flourish.
Social values and diets	• There is the integration of women and distribution of benefits to women and youth in the Vanga carbon project.
Land and natural resource governance	• Restoration efforts of the commons is strengthened through institutional arrangements/lens. • There are clear benefit sharing arrangements for revenues from carbon sales. • Documenting the distribution of incomes from forest restoration.
Participation	• There is greater participation of local communities in Vanga in decentralized management of forests and fisheries resources. • The CFA leadership is closely involved in discussions on management of the resources beyond the local level. • There is a strong ownership of the initiative which is managed by the locals. • The CFA works in collaboration with KFS to optimize forest rehabilitation. • Many of the members had worked in the hospitality sector – the requisite experience was critical for success. • The CFA has encouraged participation through a mix of the demographic dividend –old, youth and women.

Photo: Chairman, Vanga CFA making a point

Photo: Area of mangrove forest that has been restored

Outputs based on NPP pillars

The intervention has delivered multiple NPP outputs as follows:

Table 6.3: Outputs Based on NPP pillars

Pillar	Description
Protect	• Preservation of fish breeding sites hence improved fish population. • Protection of the coastal areas.
Manage	• Reduced agrochemical flows into the mangroves. • Increased tree cover through the tree planting initiative and community policing.
Restore	• Restored forest. • Improved soil health and nutrition. • Improved sequestration capacity of mangroves.

Impacts

The interventions implemented in Vanga are associated with the following impacts for people, nature, and climate;

People:

The interventions have shifted local mindsets, encouraging mangrove planting alongside other crops. Job opportunities, especially for youth (e.g., scouts), have been created. Income from carbon credit sales has boosted livelihoods, while enhanced user rights and increased seafood harvests have improved food security.

Nature:

Fish breeding sites are preserved, improving fish populations. The community has rehabilitated over 75,000 acres of mangroves and planted 2,000 terrestrial trees, enhancing ecological services and benefiting forest-dependent communities.

Climate:

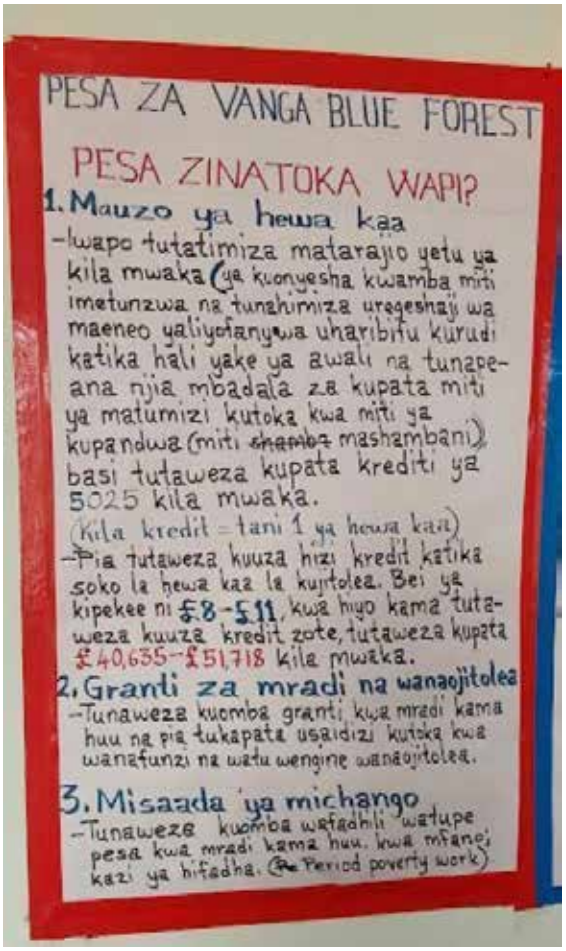
Mangroves' improved carbon sequestration helps lower greenhouse gas levels, supports biodiversity, and protects coastal areas, sustaining local livelihoods.

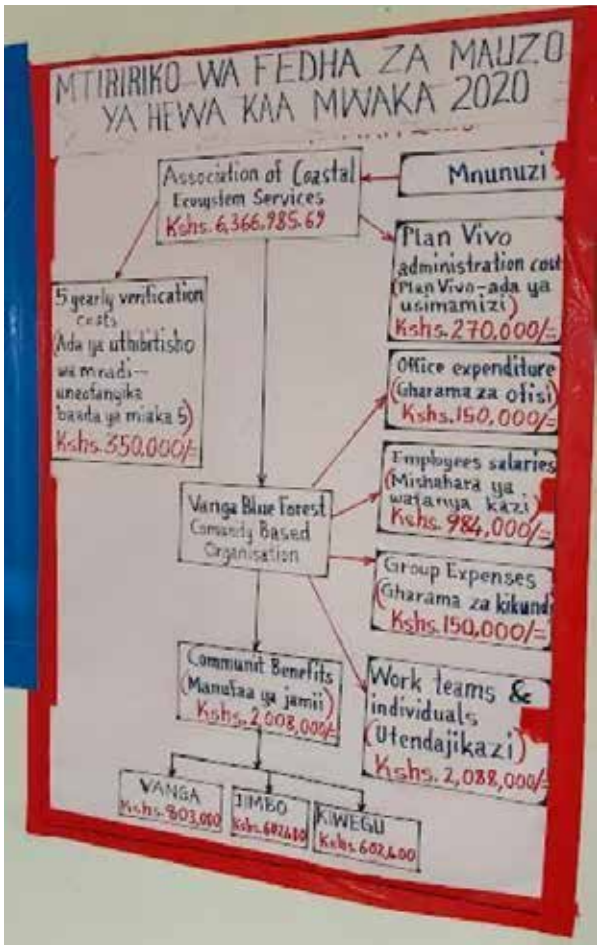
Lessons

The case demonstrates that community-driven, collaborative strategies are vital for successful marine conservation efforts. Key factors include effective awareness campaigns that shift attitudes toward forest conservation and technical support from organizations like WWF, which provides capacity-building for sustainable mangrove projects. Collaboration with government agencies like the KFS is also crucial, fostering joint efforts in forest resource use and conservation.

Table 6.4: Food systems transformational levers

Cluster	Lever
Governance Institutions	There is collaboration between the people, WWF and the government agencies (KFS) to provide capacity build on sustainable mangrove projects.
Natural Resource Management (NRM)	The community-driven strategies have been instrumental in the success of interventions aimed at addressing challenges in marine conservation areas.
Financing	Farmers generate additional income by selling carbon credits, which is reinvested into their farms. The revenue is shared equally among group members, including women and youth, providing a new, sustainable income stream.


PESA ZA VANGA BLUE FOREST
PESA ZINATOKA WAPI?
1. Mauzo ya hewa kaa
-Iwapo tutatimiza matarajio yetu ya kila mwaka (ya kuongesha kwamba miti imetunzwa na tunahimiza uregeshaji wa maeneo yaliyofanyiwa uharibifu kurudi katika hali yake ya awali na tunapeana njia mbadala za kupata miti ya matumizi kutoka kwa miti ya kupandwa (miti ~~shamba~~ mashambani) basi tutaweza kupata krediti ya 5025 kila mwaka.
(Kila kredit = tani 1 ya hewa kaa)
-Pia tutaweza kuuza hizi kredit katika soko la hewa kaa la kujitolea. Bei ya kipekee ni £8-£11, kwa hiyo kama tutaweza kuuza kredit zote, tutaweza kupata £40,635-£51,718 kila mwaka.
2. Granti za mradi na wanaojitolea
-Tunaweza kuomba granti kwa mradi kama huu na pia tukapata usaidizi kutoka kwa wanafunzi na watu wengine wanaojitolea.
3. Misaada ya michango
-Tunaweza kuomba wafadhili watupe pesa kwa mradi kama huu. kwa mfano; kazi ya hifadhi. (Re Period poverty work)


MTIRIRIKO WA FEDHA ZA MAUZO YA HEWA KAA MWAKA 2020
Association of Coastal Ecosystem Services
Kshs. 6,366,985.69
Mnunuzi
Plan Vivo administration cost (Plan Vivo-ada ya usimamizi)
Kshs. 270,000/=
5 yearly verification costs (Ada ya uthibitisho wa mradi-unaofanyika baada ya miaka 5)
Kshs. 350,000/=
Office expenditure (Gharama za ofisi)
Kshs. 150,000/=
Employees salaries (Mishahara ya watumia kazi)
Kshs. 984,000/=
Vanga Blue Forest Comunity Based Organisation
Group Expenses (Gharama za kikundi)
Kshs. 150,000/=
Communit Benefits (Manufaa ya jamii)
Kshs. 2,008,000/=
Work teams & individuals (Utendajikazi)
Kshs. 2,038,000/=
VANGA
Kshs. 803,000
JIMBO
Kshs. 602,400
KIWEGU
Kshs. 602,400

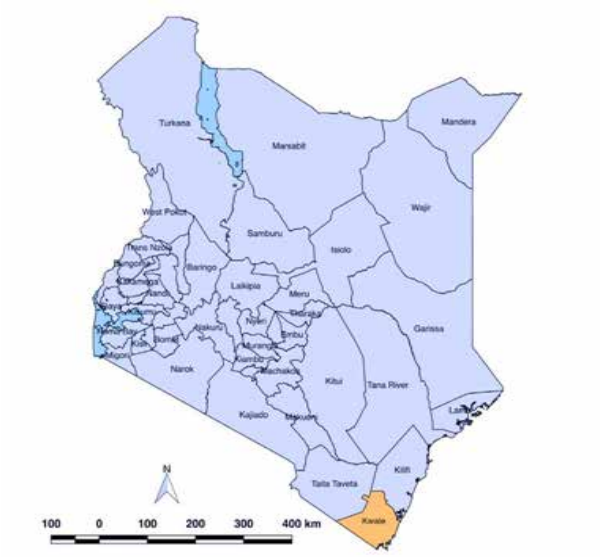
Case Study 7: Supporting Forest and Landscape Restoration for improved livelihoods and climate resilience in Gonja, Kwale County

Supporting Forest and Landscape Restoration for improved livelihoods and climate resilience in Kwale County	**Case study summary box: Case Study 7**	
	Landscape	Coastal Kenya
	Sub-Landscape	Kwale
	Ecosystem	Forests and farmland
	Sector	Forestry, water and agriculture
	Region	Gonja, Mwalegu Kwale
	Type of initiative	Supporting forest and land restoration using collaborative (community Forest Association) and agroecological approaches for reduced human-wildlife conflict and household resilience.
	Product (s)	**People:** Improved incomes, especially for women through sale of tree seedlings; food security through improved productivity; women empowerment through training and support for women's alternative livelihoods; reduced human-wildlife conflict; employment of youth to undertake forest patrols. **Nature:** Over 35,000 tree seedlings, mostly indigenous species *Afzelia quanzensis* (mahogany bean, lucky bean tree, chamfuti, Afzelia) have been planted to restore the Gonja Forest; enhanced farm biodiversity through agroforestry practices. **Climate:** On-farm agroecological practices and growing of 35,000 trees in Gonja Forest have the potential to sequester GHG emissions and improve climate resilience.
	Nexus	Linkages between forest restoration and on-farm regeneration and human-wildlife conflict management for people's livelihoods and biodiversity conservation.
	Key Agroecological Principles	Recycling, input reduction, Soil health; biodiversity, synergies, economic diversification, co-creation and social values.

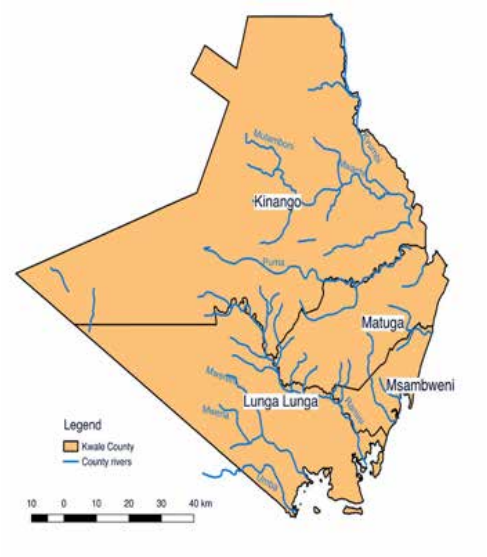
	Summary of the case	• The case demonstrates approaches for empowering communities to implement collaborative forest management approaches to address high levels of deforestation and human-wildlife conflict. • Integrates on-farm restoration using agroecological approaches to improve crop and livestock productivity, enhance household resilience and reduce pressure on protected forests. • Women empowerment in NRM, forest restoration and improved livelihoods.

Background

Kwale County, located in Kenya's coastal region, is known for its vibrant tourism, white sandy beaches, and coral reefs. It features four major topographic areas: Coastal Plain, Foot Plateau, Coastal Uplands, and Nyika Plateau, spread across four sub-counties (Matuga, Kinango, Msambweni, and Lunga Lunga (KCDIP, 2018).



Location of Kwale County



Study area: Gonja, Msambweni Sub-County

Agriculture, mainly subsistence farming, is a key economic activity for 85% of farmers. Despite its role in food security and poverty reduction, the county still faces food insecurity challenges. Households also rely heavily on natural resources like forests and fishing along the coastline. The Kwale County Forest Management and Conservation Act (2017) promotes sustainable use of these resources for socio-economic benefits.

The Problem

Kwale County has experienced severe deforestation, losing 20% of its tree cover since 2000. From 2002 to 2023, the county lost 236 hectares of humid primary forest, a 24% reduction(Global Forest Watch, 2024).Deforestation, driven by agricultural expansion, charcoal production, wood energy reliance, and mining, has worsened soil erosion and water loss, increasing the area's vulnerability to extreme climate events .

Rising temperatures and erratic rainfall further threaten Kwale's socio-economic development, especially in agriculture. Farmers face reduced yields, crop failures, and increased pests and diseases, exacerbating food insecurity. The 2022 long rains analysis reported widespread crop failure, particularly in key farming areas such as McKinnon Road and Ndavaya, due to poor rainfall distribution and early drought .

The analysis of the problem is summarized under direct and indirect threats and the stressors (Table 7.1);

Table 7.1 Contextual analysis of the problem (Indirect threat, direct threats and stresses)

Indirect threats	Direct threats	Stresses
Rising population, weak incentives for conservation and poverty.	Deforestation	Degradation of habitat, increased runoff and flash floods.
Increased change to farm-based livelihoods	Conversion of natural habitats into agricultural lands	Pressure on the natural resource base and human-wildlife conflicts.
Limited options for diversification of livelihoods and eroded resilience to climate change impacts.	Climate change.	Increased frequency of drought and water stress and reduced crop and livestock productivity, crop failure and livestock deaths.

Key interventions

Catchment level forest restoration
In 2018, 150 members of the Gonja CFA partnered with the Kenya Forest Service to restore the highly degraded Gonja Forest. With support from organizations like Plan International, WWF, and the Kwale County Government, the mostly women-led group (70%) established a tree nursery focused on indigenous species like Afzelia quanzensis (mahogany bean tree). This species provides hardwood, fodder, shade, and medicinal value .

Over five years, the CFA planted 35,000 seedlings with a 90% survival rate. In 2022, 80 active members earned an average of KES 5,000, based on participation in nursery activities like watering and weeding, tracked through a participation register.

The PFMP guides forest resource use and legal engagement in forest activities. In 2023, WWF provided 15 beehives to the bee-keeping group, though colonization rates were low. However, active community involvement in forest restoration has strengthened the governance of the Gonja CFA.

Photo: Gonja CFA tree nursery (mainly Afzelia quanzensis)

Photo: Members of Gonja CFA in the tree nursery

On-Farm level (promoting agroecological transition using champion farmers model)
The primary crops in the area are maize and green grams, but productivity has been declining. With support from Plan International, two farmers were trained in agroecological practices (kilimo hai) and subsequently shared their knowledge with others. As a result, nearly half of the participants in focus group discussions reported diversifying their crops. Widely adopted practices include water harvesting, increased manure use, liming, timely planting, terracing, and planting grass on terraces, benefiting both the farming community and the landscape.

WWF also supported the installation of a solar-powered borehole to aid crop irrigation during the dry season. However, at the time of data collection, the pump was malfunctioning and awaiting repairs. This system previously helped women reduce the time spent fetching water from the Umba River and allowed men to assist in watering trees.

Champion farmers are leading by example, showcasing the integration of traditional knowledge and innovative techniques to restore landscapes and enhance climate resilience. The case study highlights the effectiveness of locally led restoration interventions. Beyond crop and livestock farming, community members have been trained in sculpture making, tree cultivation, and converting crop residues into briquettes.

From the foregoing several agroecological principles have been initiated (Table 7.2);

Photo: Solar powered borehole set up to support water needs during drought

Photo: Diversified farm integrating various crops and livestock

Table 7.2: Agroecology principles

Principle	Initiative
Recycling	Farmers use waste from crops and food leftovers to make farmyard manure and compost.
Input Reduction	Farmers use organic and farmyard manure, which in return reduces the use of inorganic fertilizers.
Soil Health	There is an increased use of farm manure, cover crops, crop diversification by the farmers, creating conducive soil conditions for crops to grow.
Synergies	Farmers are increasingly integrating crops, trees, and livestock on their farms. The adoption of agroforestry, particularly with indigenous tree species such as mahogany bean, lucky bean tree, chamfuti, and afzelia, provides shade for crops while decomposing leaves enhance soil fertility. Additionally, the leaves serve as fodder for livestock.
Biodiversity	Restoration of Gonja Forest especially with indigenous species. Local farmers have also reported an increase in wildlife in the forest.
Economic Diversification	Engagement in alternative livelihood activities such as tree nursery business, making of briquettes, sculptures.
Co-Creation and sharing of knowledge	Farmers have been trained in agroecological practices, while members of the Community Forest Association (mainly women) collected saplings from the forest to establish a tree nursery for indigenous species like Afzelia quanzensis (mahogany bean, lucky bean tree, chamfuti, and afzelia). This initiative combines local knowledge with modern nursery techniques provided by organizations like WWF.
Land and Resource governance	Over 150 members of the local community entered into a partnership with KFS through a collaborative forest management agreement and have partnered with organizations such as WWF and Plan International to improve natural resource governance in the area.

Social values and diets	Women have a good opportunity to participate and earn from forest-based livelihood activity. Also, the setting up of a solar powered plant in the area helped to reduce the women's time demand for fetching water indicating a good attention to social values.
Connectivity	Farmers have access to markets- Most of the CFA members were able to sell tree seedlings to conservation organizations but also to other local farmers.

Outputs based on NPP pillars

The intervention has delivered multiple NPP outputs (protect, manage and restore), these include;

Table 7.3: Outputs based on NPP pillars

Pillar	Description
Protect	• Reduced degradation of the forest ecosystems. • Models that promote multi-functional landscapes have been implemented such as PFM.
Manage	• Increased adoption of agroecology principles. • Improved soil health and productivity. • Increased adoption of diversified livelihoods which support adoption of sustainable practices on -farm and household resilience.
Restore	• The Gonja Forest ecosystem has been restored. • There is increased restoration of degraded lands through practices such as agroforestry, diversity and soil and water conservation.

Impacts

People

- Increased income from the sale of crops and nursery seedlings. In 2023, each of the over 80 members who were actively involved in tending for the nursery earned an average of 5,000 Kenya Shillings (ranging from 3,000-8,000), depending on their level of participation in the activities.
- Livelihood diversification to tree nursery business, making of briquettes, sculptures resulting in household resilience.
- Employment of youth who work as forest guards therefore reducing the levels of unemployment in the area.
- Empowering women through training on nursery management, improved crop production through agroecological practices and group leadership and reduced time spent fetching water.

Nature:

- Improved forest cover; over 30,000 trees grown over a five-year period.
- Improved soil health through the adoption of agroecological practices.
- Reduced human-wildlife conflict – as one participant indicated, "in the past, baboons would be all over here destroying our crops. Even elephants would come out here because they lacked food. Now you rarely see them because they have a lot of food in the forest".

Climate

- Carbon sequestered through the growing of over 30,000 trees.
- Farmers report improved frequency of rain. As one participant said, if we destroy the forest, we will not get the rain.

Lessons and levers to food system transformation

The case has demonstrated that several levers are at play in informing the success of the

interventions (Table 7.4).

Table 7.4: Food systems transformational levers

Cluster	Levers/lessons learned
Natural Resource Management (NRM)	• Managing agroecosystems through agroecological approaches can enhance biodiversity which not only supports increased productivity but also reduces pressure on protected landscapes such as forests. • Efforts to restore and protect natural ecosystems such as forests support food system transformation through reduced human-wildlife conflicts and the various ecosystem services they provide.
Governance Institutions	• Local governance institutions are critical to catalyze collaborative efforts, collective action that support food system transformation. • Locally agreed rules on linking the level of participation in collective action to benefits helps to reduce free -rider menace and therefore deliver improvements in food system transformation efforts. • The collaboration between the community and various organizations such as KFS, WWF, Plan International, County Government has also helped to provide diverse support and services to the local community to upscale farmland and forest restoration efforts. • The case makes it evident that scaling up NPP must be complemented by other efforts that address institutional and socio-economic constraints to achieve impact at scale.
Education and Knowledge	• Agroecological approaches are knowledge intensive suggesting the need for collaborative efforts to build and transfer the knowledge needed for the transformation to occur.NPP practices should be introduced to farmers through robust extension programs, with constant and regular follow ups. • By drawing upon the experiences and expertise of agroecology champions, valuable lessons can be learned on how to promote NPP through local-led adaptation in the management of landscapes.
Trade	Markets for NPP products are critical to provide incentives for local communities to scale up the approaches.

Case Study 8: Community conservancies in ecosystem protection in Northern Kenya

Community conservancies in ecosystem protection in Northern Kenya	**Case study summary box: Case 8**	
	Landscape	Northern Kenya
	Ecosystem	Marsabit
	Sector	Livestock, dryland forests and rangelands
	Region	Marsabit
	Type of initiatives	• Use of community conservancies in ecosystem protection in Northern Kenya • Management of human-wildlife conflict and reducing maladaptation
	Products	• Community-led conservation • Reduced human-wildlife conflict • Complementary livelihoods • Collaborative governance model
	Nexus	Integrating communities in conserving and protecting dryland forests and rangelands
	Key Agroecological Principles	Land and natural resource governance; Diversity; Fairness; Co-creation of knowledge; Biodiversity and; Participation.
	Summary of Initiatives	The case illustrates how communities can be integrated lead in conserving and protecting dryland forests and rangelands. Such collaborative efforts also increase resilience while reducing human-wildlife conflict.

Background

Northern Kenya comprises eight counties—Garissa, Isiolo, Mandera, Marsabit, Samburu, Tana River, Turkana, and Wajir—that collectively cover over half of the country's land area. This region experiences extreme temperatures, low rainfall, and arid conditions, with pastoral production systems predominating. Some households rely on forestry products such as charcoal, herbs, and timber. Livelihoods in this area have been severely impacted by multiple droughts over the past decade, eroding the resilience of rangeland ecosystems. Pastoralists have lost thousands of livestock, leading to market collapse and heightened vulnerability to climate hazards and human-wildlife conflicts.

To address these challenges, the Northern Rangelands Trust (NRT) promotes conservation through community-led conservancies, which involve local populations in wildlife conservation. These conservancies offer solutions to land tenure issues, pasture management, and security, providing sustainable strategies for addressing human-wildlife conflict, diversifying livelihoods, and conserving ecosystems.

The Problem

Northern Kenya faces significant social, economic, and environmental threats. Climate change is characterized by extreme weather events, failed rainy seasons, and high temperatures, leading to the loss of over 70% of livestock, valued at more than KES 2 billion. The onset of rains in April 2024 resulted in flooding, causing an additional 5-10% livestock loss and displacing thousands of people living near rivers.

The region also grapples with tribal and political conflicts, as well as human-wildlife conflicts driven by competition for resources. Unsustainable natural resource utilization contributes to environmental degradation, exacerbating food insecurity and poverty while undermining communities' ability to cope with climate shocks. Table 8.1 summarizes the indirect threats, direct threats, and stresses affecting the region.

Table 8.1 Contextual analysis of the problem

Indirect threats	Direct threats	Stresses
Population pressure and competition for scarce water and land resources for survival.	Poaching	Degradation of water resources and rangelands; and migratory routes.
High levels of natural resource dependence for survival of livestock which forms the main source of livelihood.	Deforestation (cutting down of trees for settlement, firewood and timber).	Degradation of habitat, increased runoff and flash floods.
Communal land tenure system hinders long-term investments on land and conservation.	Unsustainable livestock production practices.	Water scarcity and pressure on the natural resource base and loss of livestock.
Limited options for diversification of livelihoods.	Climate change	Increased frequency of drought and water stress.

Key Interventions

Community Wildlife Conservancy model
The conservancy concept, established by the Kenya Wildlife Act of 2013, empowers local communities to manage and benefit from wildlife and tourism resources. NRT has established over 30 conservancies, implementing leadership training for community leaders in finance and governance. This Leadership and Management Programme (LAMP) enables local communities to exercise their rights in managing natural resources while protecting wildlife. NRT assesses governance using metrics such as accountability, fairness, and performance, tailoring support to each conservancy.

Community representatives are elected to manage activities including rangeland management, livelihood development, and conflict resolution. For example, the Shurr conservancy's board consists of 13 elected members who represent various zones within the community.

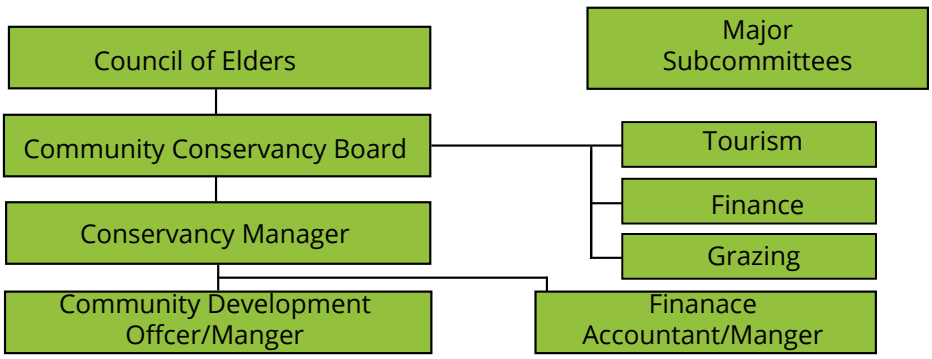


Figure 8.2: Typical conservancy leadership structure under NRT

Rangeland and water management program
The rangeland management program utilizes traditional practices to empower communities in managing grazing, habitats, and wildlife corridors. Grazing patterns are regulated by a grazing committee, and the Shurr conservancy is constructing hay storage facilities to provide feed during dry seasons.

The water management program aims to preserve water resources through interventions like sun downs that recharge aquifers. The grazing committee manages four solar-powered boreholes, controlling their usage. WWF has also drilled a borehole for wildlife, strategically located to reduce human-wildlife conflict. Notably, no poaching incidents were reported in Northern Kenya in 2023, demonstrating the effectiveness of sustainable natural resource management despite drought and hunger.

Tree planting and protection
Conservancies actively protect indigenous trees like acacia, implementing community guidelines for tree cutting and replacement. A fine of 5,000 Kenya Shillings is imposed for unauthorized tree cutting. Despite challenges with non-native tree species, the community now values indigenous trees, which are essential for livestock feed.

Vocational education program aimed at strengthening entrepreneurship and livelihood diversification

The Ujuzi Manyattani vocational training program, established in 2019, operates in eight counties to diversify livelihoods and promote entrepreneurship among women and youth. Main activities include tailoring, bicycle repair, beekeeping, and vegetable farming. By 2023, over 900 individuals were trained, contributing 97 million Kenya Shillings (USD 718,518) annually to the local economy.
Bee keeping for income and pollinator services

Beekeeping is seen as a low-cost enterprise that supports income generation and pollination, fostering biodiversity. The Shurr community has received training on modern beekeeping practices.

Photo: Modern beehives for scaling apiculture in Shurr Community, Marsabit (June, 2024)

Carbon credits program.
The Northern Kenya Rangelands Carbon Project, involving 14 conservancies, trades carbon credits from rangelands and dryland forests. By 2023, the program generated 530 million Kenya Shillings (USD 3.9 million), providing economic incentives for environmental conservation while promoting sustainable grazing practices to enhance carbon capture.

Dryland climate smart agriculture
To diversify livelihoods, conservancies promote small-scale dryland vegetable farming, establishing irrigation systems and greenhouses. Women's groups are trained in agronomy, supported by a dedicated borehole for irrigation to reduce competition for water.

Beadworks program
The beadworks initiative empowers over 1,200 women across nine conservancies to create and sell handicrafts, generating alternative incomes.

These interventions are crucial for ecosystem protection and are complemented by programs in peacebuilding, eco-tourism, microfinancing, renewable energy, and cooperatives. Table 8.2 summarizes the achieved agroecological principles.

Table 8.2: Applicable agroecology principles

Principle	Initiative
Land and natural resource governance	Institutional set-up and governance within the conservancy members have led to adherence of strict laws in NRM. In addition, partnerships with NRT and KWS are delivering collaborative efforts for the benefit of the community and wildlife.
Diversity	The conservancy has promoted livelihood options that ensure resilience to climate change and variability. Vocational skills development, dryland vegetable farming, beadworks are all increasing incomes especially for women and youth. Also, the carbon credit program is sustainably earning the community some income.
Fairness	The conservancy programmes such as vegetable farming, beadworks are targeted to support women and youth who have faced unequal access to resources and opportunities. In addition, the beadworks program is Fair Trade certified and offers the participants with the highest possible fair value.
Co-creation of knowledge	The conservancy leaders leverage on indigenous knowledge to manage rangeland and water resources equitably. They also use information to ensure wildlife corridors are not interfered with.
Biodiversity	The restoration of degraded lands is helping to increase bee population. The project is supporting bee keeping among households therefore increasing pollinator services in the community.
Participation	The conservancy facilitates community-level participation leading to more superior outcomes in NRM. The programs are tailored to address the needs of the youth and women.
Synergies	Manure from livestock production is used for crop production. Acacia leaves and twigs are used as feed for the goats.

Outputs based on NPP pillars

The intervention has delivered multiple NPP outputs. Table 8.3 presents some of the outputs associated with the intervention.

Table 8.3: Outputs based on NPP pillars

Pillar	Description
Protect	• Reduced human-wildlife conflict in access to natural resources • Reduced poaching incidences • Reduced encroachment of protected forest ecosystems • Improved safeguarding of scarce water resources
Manage	• Increased sharing and utilization of indigenous knowledge • Improved crop and livestock diversity • Improved incomes • Improved collaborative governance model
Restore	• Improved forest cover by indigenous trees • Improved management of water resources

Impacts

The interventions in Northern Kenya have significantly benefited people, nature, and the climate. Community members in conservancies are now earning sustainable incomes from various sources, with the carbon project alone generating at least KES 40 million per conservancy annually. Women involved in beadwork have produced over KES 19 million in Marsabit and between KES 30-40 million regionally. Youth have also gained regular income through skills training; the Ujuzi Manyattani program has trained over 900 individuals, contributing KES 97 million (USD 718,518) annually to the local economy.

Restoration efforts have led livestock owners to report increased incomes from goat sales, rising from 3,000 Kenya Shillings in 2023 to 10,000 Kenya Shillings in 2024. NRT conservancies have seen mass restoration of grasslands, rivers, and wildlife corridors, resulting in reduced human-wildlife conflict, with no poaching incidents reported in 2023. Enhanced rangeland and water resource management have increased community resilience, allowing pastoral production systems to better withstand dry seasons and resulting in fewer livestock deaths.

Lessons

- The conservancy concept is a sustainable way that allows communities to manage and benefit from wildlife and tourism resources in their land. Empowering community leaders to implement their projects is a suitable way of ensuring that each community is responsible for their activities and actions.
- Protection of indigenous trees is more sustainable and modern tree planting.
- Development of programs that focus on the youth and women can help bridge inequalities of income and access to resources. This must be preceded by capacity strengthening training and entrepreneurship at community level.
- Market linkages and technical support for complex markets such as the carbon market is critical for their success. These markets offer sustainable incomes that help transform the community.
- The renewable energy sector remains a big opportunity for reducing environmental degradation associated with deforestation and depletion of rangelands.
- Collective action key for linkages to better markets and dissemination of agroecological information.

In summary, the lessons identified have potential to promote food systems transformation through the following levers (Table 8.4).

Table 8.4: Food systems transformational levers

Cluster	Lever
Knowledge and Education	Capacity strengthening training and entrepreneurship at community level is important for enterprise diversification. Ecosystem restoration needs to be tailored to the local ecological, cultural and socioeconomic contexts, while considering the larger landscape.
Natural Resource Management (NRM)	Protection of indigenous trees is more sustainable and modern tree planting.
Governance Institutions	The conservancy concept is a sustainable way that allows communities to manage and benefit from wildlife and tourism resources in their land. Empowering community leaders to implement their projects is a suitable way of ensuring that each community is responsible for their activities and actions.
Financing	Low-cost financing is an enabler for enterprise diversification especially for women and youth who face more financial exclusion.

Case Study 9: Community-led Restoration of Dryland Forests and Rangelands in Marsabit, Northern Kenya Landscape

Background

Marsabit County, located in Central North Kenya, borders Ethiopia to the north, Lake Turkana to the west, and Samburu, Wajir, and Isiolo counties to the south and east. The county experiences extreme temperatures ranging from 10ºC to 30ºC, with an average of 20ºC and annual rainfall between 200 to 1,000 mm . Approximately 80% of the population relies on pastoral production systems for their livelihoods.

Forestry activities thrive in the three main forests—Mt. Marsabit, Mt. Kulal, and Hurri—covering 750 km², yielding products such as charcoal, herbal medicine, wood fuel, timber, and water. The region is arid to semi-arid, facing frequent droughts, particularly from 2014 to 2023, which have eroded rangeland resilience and severely impacted livelihoods. In March 2017, pastoralists lost over 70% of their livestock due to prolonged drought. Farmers report that droughts have become more frequent, with erratic and poorly distributed rainfall, occasionally resulting in floods.

Women now travel over 6km to fetch water, compared to less than 3km previously, due to the drying up of springs and boreholes. Social issues, including migration for pasture, school dropouts, and low literacy rates, hinder the community's ability to adapt to climate variability. High poverty levels, forest ecosystem degradation, and inadequate social safety nets further exacerbate vulnerability.

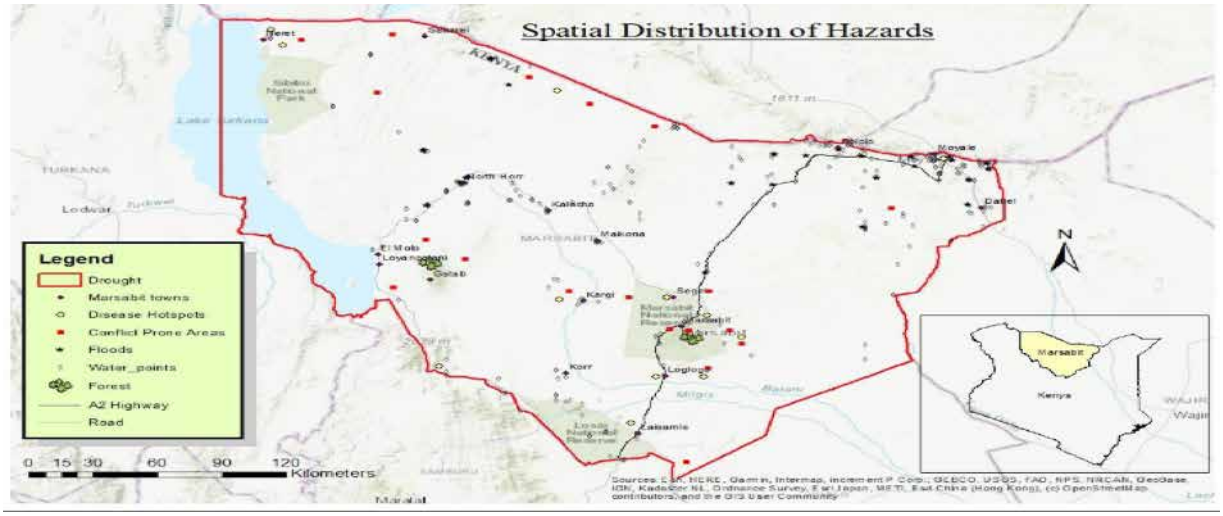


Figure 9.1: Spatial Distribution of the Marsabit County Hazard Points
Source: Marsabit County Participatory Climate Risk Assessment Report (2023)

Government and non-governmental organizations support climate change adaptation through policies and financial resources. This case study highlights lessons learned from collaboration among households, community organizations, and local governments in managing and protecting indigenous forested lands.

The Problem

Marsabit County faces significant challenges related to water scarcity and pressure on natural resources. The arid and semi-arid climate limits farmers' ability to diversify their livelihoods, and saline soils further restrict agricultural options. Overstocking is common, as livestock are seen as a sign of wealth, and cultural norms discourage selling animals even during droughts.

Poor road infrastructure and deforestation for settlement, firewood, and timber exacerbate water shortages. The communal land tenure system hampers long-term investments in land conservation and leads to inter-communal conflicts over resources during dry spells.

Table 9.1 Contextual analysis of the problem

Indirect threats	**Direct threats**	**Stresses**
High levels of forest dependence and limited incentives for conservation and protection of the commons. Inadequate mechanisms to support good land governance.	Deforestation (cutting down of trees for settlement, firewood and timber).	Degradation of habitat, increased runoff and flash floods.
Communal land tenure system hinders long-term investments on land and conservation, and lacks models to incentivize sustainable farming practices.	Unsustainable livestock production practices.	Water scarcity and pressure on the natural resource base and loss of livestock.
Limited options for diversification of livelihoods.	Climate change	Increased frequency of drought and water stress.

Traditional governance structures have weakened, as changing lifestyles and increased education have shifted priorities away from customary practices. Dependence on forest services and products has accelerated resource destruction, particularly with the growing population. Incentives are needed to unite communities and promote participation in restoration efforts, but these solutions are often not sustainable.

Key Interventions

Ramat model for protecting managing, and restoring rangelands
The Ramat model is a conservation approach rooted in the Samburu language, emphasizing lifestyle and governance. It aims to enhance community awareness of sustainable restoration and implement pastoralist-led ecosystem rehabilitation initiatives. A key element is fostering understanding of rangeland restoration importance and achieving consensus on restoration areas through participatory processes led by village elders and community leaders. In this model, young trees and shrubs at selected restoration sites are mapped and marked with red paint to signal to herders that they must be protected from grazing for an agreed period (Figure 9.2);

Figure 9.2: A young tree marked with paint in Karare, Marsabit

Protection lasts six to 12 months, allowing trees to grow beyond livestock reach. Some sites are fenced with hedges, but individual community members, known as champions, are responsible for their care. Acacia trees are prioritized for their vital role in supporting pastoralist resilience.

The Ramat model is implemented in Karare, Marsabit, by the youth-led organization Nature and People as One (NaPO), which collaborates with WWF and local communities to conserve landscapes and biodiversity. Technical officers train champions on tree management, including pruning and weeding. Each month, 1,000 to 1,200 trees are identified, with each champion managing ten trees. Ten champions are selected from each area, mobilizing 80-120 community members. So far, 483 hectares of rangeland have been mapped and protected. This model emphasizes the need for ecosystem management tailored to local ecological, cultural, and socioeconomic contexts.

A female local area chief observed that;
"We believe that pastoral rangeland ecosystems are complex. Restoration efforts that do not take these complexities into account often lead to inappropriate interventions, causing more harm than good." The local area female chief spearheading enforcement of the community by-laws on Ramat.

Collaborative governance of natural resources model
The governance model unites community members—including women, youth, local CBOs, leaders, village elders, and government officials—at the grassroots level. By combining local knowledge, leadership, and government resources, the community has developed sustainable strategies that honor local ecosystems, cultures, and socioeconomic needs. This collaboration fosters shared responsibility, enhances community ownership, and ensures that restoration efforts are effective and lasting.

Local bylaws for tree conservation are enforced by elders and the community, ensuring that marked trees thrive and continue to provide ecosystem services. The local enforcement structures effectively integrate the authority of area chiefs, encouraging compliance among community members. Violations, such as cutting or browsing marked trees, incur a penalty of two goats, a rule upheld by the community.

Only specific tree varieties are permitted for cutting, primarily branches. Champions, acting as ecosystem trustees, patrol to ensure tree protection. These champions include men, women, and youth from the community. Participatory workshops have refined the bylaws for practicality, and locals have actively set up monitoring areas for human-wildlife interactions.

"For construction purposes, specific varieties of trees are acceptable for cutting, mostly we encourage people to use the branches. Personally, as one of the champions in my plot, I am in charge of 300 trees, which I have ensured that they are well protected and managed, with the help of the elders who patrol to make sure the trees are protected as required", elderly champion.

Complimentary livelihoods
NaPO collaborates with local communities and forest associations to produce and market quality honey. By purchasing honey directly from producers, NaPO creates value for households and supports the ecosystem. The project connects honey-producing communities to larger urban and export markets, benefiting both people and nature. Beekeeping, a low-investment enterprise, also helps preserve biodiversity. Over the past year, the project provided beehives to women's groups in the Mt. Marsabit ecosystem and trained indigenous women in beekeeping.

Herder Conservation Initiative
The initiative engages herders, who have a deep understanding of the local environment and the behaviour of wildlife, to monitor wildlife and enhance conservation outcomes. Under this programme, four herders carry out conservation monitoring and have reported over 500 sightings of endangered wildlife species. The herder efforts are aided by smart cameras placed in strategic wildlife routes. The model has reduced poaching as well as human-wildlife conflicts. The community members feel empowered and responsible for protecting wildlife.
From these interventions a number of agroecology principles are promoted. Table 9.2 shows several principles that have been achieved.

Table 9.2: Applicable agroecology principles

Principle	Initiative
Co-creation of knowledge	The collaboration with WWF enabled NAPO to ensure co-creation by bringing onboard the elders to share knowledge on governance of the natural resources in the area.
Economic Diversification	Farmers embrace livestock production, crop production and complementary beekeeping.
Input reduction	Depending on naturally regenerating vegetables reduces the need for external inputs including seedlings, labour and water. and avoids introduction of non-adaptive tree species.
Connectivity	Women supply milk in the nearby milk cooling plant.
Synergies	Manure from livestock production is used for crop production. Acacia leaves and twigs are used as feed for the goats.
Land and natural resource governance	Institutional set-up and governance within the group (the group has by-laws in place). Partnering with WWF and other organizations to allow other groups to benchmark. Collaboration with other relevant government agencies (KFS). Restoration efforts of the commons strengthened through institutional lens.
Participation	Organized group, Ramat ensures participation of both women, men and youths in decision making, protection and monitoring of the resources.

Outputs based on NPP pillars

The NPPs of the intervention are as follows:

Table 9.3 Outputs based on NPP Pillars

Pillar	Description
Protect	Reduced wildlife poaching. Increased forest cover through protection of indigenous trees and tree planting initiatives.
Manage	Reduced human-wildlife conflicts. Leveraging on the indigenous knowledge to manage rangeland and water resources equitably.
Restore	Restored degraded lands. Better rangeland and water resource management.

Impacts

The implemented interventions have led to various positive impacts on people, climate, and nature.

People:
livelihoods have improved through income diversification activities, such as beekeeping, particularly benefiting women's groups and promoting more equitable incomes within the community. Collaboration between elders and community members has enhanced cohesion, leading to changing perceptions, including greater acceptance of women's involvement in the Ramat model.

Climate:
there has been an increase in rainfall in the Karare area, benefiting domestic use and farming. Additionally, the incidence of whirlwinds has decreased due to trees acting as windbreaks. Nature: tree protection initiatives have positively impacted the environment, increasing firewood availability from tree trimming at protected sites. Community members have also reported reduced poaching and human-wildlife conflicts.

Lessons

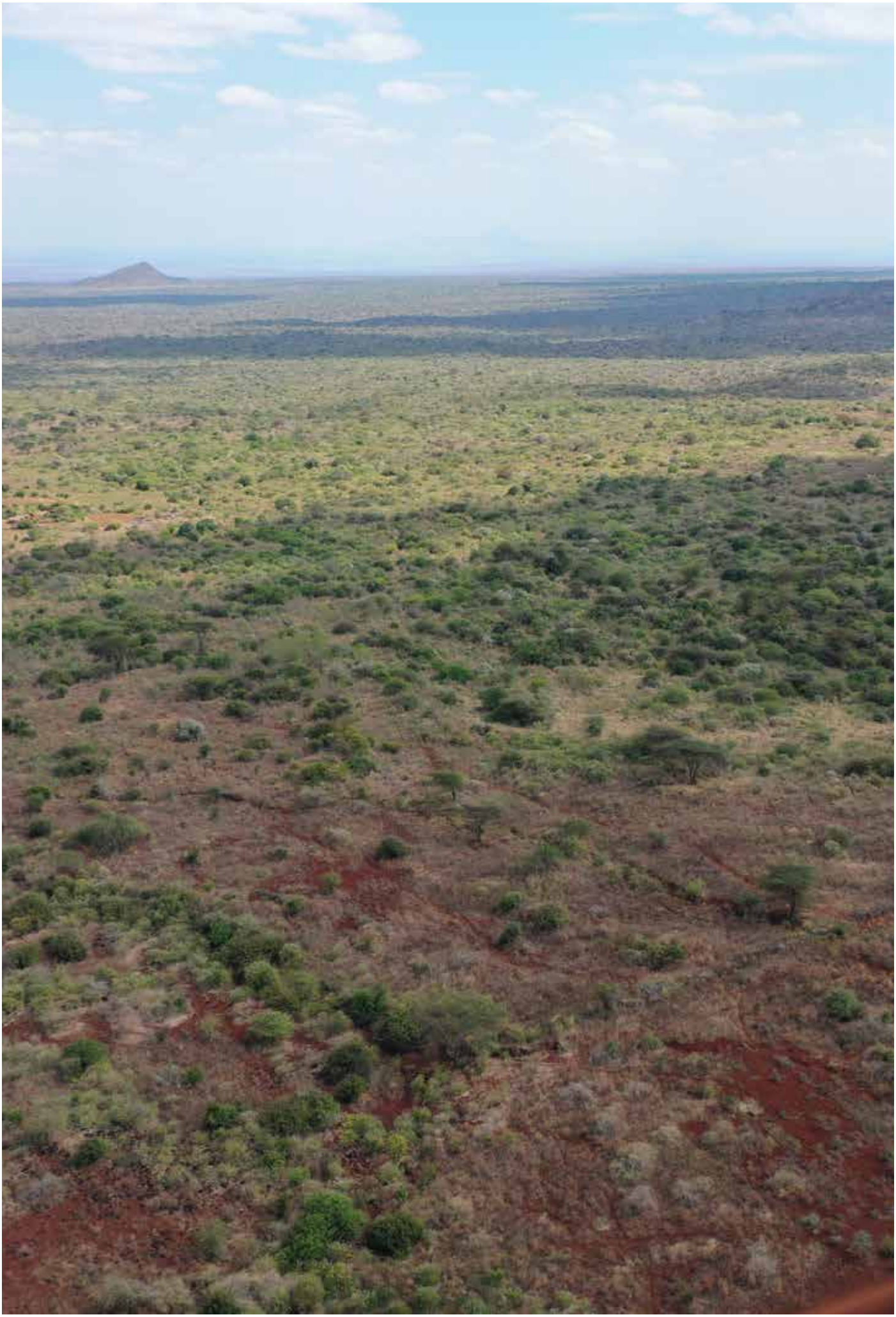
Key lessons from the case study include:

- **Contextual Restoration:** Ecosystem restoration must be tailored to local ecological, cultural, and socioeconomic contexts while considering the broader landscape. The Ramat model highlights that promoting alternative livelihoods in Northern Kenya isn't a straightforward solution for enhancing climate resilience. Instead, development planning should be context-specific and holistic, incorporating traditional ecological knowledge.
- **Sustainability of Initiatives:** Donor projects and government efforts, such as those by the Kenya Forest Service (KFS), are vital for ensuring sustainability. However, community members expressed doubts about the feasibility of tree-planting initiatives due to harsh climate conditions. They prefer to plant seedlings on institutional grounds, where better maintenance infrastructure exists. Concerns include potential maladaptation from planting non-native species that may disrupt the ecosystem, especially in a water-scarce environment.
- **Alternative Livelihoods:** While exploring alternative livelihoods is essential for resilience against climate variability, this approach can lead to maladaptation if not aligned with local conditions. For example, promoting water-intensive agricultural practices in arid areas can increase vulnerability. Many proposed livelihoods depend on external inputs that may not be sustainable or locally available, potentially undermining traditional knowledge and local resilience strategies.

In summary, these lessons offer pathways for transforming food systems through targeted approaches (see Table 9.4).

Table 9.4: Food systems transformational levers

Pillar	Description
Protect	• Reduced wildlife poaching. • Increased forest cover through protection of indigenous trees and tree planting initiatives.
Manage	• Reduced human-wildlife conflicts. • Leveraging on the indigenous knowledge to manage rangeland and water resources equitably.
Restore	• Restored degraded lands. • Better rangeland and water resource management.



Section 4: Summary of Practices, Lessons and Opportunities

4.1 Introduction

This section summarizes best practices, lessons, and opportunities from nine NPP case studies, highlighting interventions that enhance environmental conservation, biodiversity, and ecosystem services while ensuring sustainable livelihoods. Successful strategies include agroecological practices, local ecosystem governance (Ramat), farmer certification (KS 1758), mangrove and rangeland restoration, agroforestry, and water catchment protection. Key lessons emphasize the importance of indigenous knowledge, farmer-driven initiatives, and integrating biodiversity into agricultural practices, while also considering local cultural needs. Opportunities for scaling up conservation efforts include technological advancements, sustainable funding mechanisms such as carbon credits, and collaborative networks like WWF and NaPO. These interventions demonstrate the potential for NPP practices to provide resilient and sustainable solutions for food security and environmental conservation

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4.2 Nature of the problem in agro ecosystem conservation

Agro-ecosystem conservation faces significant challenges due to the complex relationship between agricultural production and environmental sustainability . Modern practices often prioritize high-yield crops and the excessive use of fertilizers and pesticides, leading to biodiversity loss and diminished resilience to climate change (Pretty, 2018) . The reliance on natural resources—such as forests and water—by local communities is exacerbated by rising populations and declining productivity. Deforestation for timber and charcoal, illegal harvesting, and ineffective governance contribute to this problem, resulting in erosion, habitat degradation, and reduced fish catches.

Climate change further threatens livelihoods, increasing droughts, crop failures, and food insecurity while eroding the resilience of agricultural systems. Additionally, unsustainable farming practices, driven by population growth and limited knowledge of agroecological methods, lead to soil degradation and water scarcity. Over-extraction of water, particularly from wetlands, exacerbates these issues, causing conflicts over resources.

In rangelands, population pressures and shifts in land tenure disrupt communal grazing practices, leading to ecosystem degradation. Overstocking and invasive species limit pasture availability, impacting both livestock productivity and human-wildlife relations. Marine ecosystems face similar threats, including over-extraction of resources and pollution, contributing to flooding and declines in fish populations.

The interconnectedness of these challenges highlights the urgent need for nature-positive practices that protect, manage, and restore ecosystems. Short-term agricultural pressures often overshadow long-term sustainability, as farmers lack the knowledge and resources for sustainable practices. Addressing these challenges requires integrating agroecological principles with economic incentives, training, and supportive policies to promote sustainable agriculture and conserve agro-ecosystems. Implementing these approaches can foster outcomes that benefit people, nature, and climate.

4.3 Profile of best practices that have supported community resilience during climate extremes

Building resilience for vulnerable communities amid climate change is a significant challenge addressed by both state and non-state agencies. The NPP framework applied in nine case studies has identified best practices around key food system transformation levers:

Natural resource governance: Interventions enhance nature-positive production to reduce environmental impact and boost ecosystem services. Key practices include sustainable land-use policies, community engagement in resource management, and conservation-linked livelihoods.

- Incentives for farmers, such as co-payment for inputs and involvement in project design, encourage sustainable restoration activities by linking conservation with income generation.
- Tailored incentives should balance individual and group interests, for example, through individual allocations in group nurseries or financial rewards based on contributions.
- An integrated approach addressing vulnerabilities across ecosystems—both aquatic and terrestrial—is crucial for resilience.

- Protecting natural ecosystems, like forests, supports food system transformation by reducing human-wildlife conflicts and enhancing ecosystem services.
- Restoration efforts must consider local ecological, cultural, and socioeconomic contexts, leveraging traditional ecological knowledge.

Governance and institutions: These interventions strengthen governance by supporting smallholders, improving land tenure, and fostering collaboration. Best practices include community-led governance frameworks and partnerships among local communities, governments, and NGOs for better ecosystem management.

- Effective multi-stakeholder collaboration, involving communities and various agencies, is essential for restoring biodiversity and ecosystem functions.
- The champion agroecology farmer model demonstrates the benefits of local-led restoration that incorporates traditional knowledge and supports climate resilience.
- Establishing local governance systems—such as by-laws and community committees—provides low-cost, sustainable ecosystem management and reduces free-rider issues.
- Empowering women and youth promotes inclusivity and narrows gender participation gaps in decision-making and benefit-sharing.
- The conservancy model enables communities to manage and benefit from wildlife and tourism, fostering accountability among leaders
- Education and knowledge: Interventions raise awareness of NPP practices. Effective strategies include gender-responsive extension programs and community workshops that promote knowledge sharing and sustainable practices.
- Robust, gender-responsive extension programs are vital for introducing NPP practices to farmers, with regular follow-ups to ensure effective adoption.
- Farmer group models and centers of excellence engage stakeholders and promote agroecology knowledge across the community.
- Collaborative efforts are necessary to build and transfer the knowledge required for successful transformation to NPP practices.
- Utilizing indigenous knowledge can promote sustainable, low-cost NPP methods and reduce maladaptation risks.

Technology: This lever focuses on advanced food production methods and innovative storage technologies. Best practices include precision agriculture tools and mobile apps for market access and agricultural advice

- Optimizing agricultural land use and crop yields through efficient practices enhances resilience while preserving ecosystem functions.
- Spatial tools for monitoring wildlife are instrumental in managing human-wildlife interactions effectively.

Trade: These interventions promote sustainable food trade. Best practices include establishing fair trade networks and supporting collective marketing initiatives for nature-positive products. Collective action key for linkages to better markets and dissemination of agroecological information.

- Markets for NPP products is critical to provide incentives for local communities to scale up the approaches
- Market linkages and technical support for complex markets such as the carbon market is critical for their success. These markets offer sustainable incomes that help transform the community.

Finance: Interventions aim to redirect financial resources to healthier foods and nature-positive farming. Observed practices include reallocating subsidies to sustainable agriculture and developing microfinance options for smallholders.

- Collective action is essential for linking communities to better markets and disseminating agroecological information.
- Establishing markets for NPP products incentivizes local communities to scale up sustainable practices, while technical support for complex markets, like carbon credits, can transform livelihoods.

Emerging gaps and challenges;

- From the cases a number of gaps and challenges are noted;
- Collaboration Gaps: Limited collaboration exists between established groups and government programs for forest and land restoration, such as tree planting.
- Youth Engagement: Youths require motivation to participate in seedling production, with a recommendation for the government to purchase seedlings locally.
- Flood Planning: There is a need for planning to address potential flood damage due to increasing peak flows and reduced low flows.
- Integration of Local Knowledge: Community planning lacks sufficient bottom-up approaches, limiting the integration of local knowledge and priorities.
- Equity in Benefits: Forest and Land Restoration (FLR) activities often disproportionately affect poorer communities; auditing benefit-sharing mechanisms is necessary to support those most impacted.
- Focus on Youth and Women: Developing programs aimed at youth and women can address income inequalities, supported by capacity-building and entrepreneurship training.
- Extension Systems: Public extension services, vital for sustaining agroecology knowledge, are often lacking in many communities.
- Alternative Livelihoods: Pursuing alternative livelihoods to enhance climate resilience must be carefully aligned with local environmental and socio-economic conditions to avoid maladaptation.

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