Beyond Tourism:
Assessing the Viability of Community-based Natural Resource Enterprises in Africa

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[1] Produced for WWF's Nature Pays program by CARMa-Afrika, Sustainability Research Unit, Nelson Mandela University, South Africa. Contact: christo.fabricius@mandela.ac.za

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Executive summary

Context

The COVID-19 pandemic has caused the plummeting of income to communities who normally relied on trophy hunting and wildlife tourism to supplement their livelihood strategies, creating unprecedented vulnerabilities and threatening local social-ecological resilience and the sustainability of community-based natural resource management in Africa. While WWF wishes to support community-based natural resource enterprises with the greatest potential to have positive long term impacts on nature and livelihoods, the viability of such enterprises is seldom objectively evaluated before they are initiated.

There is therefore a need to assess the long term financial, social and ecological viability of these enterprises thoroughly and objectively, and to develop decision support tools to enable their proactive evaluation.

Purpose

The purpose of this assessment is to assess and rank existing candidate enterprises in WWF priority landscapes in Africa, in terms of their future viability and potential long term contributions to people and nature.

Lay-out

The investigation has 3 parts and 6 appendices:

- PART I. A rapid evidence review of the viability of nature-based community enterprises, based on a literature survey and six case studies.
- PART II. Infographics and detailed descriptions of six case studies: baobab products; beekeeping; carbon markets; charcoal production; timber extraction; and wildlife credits.
- PART III. Guidelines for using an on-line rule-based spreadsheet tool to guide users through a viability assessment of individual community-based nature enterprise initiatives.
- APPENDIX 1-6. Case study reports focusing on:
    - baobab products
    - beekeeping
    - voluntary Carbon markets
    - charcoal production and
    - wildlife credits.

The reports, spreadsheet tool and literature are also available online.

Approach

We used a mixed methods approach, starting with a conceptual framework and evaluation tool, followed by a literature review of case studies, coding of the literature, and subsequent analysis of the coded case studies to assess the relative frequencies of geographic and contextual factors. In

addition, we conducted a deep dive into six representative community-based natural resource management enterprises. The spreadsheet tool was developed following a literature review of viability assessment methods, and using if-then-else rules to recommend actions based on input provided by the end user.

Key results

1. A simple, easy to use rule-based spreadsheet model allows the user to proactively assess the viability of community-based enterprises. It is available here.
2. The literature covered 16 African countries, with a focus on Kenya, Namibia, Kenya and Tanzania
3. Most enterprises (72%) were plant-based.
4. Non-extractive practices (carbon credits, wildlife credits and restoration) and extractive practices (gathering, harvesting) were represented in approximately equal proportions.
5. Key resources being used are wildlife; Carbon credits; Non-Timber Forest Products; landscape restoration; biocredits and other payments for ecosystem services; and timber extraction. A table detailing the uses and beneficiaries is presented.
6. Key risks were governance-related, followed by economic, social, ecological and cultural risks.
7. Enterprises can be classified according to types of resources, types of practices, or types of uses.
8. Value chains are complex, with many actors and beneficiaries involved, all of whom should be considered when enterprises are supported.
9. A typology of natural resource enterprises was developed and is diagrammatically presented below.

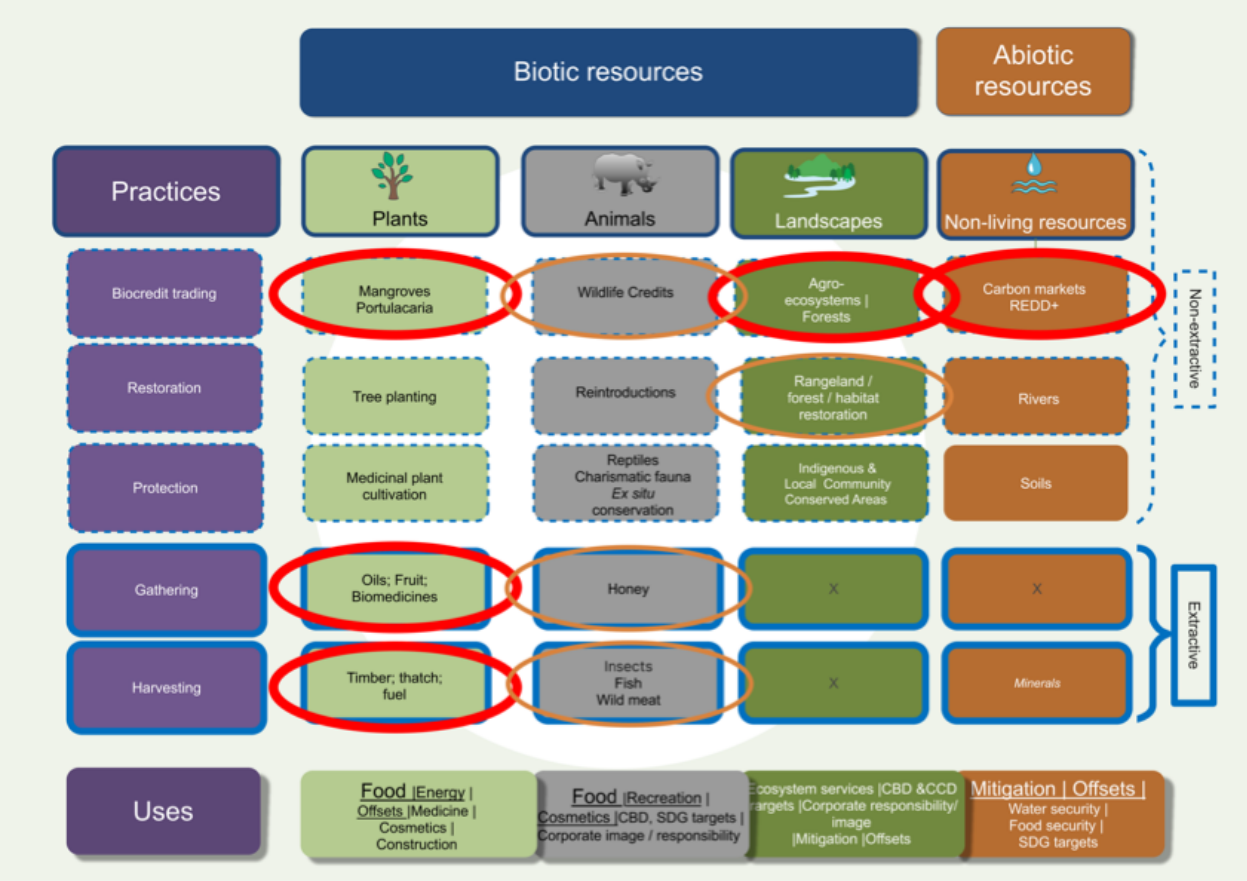
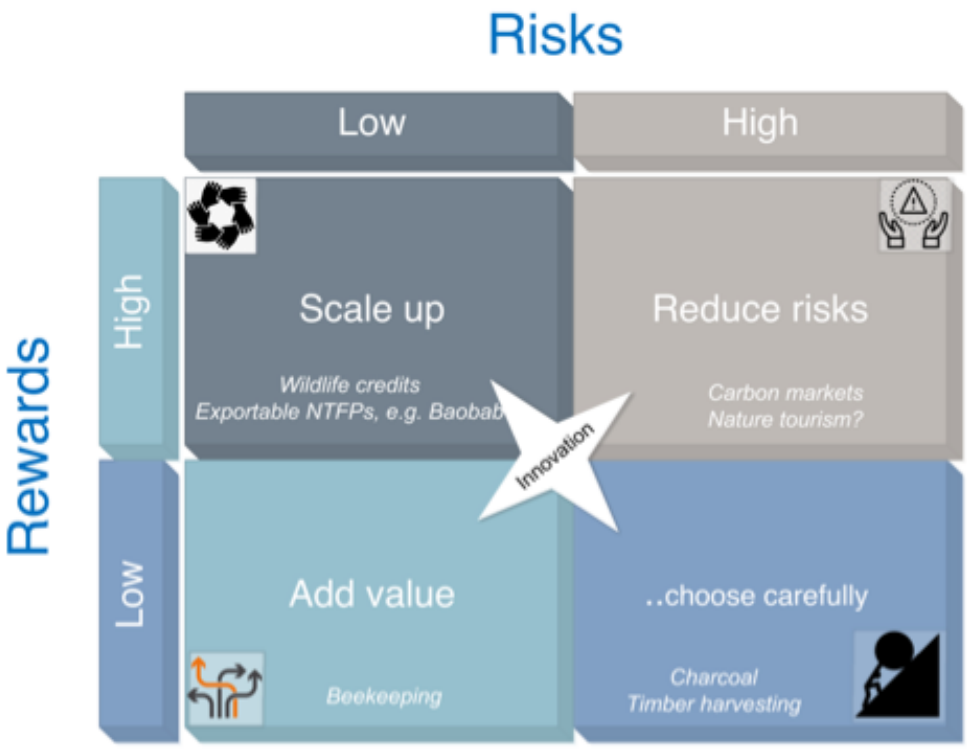


Figure 1. A matrix of practices, types resources being used and categories of use. The thickness of the red ovals represent the prevalence of that resource's use in the literature

Synthesis and applications

1. The risks vs. rewards of community-based natural resource enterprises need to be carefully weighed up before supporting or initiating them. Any initiative can be placed along the two axes, either based on solid data or consensus seeking in a workshop setting. A broad strategy is recommended, depending on the quadrant where the initiative falls.
2. Strategies that may be considered for each risk category. Examples of enterprises in each risk-reward category are summarized below.
3. *Priorities for future work* – Lack of context-specific data and information about the long term viability of community-based enterprises is a major risk. Future investigations should conduct more rigorous risk-reward analyses, with a particular focus on governance and economic risks vs. rewards. Enterprises should be adaptively managed, especially in their early stages. This will require continuous monitoring and evaluation systems, using the spreadsheet model mentioned earlier. The 'keys to success' described in the infographics and summary reports are a useful basis for on-going subjective evaluation.



Risks vs. rewards of different community-based enterprises. Low risk high reward enterprises are priorities for scaling up. Strategies for high risk high reward enterprises are to reduce the risks through e.g. providing clearer standards and more stable markets

Strategies appropriate to different risk vs reward configurations

Risk category	Generic strategy	Examples
Low risk - high reward (top left)	Explore partnerships, invest in technology, provide seed funding.	Wildlife credits Exportable high value NTFPs
Low risk - low reward (bottom left)	Add value and develop new products and markets.	Beekeeping. Local wild fruit trade.
High risk – high reward	Decrease risk vulnerability. Diversify income streams. Develop rules and institutions. Invest in local governance capacity and policy reform at national and global levels.	Some Carbon markets in early stages of development. Timber harvesting on large land parcels. Nature tourism.
High risk – low reward	Proceed with caution. Requires patience and a great deal of investment in value addition, market development, capacity development and governance strengthening. Risks are often systemic and cannot be addressed through local interventions.	Charcoal production. Timber harvesting on small land parcels.

PART I. A rapid review of the viability of community-based natural resource enterprises

1 Background and Introduction

The COVID-19 pandemic has severely affected the income to communities who normally relied on trophy hunting and wildlife tourism to supplement their livelihood strategies, creating unprecedented vulnerabilities and threatening local social-ecological resilience and the sustainability of community-based natural resource management in Africa.

WWF works with more than 200 community conservation enterprises in over 50 countries across the globe, with the assumption that such initiatives "can be integral in targeted efforts to protect some of the world's most biologically diverse landscapes, seascapes and river-basins, making a vital contribution to WWF's global ambition for zero loss of habitats". WWF is interested to help diversify the livelihoods of communities living with wildlife by supporting nature-based enterprises that have positive long term impacts on people and nature.

Alternative nature-based enterprises that may diversify livelihood strategies beyond income from hunting and tourism have been provisionally collated in a Luc Hoffmann Institute desk-based study which found that, while promising alternatives exist, few have been evaluated or demonstrated their ability to persist without the support of donor funding. More recently, two additional inventories have been conducted: a survey of the African Wildlife Economy, coordinated by African Leadership University; and a 'beyond hunting and tourism' innovation challenge coordinated by Luc Hoffmann Institute and ALU. In addition, dialogues were facilitated with landscape leaders to identify promising community-based enterprises in SOKNOT, KAZA, and a hackathon on 'diversifying economies in protected and conserved areas' has been organized.

Together, these assessments and discussions provide a rich source of information about potential nature-based community enterprises. The challenge is to objectively assess the viability and sustainability of community-based natural resource enterprises before initiating and supporting them.

2 Problem statement

WWF wishes to support livelihood diversification enterprises with the greatest potential of independent financial viability, with positive long term impacts on nature and livelihoods. A growing list of livelihood diversification initiatives are being proposed within WWF priority landscapes, yet without thorough objective assessment of their long term financial viability and their benefits to and impacts on nature and people.

Available inventories and examples of nature-based community enterprises have not yet been prioritized on the basis of integrated feasibility and long term sustainability criteria. It is therefore necessary to prioritize high-potential nature-based community enterprises.

There is a need to:

- Develop an integrated yet rapid, user-friendly evaluation system to assess the viability and sustainability of livelihood diversification enterprises, focusing on their potential to improve local livelihoods while simultaneously preserving or enhancing landscape integrity;
- Use such a screening system to provisionally assess and rank existing candidate enterprises in WWF priority landscapes in terms of their future viability and potential long term contributions to people and nature.

Through this report the authors hope to catalyze more nuanced, practical thinking about innovative yet workable alternative income generation opportunities for communities who have been dependent on trophy hunting and tourism in Africa.

3 Report structure

The investigation has 4 parts:

- PART I. A rapid evidence review of the viability of nature-based community enterprises, based on a literature survey and six case studies.
- PART II. Infographics and detailed descriptions of six case studies: baobab products; beekeeping; carbon markets; charcoal production; timber extraction; and wildlife credits.
- PART III. Guidelines for using an on-line rule-based spreadsheet tool to guide users through a viability assessment of individual community-based nature enterprise initiatives.
- APPENDIX 1-6. Case studies focusing on baobab products; beekeeping; Carbon markets; charcoal production and wildlife credits.

Reports, the spreadsheet tool and literature are also available online.

3.1 Methods

We used a mixed methods approach, starting with a conceptual framework and evaluation tool, followed by a literature search of case studies, coding of the literature according to key words and concepts and subsequent analysis of the coded case studies. In addition, we conducted a deep dive into six representative community-based natural resource management enterprises.

3.2 Literature search

Two key resources: the African Wildlife Economy report (Snyman et al. 2021[2]) and the Luc Hoffmann Institute 'Diversifying Livelihoods' report (Roe et al. 2020[3]), together with the GEF projects database and Conservation Enterprises Learning Group theories of change and the Fairwild database of projects were used as a basis to explore the basic literature and identify key resources and categories. Thereafter, the resource keywords (e.g. "baobab") together with the phrase "value

[2] Snyman, S., Sumba, D., Vorhies, F., Gitari, E., Enders, C., Ahenkan, A., Pambo, A.F.K., & Bengone, N. 2021. *State of the Wildlife Economy in Africa.* African Leadership University, School of Wildlife Conservation, Kigali, Rwanda., Kigali.

[3] Dilys Roe, Francesca Booker, Olivia Wilson-Holt, and Rosie Cooney. 2020. DIVERSIFYING LOCAL LIVELIHOODS WHILE SUSTAINING WILDLIFE. Exploring incentives for community-based conservation. Luc Hoffmann Institute.

chain" was used to search for additional literature in Google and Google Scholar. Both peer reviewed and grey literature were accessed.

A total of 158 documents and papers were accessed in this way. These were refined, using exclusion criteria: they had to contain place-based information, had to deal with a specific natural resource, and had to include elements of a value chain, or preferably a full value chain analysis. In this way, a final sample of 58 case study documents were identified. Due to time constraints it was impossible to conduct a full systematic review. We declare biases towards East and Southern Africa.

3.3 Coding

A spreadsheet was used to code each document, using the following fields (Table 1).

Table 1. Coding categories for publications

Coding category	Description
Project title	The title of the project as it appears in the documentation
Source data link/s	Where the document can be found
Year	Year of publication
Project country	Country where the project is based
Location/s	Within-country location
Project type	Place-based or Sectoral
Resource type	The resource being used
System	Terrestrial / Freshwater / Marine
Biome	Terrestrial / Freshwater / Marine
Taxa	Plants / Trees / Terrestrial animals / Aquatic animals / Landscape/system / Algae / Fungi
Non-extractive practices	Wildlife credits / Carbon credits / EBA / Restoration / Other
Extractive practices	Fishing / Gathering / Terrestrial animal harvesting / Timber harvesting
Use	Ceremony/ritual / Decorative / Energy / Food / Learning / Construction materials / Medicine / Recreation / Beauty/cosmetic / Other
Data availability	High / Medium / Low
Duration of project (Years or NS for not stated)	Years since inception
Beneficiaries	Who benefits
Funding organization	Who funds it
Risks	High / Medium / Low
Project scalability	Description
Comments/Notes	Any additional comments

4 Analysis

The 58 case studies were analysed, using frequency counts of the different coded categories, to produce tables, bar charts and pie charts of the countries, resource types, practices, and typical risks and rewards. Case studies were also categorized.

4.1 Geographic distribution

The literature covered 16 African countries, with most cases from Kenya, Namibia, Tanzania and South Africa (Figure 5).

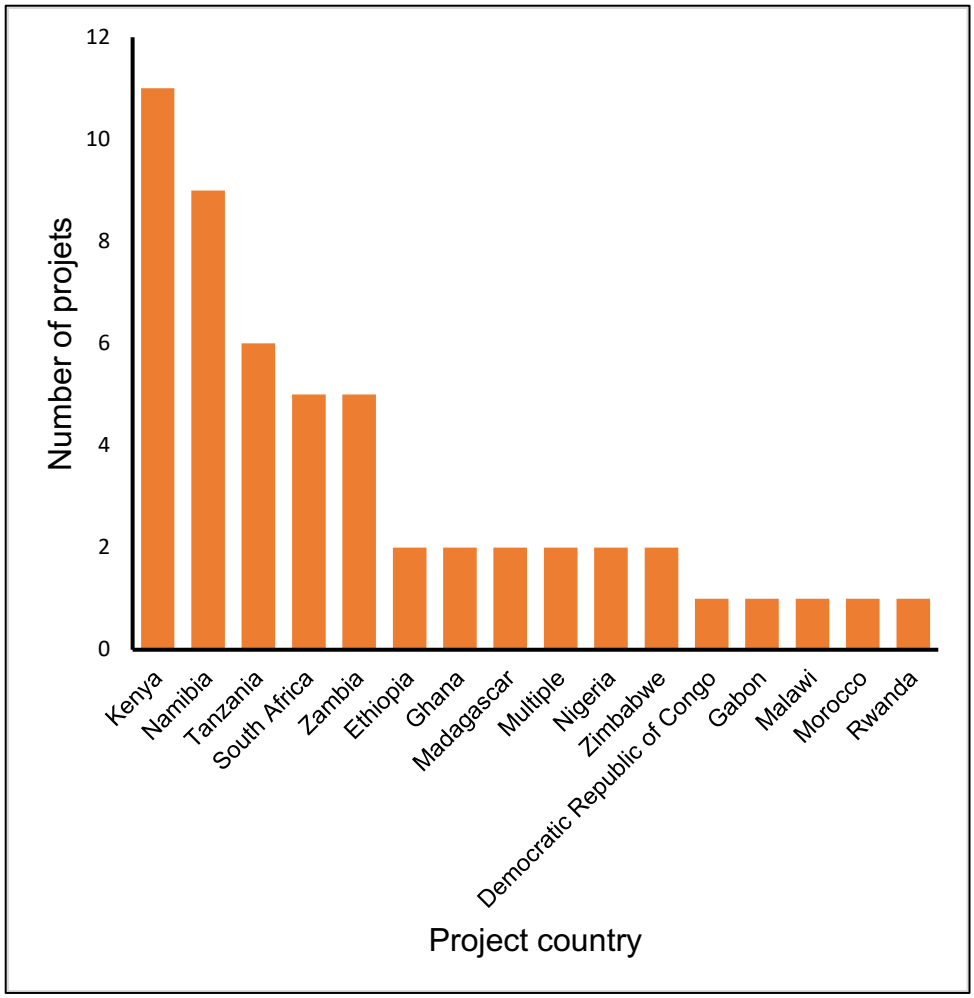


Figure 2. Countries covered by the literature resources

Tables 2 and Figures 6-7 show that most of the enterprises were plant-based (72%) vs. animal-based (28%). The former included gathering and timber harvesting as non-extractive practices, and Carbon credits, NTFP harvesting, and restoration as non-extractive practices. Harvesting and gathering were included in extractive use of terrestrial animals, while non-extractive wildlife enterprises included wildlife credits and wildlife bonds (Table 3; Figures 4 and 5).

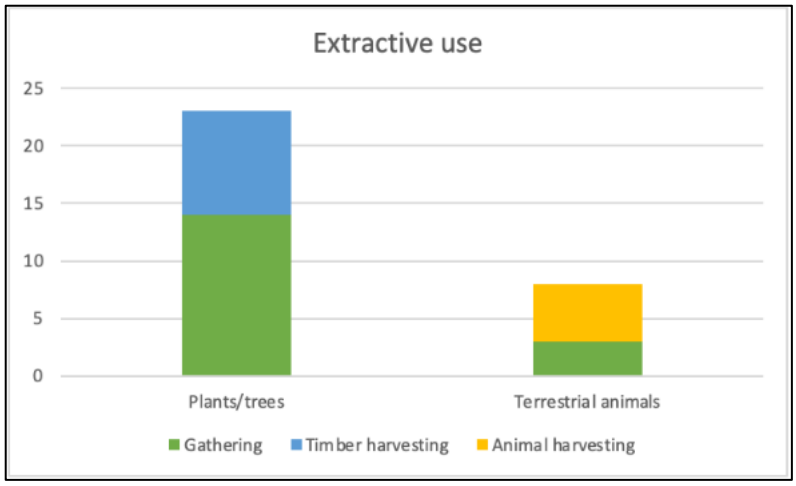


Figure 3. Extractive uses of plants and terrestrial animals

Table 2. Extractive and non-extractive uses of plants, landscapes and animals. Numbers refer to number of cases encountered in the literature[4]

	Extractive use			Non-extractive use			
	Gathering	*Timber harvesting*	*Animal harvesting*	*Carbon credits*	*Other*	*Restoration*	*Wildlife credits*
Plants/trees	14	9	0	10	3	3	
Landscape	1	0	0	7	1	0	
Terrestrial animals	3	0	5	0	3	0	4
Aquatic animals	0	0	1	0	0	0	0

[4] Note that ours was not a comprehensive assessment of all available literature, which fell beyond the scope and budget of the current investivations

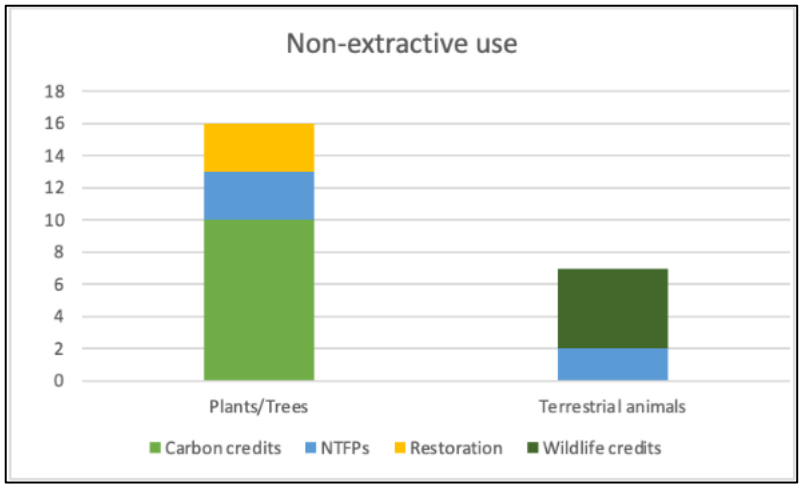


Figure 4. Non-extractive use of plants and animals

4.2 Uses and beneficiaries

Key resources being used are wildlife; Carbon credits; non-timber forest products; landscape restoration; biocredits and other payments for ecosystem services; and timber extraction. Uses and beneficiaries are listed in Table 4.

Table 3. Resources, uses and beneficiaries

Group	Resource types/use	Range of beneficiaries
Wildlife utilization	Bees	Community
	Butterfly pupae	Magangani farming group members
	Crocodile	Community and ranchers
	Insects	Direct sellers (38%), Dealers (38%), Wholesalers (24%)
	Rhino	Community conservancies and rangers
	Wildlife	Rural community
Carbon credits	Blue carbon credits	Unclear
	Carbon market REDD+	Tree planting families, 30% of gross revenues to local communities; communities; cocoa farmers. Hadza community (60%); Carbon Tanzania (20%); Tanzanian authorities (20%)
	Carbon offsetting mangrove restoration	Paid project staff; 5400 local community
Non-timber forest products	Aloe	Community and associations
	Argan Forests	Rural population in the South of Morocco
	Beekeeping	Community; smallholder farmers
	Boabab fruit	Harvesters (15%), wholesalers (48%), processors (57 - 80%), retailers (53%), exporters (58 - 84%). Farmer n=10; Collector n=7; Wholesaler n=6; Processor n=15; Retail n=37.
	Fruit and seed (Irvingia gabonensis var gabonensis & excelsa aka wombolu)	Farmers & wild collectors, village merchents, middlemen, wholesalers, retailers
	Honey; bamboo species for crafts; tubers	Weavers, honey producers,
	Honeybush tea	Commercial farmers
	Mkongo (Afzelia quanzensis); Mpingo (Dalbergia melanoxylon), Mninga Jangwa (Pterocarpus angolensis)	Village communities (e.g. Nanjirinji A and Nainokwe Village)
	Mopane worm	Rural community
	NTFPs - perfume	Himba pastoralists
	Shea butter	Women
	Shea nuts	Wechiau community
	Silkworm pupae	Community farmers
	Wild mango	Harvesters, processors, traders
Revenues from Biocredits and PES	Eco-agriculture	Smallholder farmers e.g. Luangwa Valley
	Investment bonds	NGOs, CBOs, government agencies & research institutions
	Purchase of biodiversity conservation services	People neighbouring the park
	Wildlife credits - willingness to pay	Conservancies

	Biodiversity credits	Communities
Rangeland restoration	Rangeland restoration	Four wards in Matatiele Municipality, South Africa. CBRLM covers seven regions in Namibia: Kunene, Omusati, Oshana, Ohangwena, Oshikoto, Kavanago East, and Kavango West. 39 community conservancies across 42,000 square kilometres of northern and coastal Kenya. Maasai community south of Nairobi National Park
Timber and charcoal production	Sustainable charcoal production practices	8,300 people in 9 villages in the Rufunsa District; companies e.g. Bushblock; NGOs e.g. Cheetah Conservation fund
	Sustainable charcoal production REDD+	Members of Charcoal Producer Association (CPA) and Charcoal Procured Group (CPG)

4.3 Risks

Most risks were governance-related, followed by economic risks (Figure 6 and Table 5).

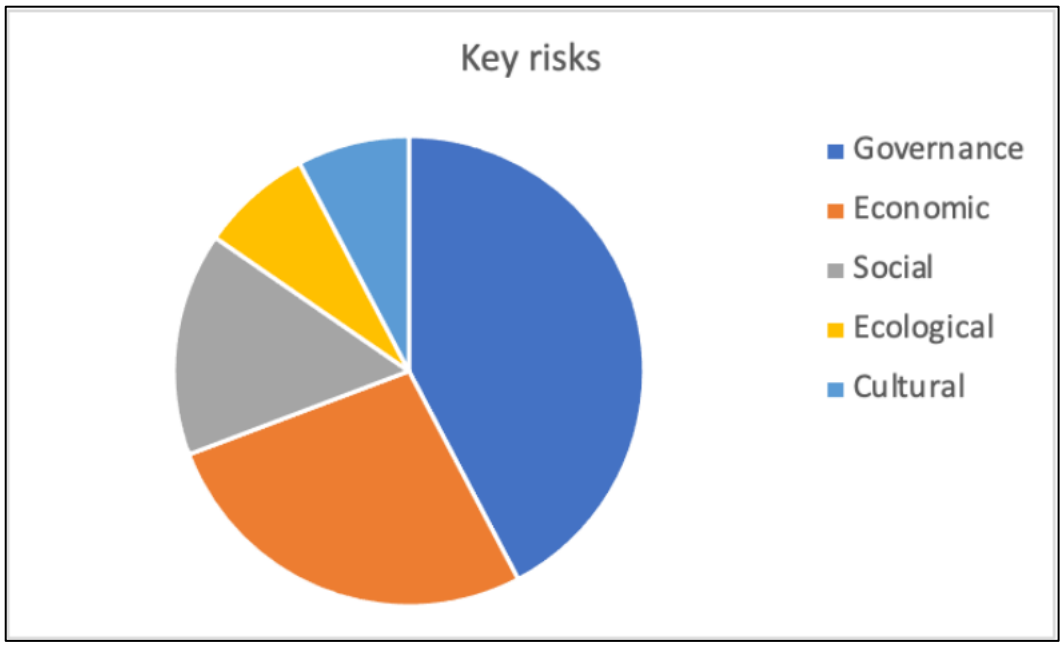


Figure 5. Main risk categories and their proportional prevalence in Africa

Governance risks **-** illegal and unregulated activities undermining profitability; elite capture; weak government commitment; and unclear policies.

Economic risks **-** weak cash flow and deferred payments; revenues not matching opportunity costs of forfeited land or resource use options; operating costs exceeding revenues; leakage of revenues to intermediaries; and low quality locally produced products that cannot be exported.

Social risks **-** exclusion of some community members and elitism*. Conflict among communities, and between communities and authorities, over access and benefit sharing arrangements.*

Cultural risks **-** The most important cultural risk was undermining of traditional and local knowledge through new technologies, and introducing new ideas that were incompatible with local customs.

Ecological risks **-** over-utilization and illegal use, as well as conflicting objectives and outcomes. Transfer of impacts from one area to another was another risk which is difficult to mitigate. None of the enterprises focused on the root causes of climate change and biodiversity loss: systemic

maladaptations and inequalities in the global economy, over-consumption in the developed world, and population growth in the developing world.

Technological risks **-** Key technological risks are related to monitoring and data quality, and difficulties in empirically demonstrating net gains in Carbon, biodiversity, habitat and wildlife numbers.

Table 4. Detailed descriptions of risks in different categories

Risk category	Risk description	Affected natural resource enterprise
Cultural	Overharvesting	NTFPs: leaves, fruit, seeds and oils
	Behavioural change	Landscape restoration
	Undermining of traditional and local knowledge	Beekeeping; over-regulated wildlife harvesting
Ecological	Drought, vegetation change caused by population pressure	NTFPs: honey
	Poor quality of product.	NTFPs: leaves, fruit, seeds and oils
	Overharvesting	Extractive use of insects, trees, fruit, wildlife
	Degradation and biodiversity loss	Beekeeping
	Pesticides	Beekeeping
	Climate change: year on year variability, drought, fire and floods	Landscape restoration; NTFPs: fruit; honey
Economic	High production costs	Insect harvesting; timber production;
	Unmeasured metrics and outcomes	Carbon credits
	Unregulated timber harvesting and charcoal production	Carbon credits
	Market constraints	Timber
	Poor quality of local products	NTFPs: e.g. honey, wild fruit
	High cost and technical complexity	Timber
	Competition from commercial farmers,	NTFPs: leaves, fruit, seeds and oils
	Scarcity, market access (informal, distances and transportation), abnormal (several middlemen)	
	Cash flow. Insufficient cash to purchase products from farmers. Low capacity of chiefs to serve on the Board. Lack of community experience. Insufficient monitoring data to demonstrate progress. Continued reliance on donor funding	Landscape restoration
	Payments not compensating for opportunity costs., Rewarding people for not breaking the law. Practicalities of distributing revenue.	Wildlife credits, Carbon credits
	Reporting systems and measurement; inadequate benefit flows; lack of transparency; insufficient revenues to prevent deforestation	Carbon credits
	Low demand for FSC certified timber. Cost of certification exceeds the financial rewards of certification. Communities do not adequately implement required forest management procedures to comply with certification standards, leading to reputation and/or certification status loss.	Timber
	High price of Argan Oil threatening the forest	NTFPs: leaves, fruit, seeds and oils
	Low private investments due to poor profitability, low returns on investments and perceived risk associated with agriculture (especially smallholder agriculture). Risk of default from end-beneficiaries and low dividends from equity investments would impact investors' returns	
	Opportunity cost of agriculture	Timber harvesting
	Revenues failing to compensate for wildlife damages	Terrestrial vertebrate harvesting; wildlife credits
Political / governance	Government bans on wildlife export, distance from markets, habitat loss, irregular demand	Insect harvesting

	Lack of institutional support from government entities	Timber
	Land and resource rights and tenure arrangements	All enterprises
	Failure to scale to meaningful level. Weak Coordination between env management institutions in the catchment. Spread of nvasive alien plants (Lantana).	NTFPs: honey
	Upsetting local property rights and power relations. Countries don't have defined REDD+ strategies, governments may want to claim generated credits for NDCs (so the credits cannot be sold on the open market), no baseline data exist at country level	Carbon credits
	Communities being unaware. Loss of access to resources. Untransparent reporting see	Carbon credits
	Overgrazing due to tenure insecurity	Landscape restoration
	Lack of formal regulation, poor and variable quality of products, fire, limited regeneration, season production, short shelf life for pulp	NTFPs: leaves, fruit, seeds and oils
	Uncontrolled use of fire, unregulated overharvesting	NTFPs: charcoal and wood
	Local governance issues and external conflicts	Wildlife credits
	Unregulated/illegal charcoal trade, rampant and Systemic Corruption in the Charcoal trade, variations in prices of charcoal, declining amount of high quality species, unsustainable fuelwood resource exploitation	NTFPs: charcoal and wood
	Encroachment and unregulated land use	Timber harvesting; Carbon credits
Social	Industry lacks cohesion, variable quality of tea, tax on farm lands, variable currency	NTFPs: leaves, fruit, seeds and oils
	Livestock farming opportunity cost, poaching	Terrestrial vertebrate harvesting
	Rapid urbanization	Charcoal; landscape restoration
	Encroachment and illegal harvesting; illegal operators controlling value chains with higher-up managers getting the lion's share of benefits, accompanied by corruption and bribery	Carbon credits; charcoal; timber
	Social conflict about benefit sharing. Alcohol abuse	NTFPs: leaves, fruit, seeds and oils
	Deforestation, lack of harvesting standards and poor management of resources, according to the stakeholders, represent the main factors threatening the sustainability of the chain	NTFPs: leaves, fruit, seeds and oils
	Deforestation; seasonality; overharvesting	Insect harvesting
	Ethnic conflict and crime (road bunditry and livestock theft), profitability issues and the COVID 19 pandemic	Landscape restoration
	Poverty-driven deforestation	Timber
	Resistance from the local land owners due to mistrust in government, due to rapid population growth, Rising land prices, Road infrastructure development	Landscape restoration
	Revenues failing to compensate for wildlife damages	Terrestrial vertebrate harvesting; wildlife credits
Technological	Shortage of bee equipment, pesticide threat, poor infrastructure development, lack of research and extension	NTFPs: honey
	Expensive and complicated monitoring and reporting requirements	Wildlife credits; Carbon credits
	Unreliable verification systems	Wildlife credits; Carbon credits

4.4 Typologies

Wildlife enterprises can be classified in several ways. Depending on an organization's objectives, enterprises can be grouped by a) resource type (plants, animals, landscapes or non-living resources); b) the way they are used (practices); or c) the different types of uses (food, energy, cosmetics,

construction, offsets and mitigation, corporate image and responsibility, or meeting SDG, CBD and CCD targets).

The matrix below (Figure 7) depicts the various classification possibilities. The weight of the ovals represents the prevalence of that resource in the literature we accessed – the thicker the weight the more prevalent. Practices include biocredit trading, restoration and protection (non-extractive) and gathering and harvesting (extractive).

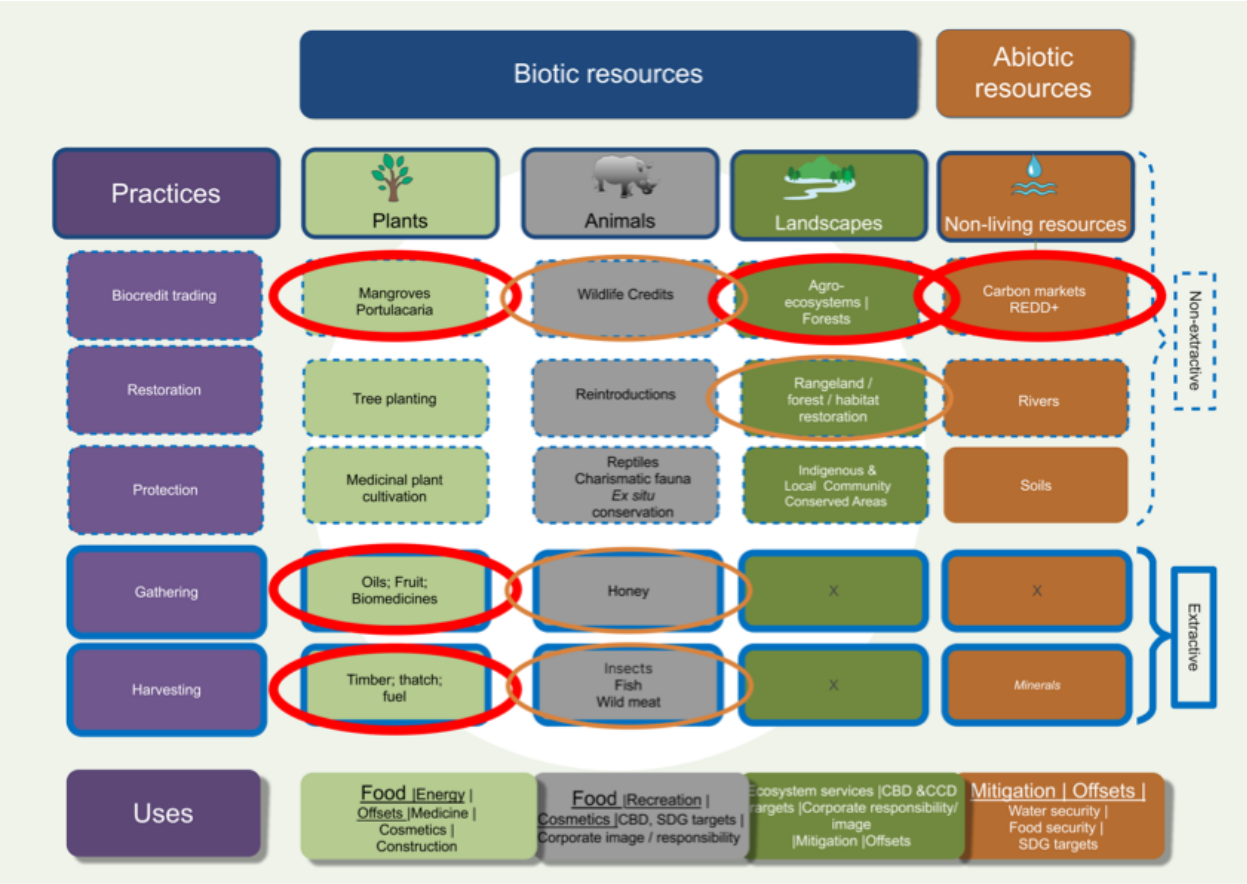


Figure 6. Categories of community-based resource enterprises, classified according to resource type; practices; uses; and mode of use (extractive / non-extractive). Underlined uses were most prevalent, and the weight of oval circles represents the prevalence of a resource or practice in the literature accessed

4.5 Risk vs reward analysis

Weighing up risks vs. benefits is a key consideration in community-based natural resource enterprises. NGOs have a particular obligation to indigenous and local communities to balance the risk-reward ratio and to avoid proposing high-risk initiatives to IPLCs (Figure 8). Initiatives in the top left quadrant (low risk / high reward) are the most desirable and worthy of replication, whereas those in the bottom right quadrant should be selected and advocated with caution. Generic strategies in the different categories are summarized in Table 6.

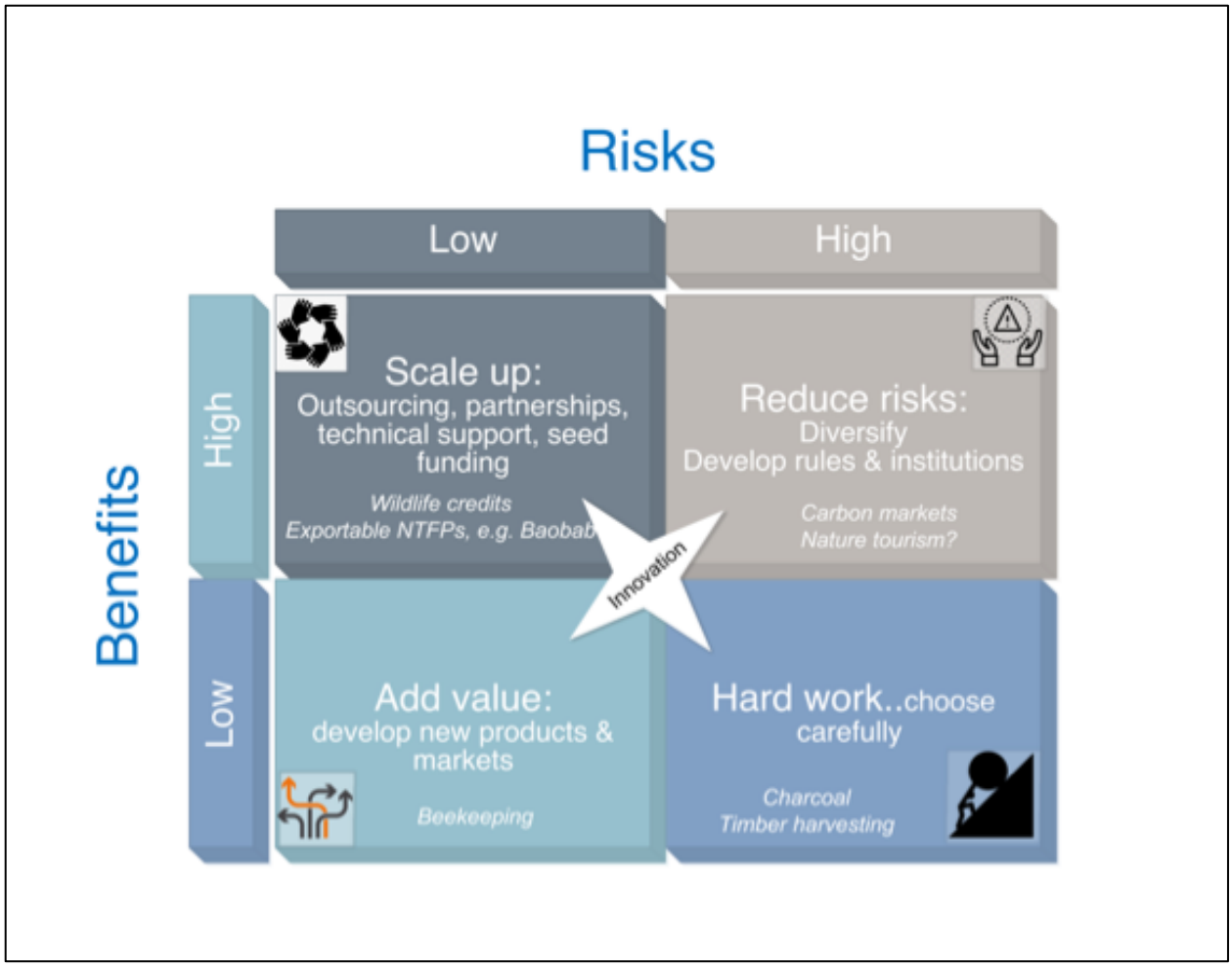


Figure 7. Risks vs. rewards in community-based natural resource enterprises. Any initiative can be plotted on the two axes (benefits; risks) and follow one or more recommended strategic pathways, depending on the quadrant where it lands. Innovation is a central strategy that cuts across all initiatives

Table 5. Risk - reward categories and generic strategies to manage risk and reward

Risk category	Generic strategy	Examples
Low risk - high reward (top left)	Explore partnerships, invest in technology, provide seed funding.	Wildlife credits Exportable high value NTFPs
Low risk - low reward (bottom left)	Add value and develop new products and markets.	Beekeeping. Local wild fruit trade.
High risk – high reward	Decrease risk vulnerability. Diversify income streams. Develop rules and institutions. Invest in governance capacity.	Some Carbon markets in early stages of development. Timber harvesting on large land parcels. Nature tourism.
High risk – low reward	Proceed with caution. Requires patience and a great deal of investment in value addition, market development, capacity development and governance strengthening. Risks are often systemic and cannot be addressed through local interventions.	Charcoal production. Timber harvesting on small land parcels.

Investments in innovation is a crucial element of each strategy, regardless of risk or reward.

PART II. Case study infographics and value chains

Infographics

Six case studies were reviewed in greater detail to inform the Part I review as well as to provide an information base for project managers and practitioners. Baobab products, Beekeeping, voluntary Carbon trade, Charcoal production, Timber harvesting and Wildlife Credits were analysed by conducting more extensive literature searches.

An infographic in the form of an analysis canvass was prepared for each case study, using the following format for each:

Infographic heading	Explanation
General description	What the initiative is about, its purpose, what the product is typically used for and which management aspects are crucial
How does it work?	A description of the value chain
Keys to success	Crucial strategies and actions that can make a difference
Advantages and strengths	The upside of the initiative
Risks and uncertainties	The downside of the initiative
Financial viability	Whether the benefits are substantial, with due consideration of costs and risks
Enabling context	Social, technological, economic, ecological, political and cultural aspects that have to exist for the initiative's success
Supporters and partnerships	Which collaborators contribute to co-production

Infographic canvasses are presented in Figures 9-13 below. Infographics can also be downloaded online.

Figure 8. Infographic canvass: Baobab products

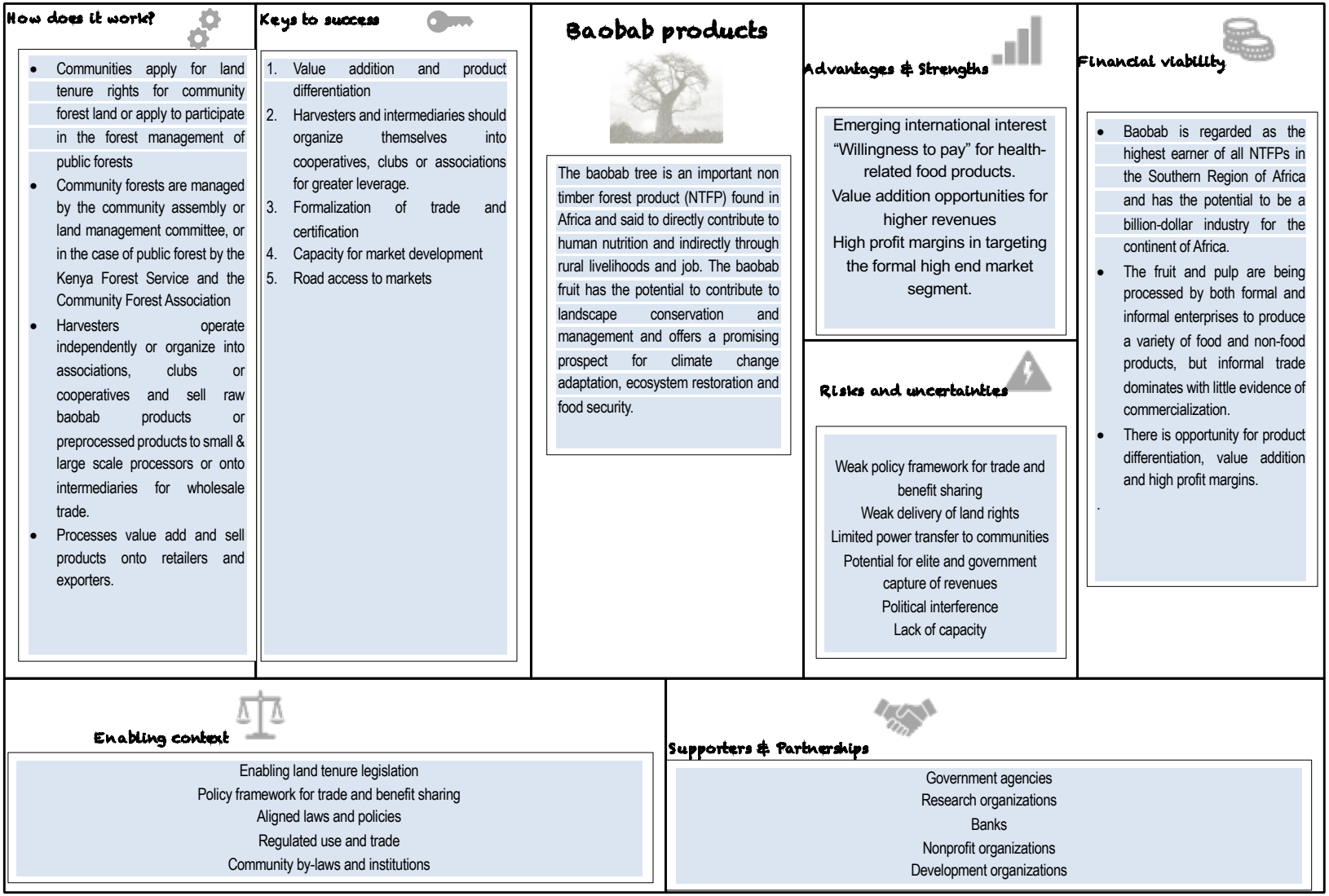


Figure 9. Infographic canvass: beekeeping

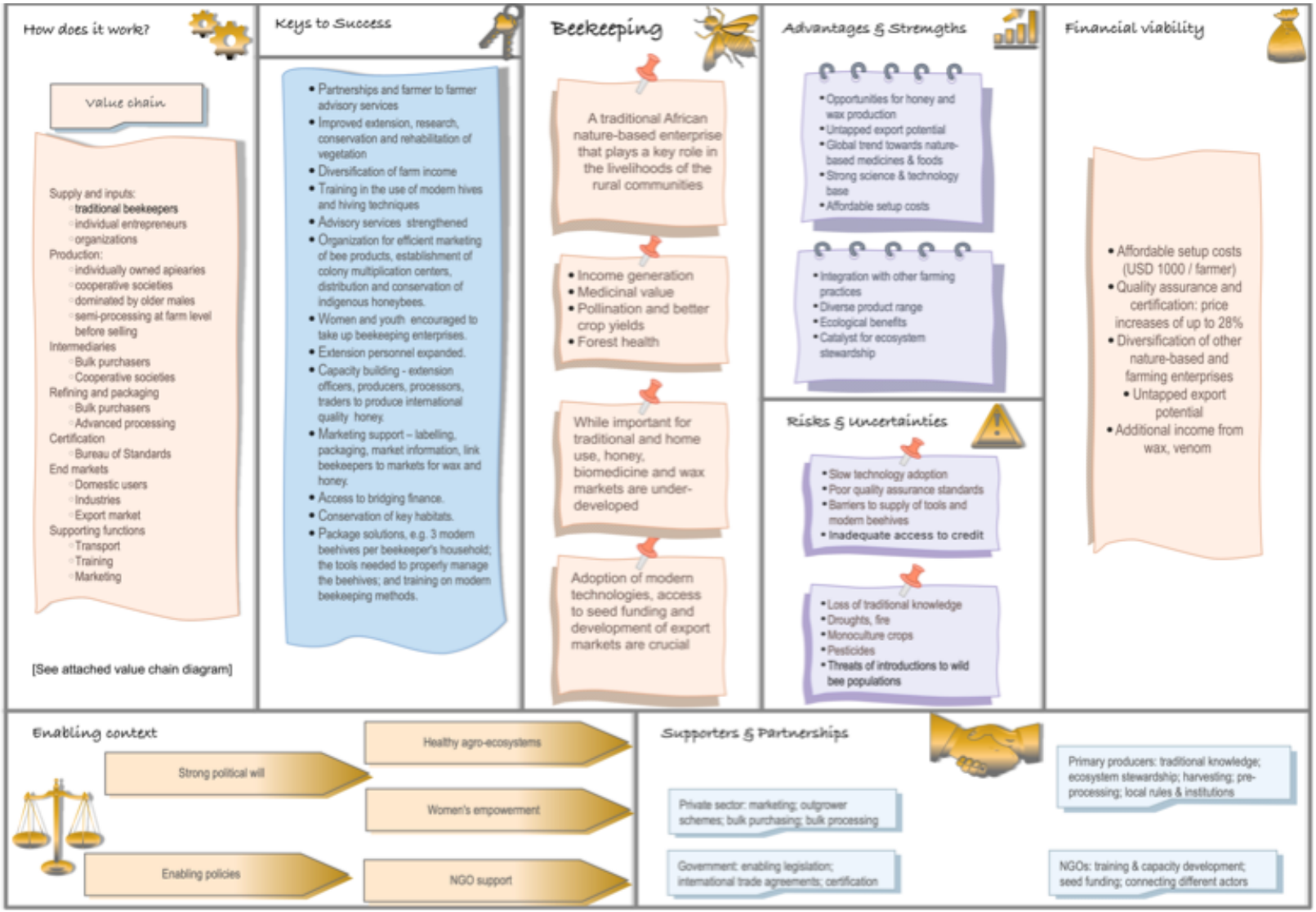


Figure 10. Infographic canvass: Carbon markets

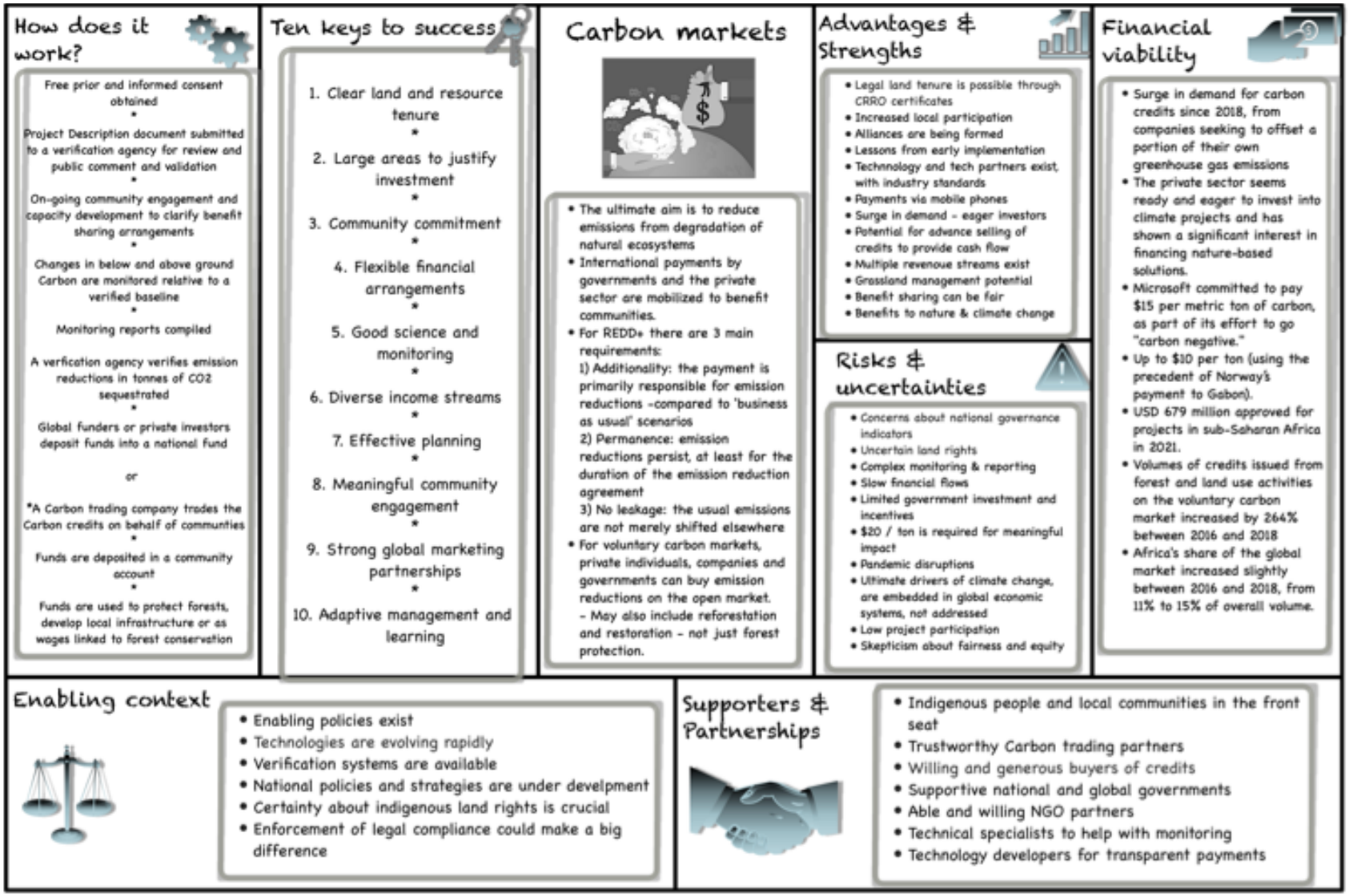


Figure 11. Infographic canvass: charcoal production

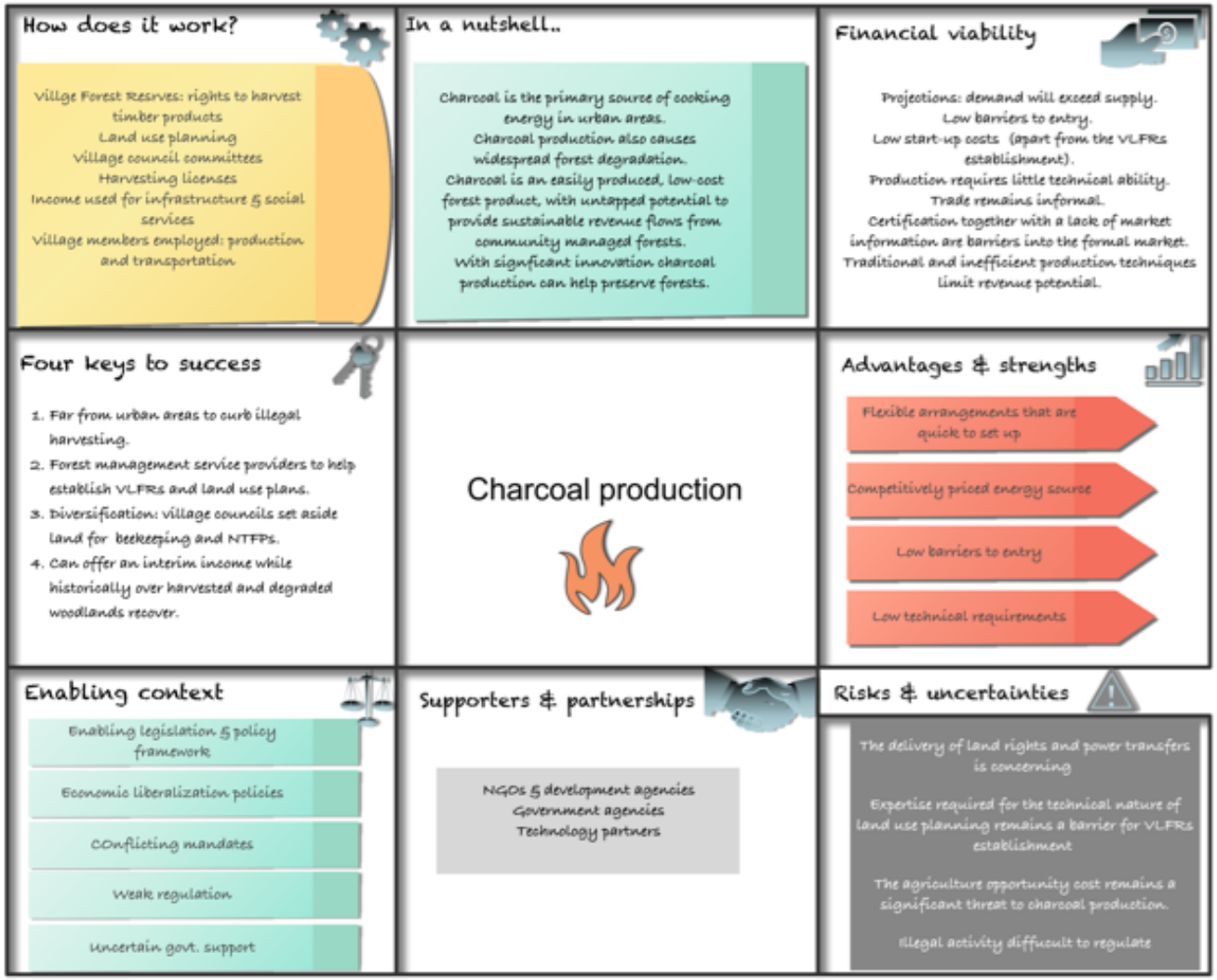


Figure 12. Infographic canvass: timber extraction

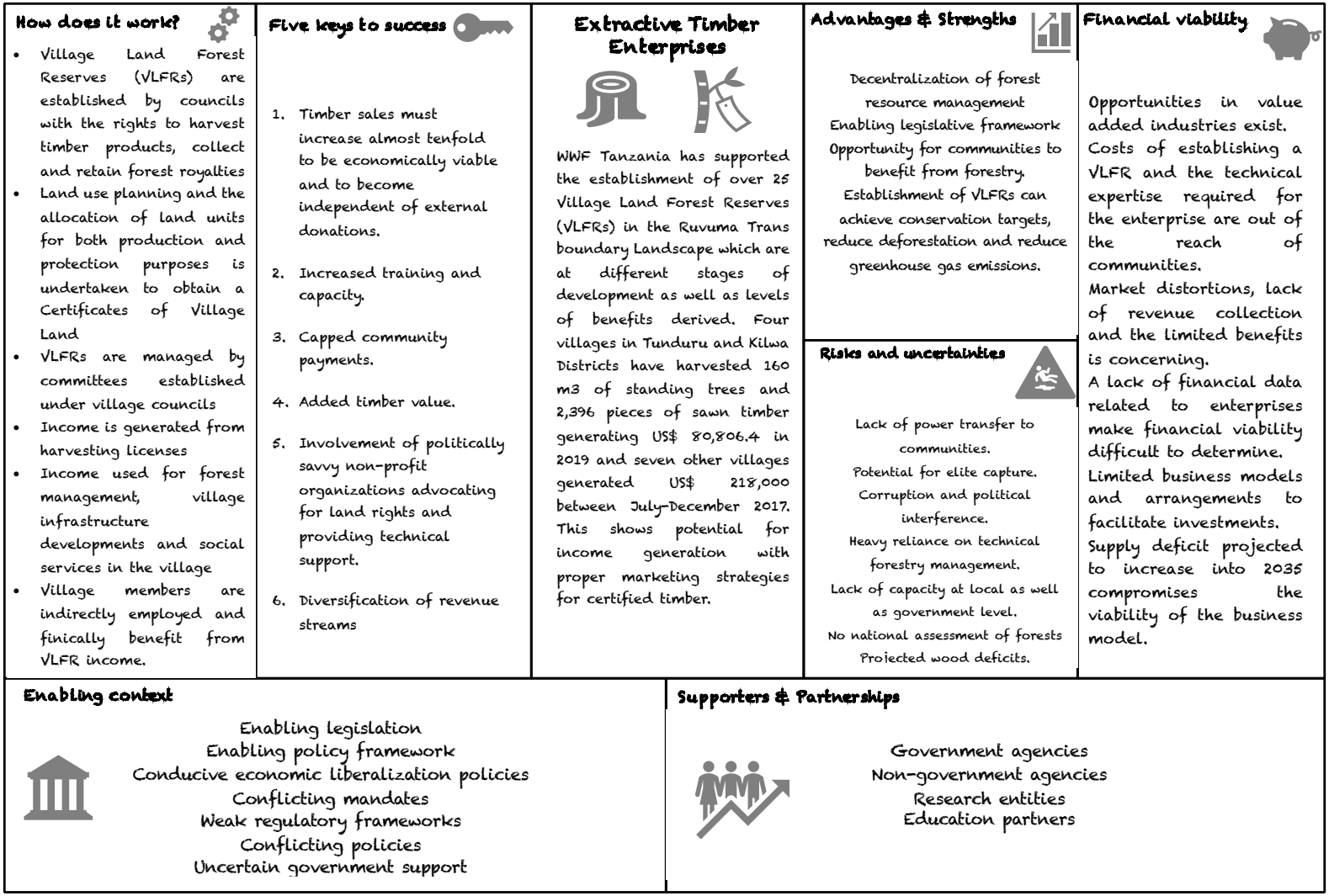
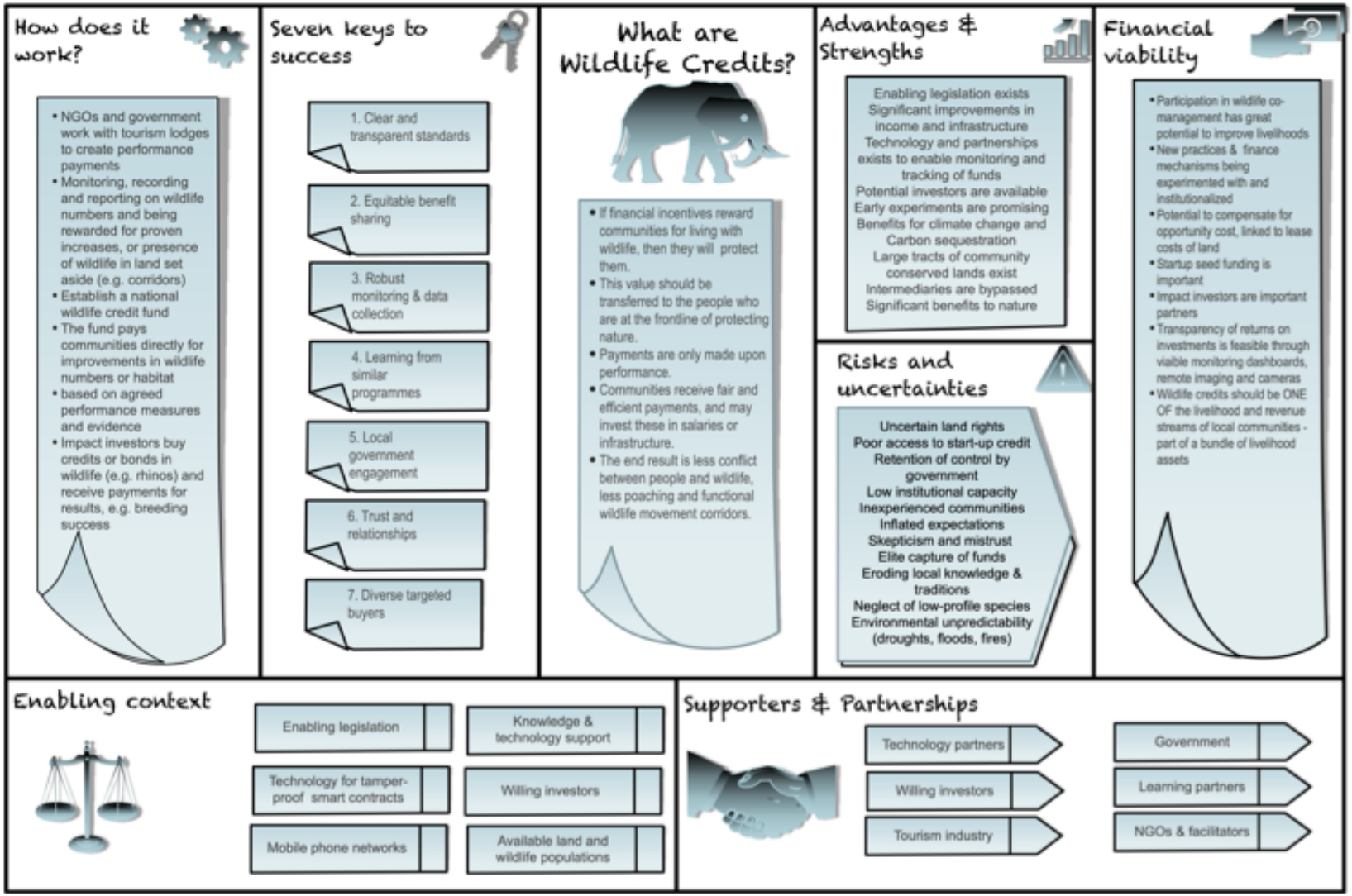


Figure 13. Infographic canvass: wildlife credits



Case study value chains

Value chains are complex, with many actors and beneficiaries involved, all of whom should be considered when enterprises are supported.

The value chains are graphically presented below. The resource base and its management is a crucial part of the value chain. The feedbacks between revenues being shared with local communities and their resource stewardship and management are a critical consideration; if feedbacks are weak due to e.g. sparse revenue flows then active management and stewardship is unlikely. More detail is provided in the respective case study reports.

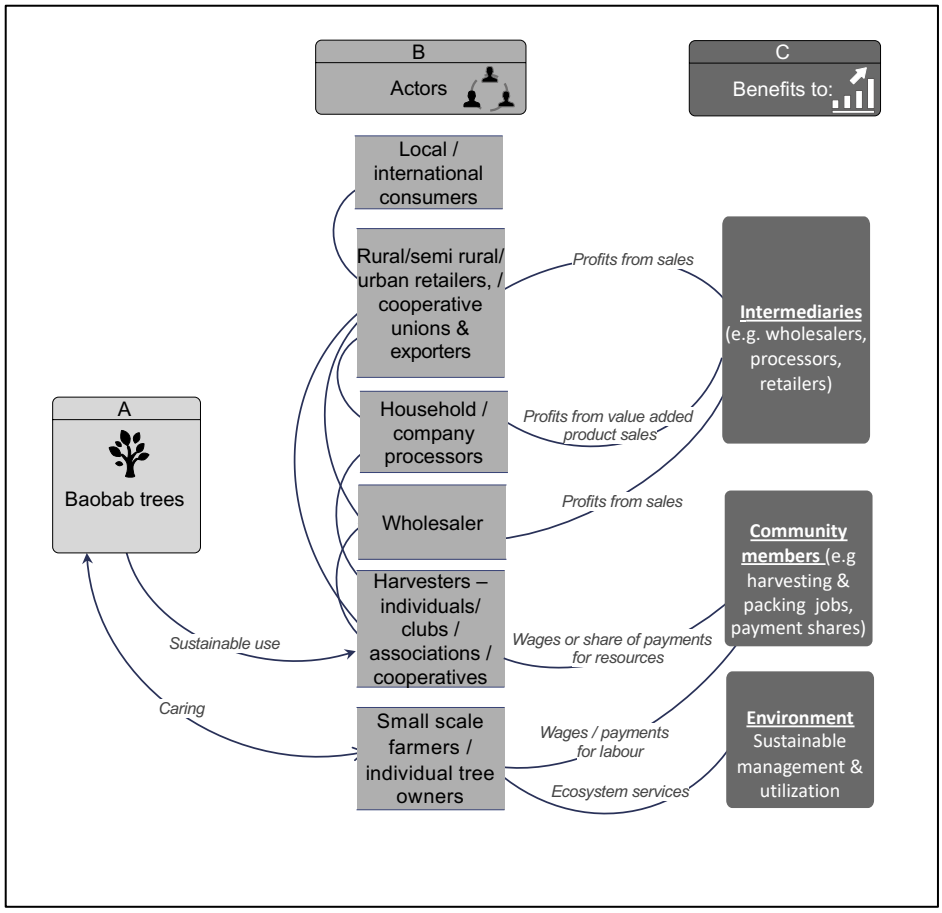


Figure 14. Value chain: Baobab fruit

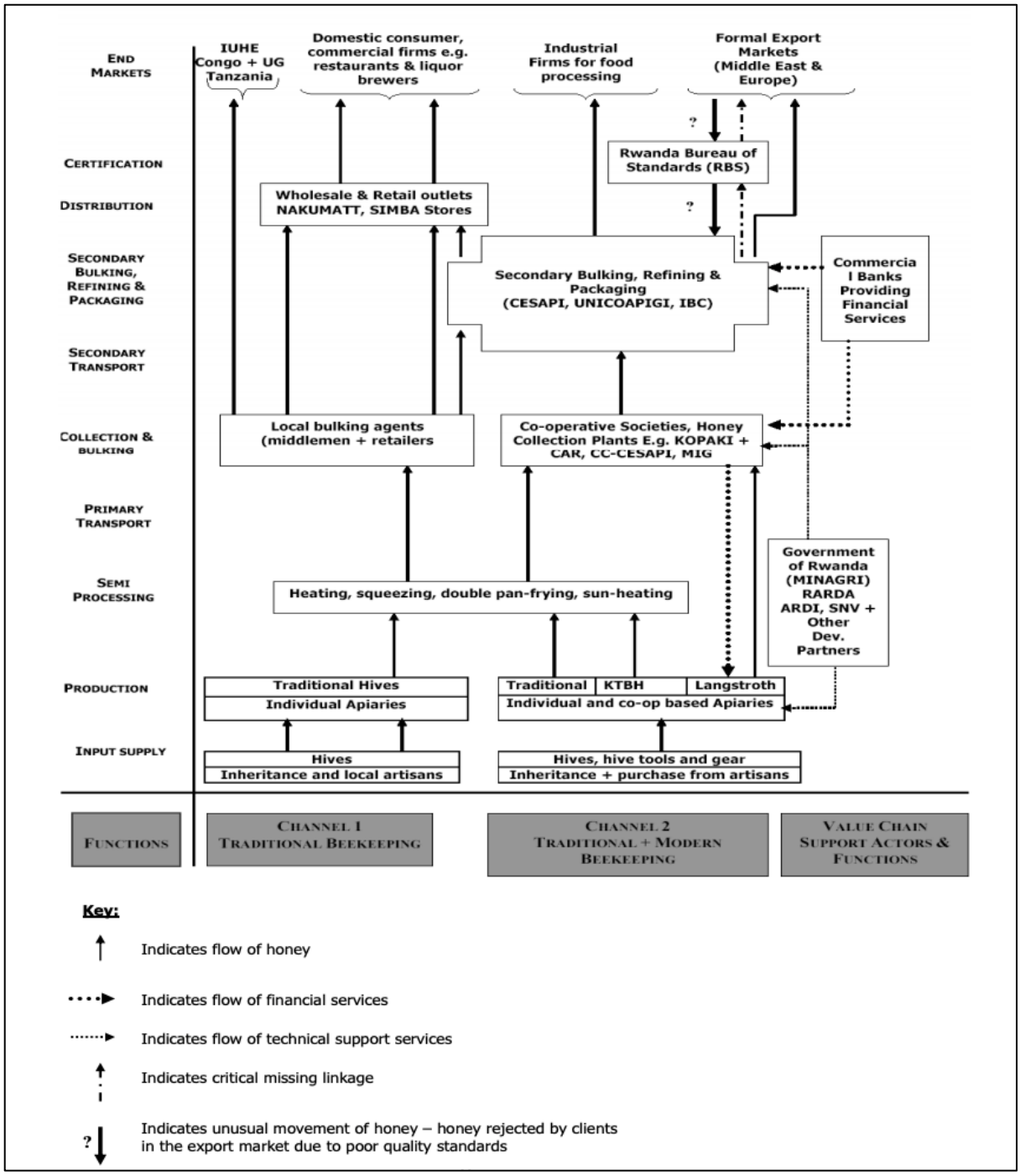


Figure 15. Value chain: beekeeping (from CODIT 2009)

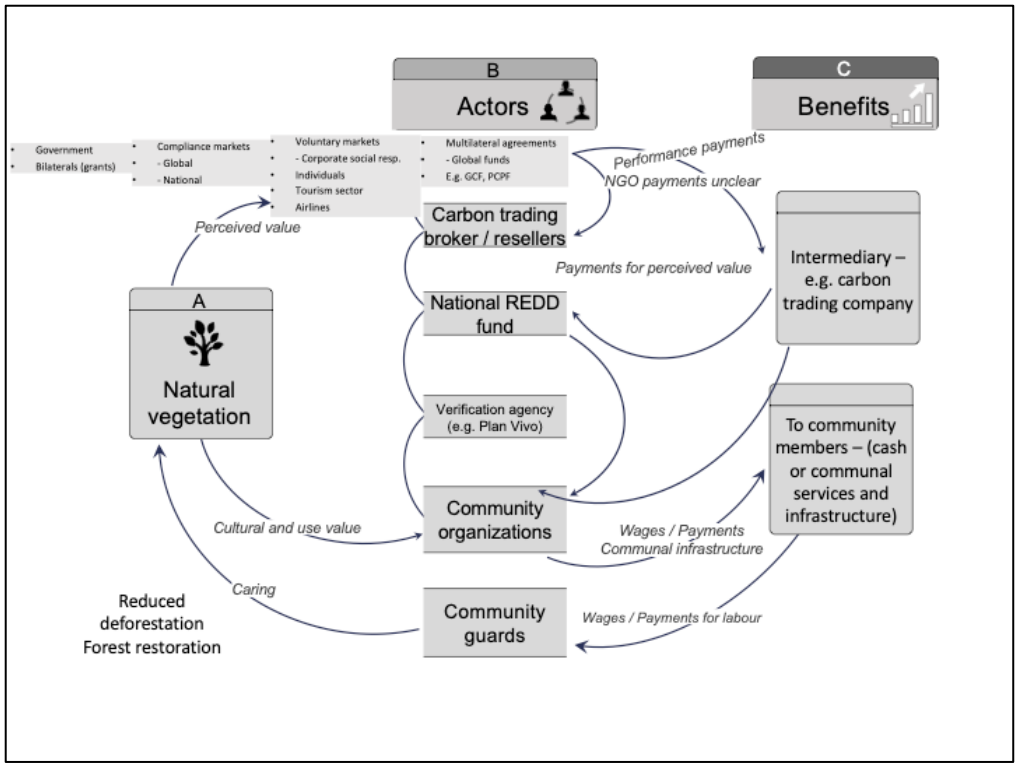


Figure 16. Value chain diagram: voluntary Carbon markets

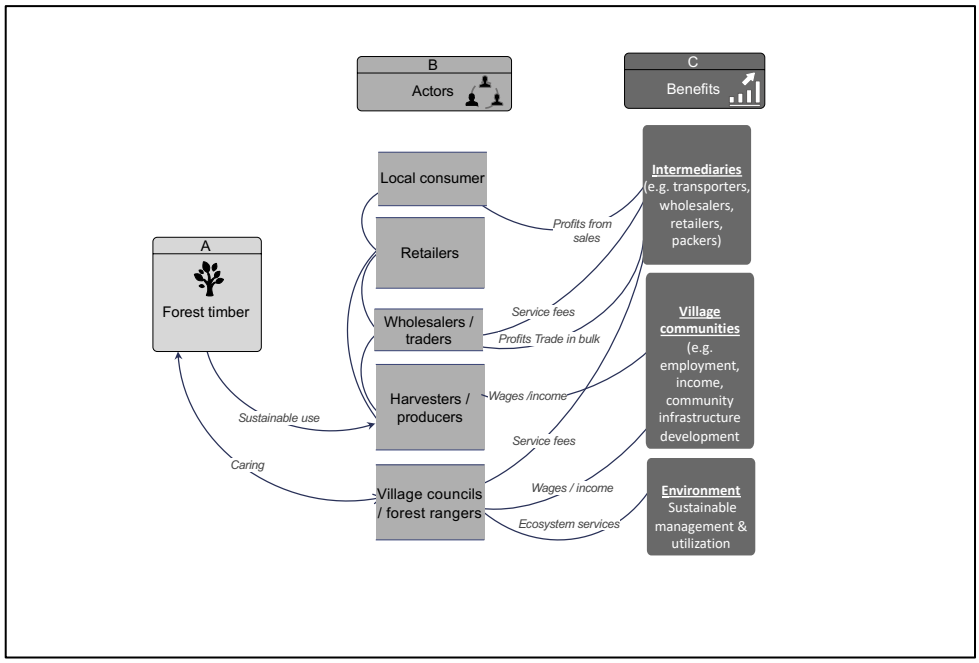


Figure 17. Value chain: charcoal production

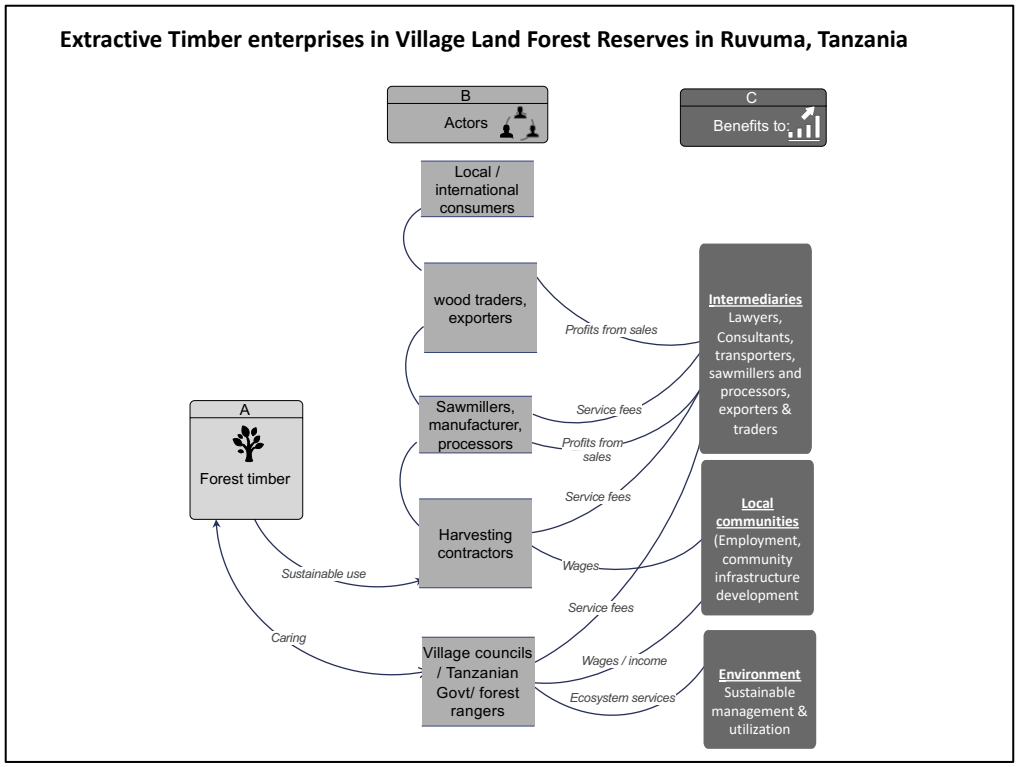


Figure 18. Value chain diagram: timber extraction

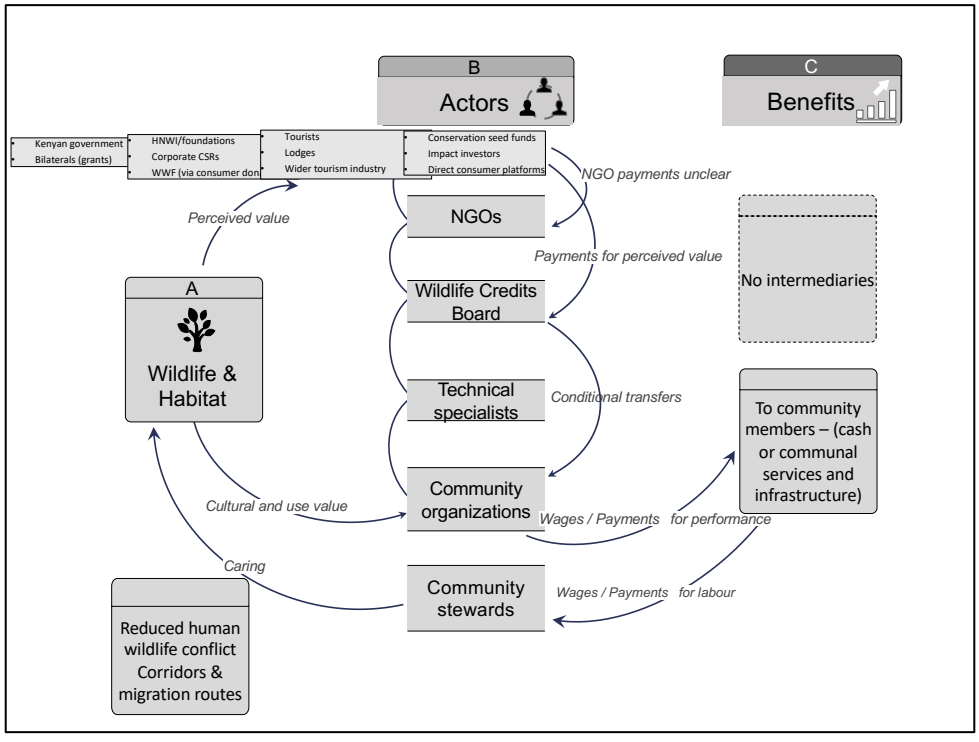


Figure 19. Value chain: wildlife credits

PART III. Evaluation tool and spreadsheet

The evaluation tool is a spreadsheet model, based on four categories (enabling context; viable business model; socio-economic values; and biodiversity and ecosystem services) with 5-7criteria within each category (Figure 20).

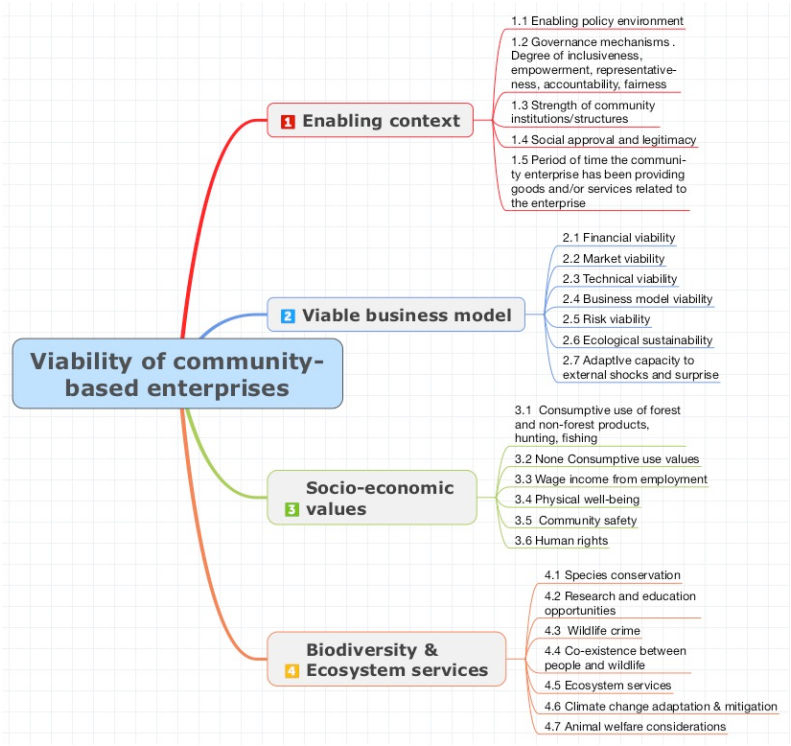


Figure 20. Framework for viability analysis

A simplified version of the spreadsheet model (Figure 4) can be downloaded here.
The user answers Yes or No in Column F (yellow column), to the questions in Column D. The spreadsheet then calculates strengths, weaknesses and uncertainty scores using a set of If-Then-Else rules to formulate a recommendation in the red cells in Column G. The recommendations include a set of warnings, e.g.: "Several underlying essential conditions are unknown |Some essential conditions are absent and /or unknown |First lobby for policy reform |First involve community engagement specialists to help with joint project design |First involve law enforcement agencies to reduce crime |First engage a willing investor with genuine partnership intentions |There are many unknowns |Only 1/3 or less of the business viability conditions exist, or are known |First involve a specialist to develop a plan to increase revenue per unit time or land |First involve specialists to develop a plan to increase market share or diversity |First seek investments in infrastructure improvements |The risks are too high |First engage a willing investor with genuine partnership intentions |The enterprise will probably be unsustainable, ecologically and economically |More information is required. |The socio-economic disadvantages of the proposed enterprise outweigh the advantages |There are significant socio-economic and cultural impacts that could derail the enterprise."

Factor	Description	Dimensions to assess	Leading questions	Response: YES | NO | UNDECIDED	
OVER-ALL ASSESSMENT OF UNDERLYING ESSENTIAL CONDITIONS					✅Yes. All the underlying essential conditions are present
1. Enabling context	The underlying essential conditions, and abilities, to manage the industry and mitigate impacts	1.1 Enabling policy environment	Is there a legal and policy framework that supports and regulates this enterprise's development?	Yes	✅Yes. Please proceed to the next question
		1.2 Rights to land or resources	Does the community have legal access rights to the land or resources involved in the enterprise?	Yes	✅Yes. Please proceed to the next question
		1.3 Participation. Degree of inclusiveness, empowerment, representativeness, accountability, fairness	Did the community actively participate in initiating this enterprise (i.e. they were not merely informed or consulted) and do they accept or support it?	Yes	✅Yes. Please proceed to the next question
		1.4 Strength of community institutions/structures	Is the community largely law-abiding and respectful of laws, rules and codes of conduct?	Yes	✅Yes. Please proceed to the next question
		1.5 Period of time the community has been involved in the enterprise	Does the community have prior experience of the proposed enterprise?	Yes	✅Yes. Please proceed to the next question
OVER-ALL ASSESSMENT OF BUSINESS VIABILITY					! WARNING. The enterprise will probably be unsustainable, ecologically and economically
2. Viable business model	Extent to which the enterprise is a viable business model	2.1 Financial viability	Will the revenues generated from the proposed enterprise compare favorably with other uses of people's time, land and resources?	Yes	✅Yes. Please proceed to the next question
		2.2 Market viability	Is there a large enough market demand for the goods or services being produced?	No	! WARNING. First involve specialists to develop a plan to increase market share or diversity
		2.3 Operational viability	Is there adequate infrastructure and skills to produce the goods or services and get them to market?	No	! WARNING. First seek investments in infrastructure improvements
		2.4 Risk viability	Are the social, political, economic and environmental risks acceptable and manageable?	Yes	✅Yes. Please proceed to the next question
		2.5 Benefit sharing potential	Is there potential for fair benefit sharing through real partnership and joint decision making?	No	! WARNING. First engage a willing investor with genuine partnership intentions
		2.6 Ecological viability	Is there a sustainable long term supply of natural goods or services to meet the requirements of the enterprise?	No	! WARNING. The enterprise will probably be unsustainable, ecologically and economically

OVER-ALL ASSESSMENT OF SOCIO-ECONOMIC VALUES					⚠ CAUTION. Socio-economic and cultural impacts need to be addressed
3. Socioeconomic values	Financial and non-financial benefits not directly related to the enterpriss, e.g. cultural values, religious importance, aesthetic values, research and education opportunities	3.1 Consumptive use of forest and non-forest products, hunting, fishing	Do the material benefits / advantages from the proposed enterprise outweigh the costs and disadvantages due to people's loss of access to wild resources or land?	Yes	✅Yes. Please proceed to the next question
		3.2 Intangible values	Are the socio-economic impacts of the proposed enterprise (on e.g. human rights, culture and tradition, identity, pride, health and well-being) acceptable and manageable? Do the advantages outweigh the disadvantages?	Unsure	FALSE
OVER-ALL ASSESSMENT OF BIODIVERSITY AND ECOSYSTEM SERVICES IMPACT					! WARNING. There are significant negative ecological impacts
4. Biodiversity and ecosystem services	Impacts on biodiversity and ecosystem services	4.1 Species conservation	Do the benefits for species and their habitats outweigh the potential threats due to the enterprise?	No	! WARNING. Engage specialists to develop a threat reduction plan
		4.2 Conservation stewardship	Are people likely to actively protect and restore ecosystems and species due to the enterprise?	No	CAUTION. Incorporate an awareness campaign
		4.3 Ecosystem services	Are the benefits to ecosystem services such as flood protection; erosion regulation; pollination; air and water quality; waste sequestration; noise reduction; reduced frequency and intensity of wildfires; watershed services likely to outweigh the negative ecosystem impacts?	Yes	✅Yes. Please proceed to the next question
		4.4 Climate change	Are there likely to be net benefits for aborbing or reducing greenhouse gas emissions? I.e. are more greenhouse gases absorbed due to the enterprise, than greenhouse gases produced through the full upstream and downstream emission cycle of the project?	Unsure	FALSE

Figure 21. Screen shot of the simplified spreadsheet model

PART IV. APPENDICES

APPENDIX 1. BAOBAB PRODUCTS

Baobab products [5]

October 2021

[5] One of 6 reports on the viability of community-based natural resource enterprises (baobab products; beekeeping; Carbon markets; charcoal production; wildlife credits) in Africa. Produced for WWF's Nature Pays program by CARMa-Afrika, Nelson Mandela University, South Africa. The authors are Christo Fabricius, Bianca Currie, Monicah Mbiba and Herbert Ntuli. Contact us at christo.fabricius@mandela.ac.za

1 Introduction to the initiative

The Baobab tree occurs naturally in semi-arid regions of tropical Africa. It is an important source of non-timber forest products (NTFP) and said to directly contribute to human nutrition and indirectly through rural livelihoods. The tree provides shelter, food, fiber and medicine as well as raw materials for many purposes (Dar et al 2020; Amosi 2018; Meinhold et al. n.d; Bioversity International n.d.) and has the potential to contribute to landscape conservation and management offering a promising prospect for climate change adaptation, ecosystem restoration and food security (Sardeshpande & Shackleton 2019).

1.1 National context

Table 1. National context (UNDP - (http://hdr.undp.org/en/countries))

Country:	Kenya	Mozambique	Malawi
HDI:	0.601	0.456	0.483
Rank:	143	181	174
Trend since 1990 (Positive / Neutral / Negative):	Positive	Positive	Positive
Total population (millions):	66.4	41.2	24.8
Per capita Gross National Income:	$4244	$1250	$1035
Multidimensional poverty %:	38.7	72.5	52.6
Inequality (Gini Coefficient):	40.8 (2015) World bank estimate	54 (2014) World bank estimate	44.7 (2017) World bank estimate
Employment %:	72.7	75.6	72.4
Internet users %:	17.8	10	13.8
Skilled labour force %:	40.5	7.1	17.6

- *Problem being addressed* – Deforestation, food security and livelihoods.
- *Locality* – Kenya including insights from Mozambique and Malawi, Tanzania and other African countries.
- *Activities* – Harvesting of baobab fruits and processing them into a diverse range of value-added products
- *Intermediate outcomes* – Enterprise development and livelihoods
- *Ultimate impacts* – Protection of woodlands and forests, enhanced livelihoods.
- *Value chain* – Harvesters – processors – traders, wholesalers and exporters – retailers – consumers.

Table 2. Value chain analysis of baobab products

The resource:	Natural forest timber				
Value chain	Activities	Direct beneficiaries	Indirect beneficiaries	Supporters*	Outcome
1. Management / cultivation / conservation of the resource	Community assemblies & land management committees Farmers Forest rangers	Tree owners / community forest traditional authority	Government	Govt agencies UNDP FAO GEF TRI	Sound resource management and conservation
2. Use / harvesting / extraction	Harvesting, Pre-processing, collecting and bulking pulp/ seed	Collectors Collecting wholesalers Distributing wholesalers	Pre processors Transporters Packers	ICRAF GIZ	Extraction of raw material
3. Value added industries	Processing	Small and large scale processors	Transporter Service providers Standardisation organisation	Banks MICAIA Foundation (Moz) BMP (Moz) GIZ	Boabab products (oils, juices, cosmetics, health)
4. Sales	The sale of raw and processed product	Rural, semi urban and urban Vendors/middlemen / traders / wholesalers / retailers / exporters	Service providers	BMP (Moz)	Profit and socio economic development
5. Benefits to households / individuals	Nutrition Income	Consumption	Employment	GIZ Govt	Nutritional food source and income
6. Benefits to the natural environment	Stewardship and sustainable management	Sustainable utilization	Standards for utilization	Support for conservation	Sustainable utilization
7. Supporting organizations	Govt agencies Research organisation Banks NGOs Export agencies	Processors Traders Service providers	Service providers	Govt agencies NGOS	Sound resource management, utilization, financial management and governance, optimal benefits sharing

* International Centre for Research in Agroforestry (*ICRAF);* Baobab Products Mozambique (BPM); Deutsche Gesellschaft für Internationale Zusammenarbeit *(GIZ);* United Nations Environmental Program *(UNDP);* Food and Agriculture Organisation *(FAO);* Global Environment Facility Restoration Initiative *(GEF TRI).*

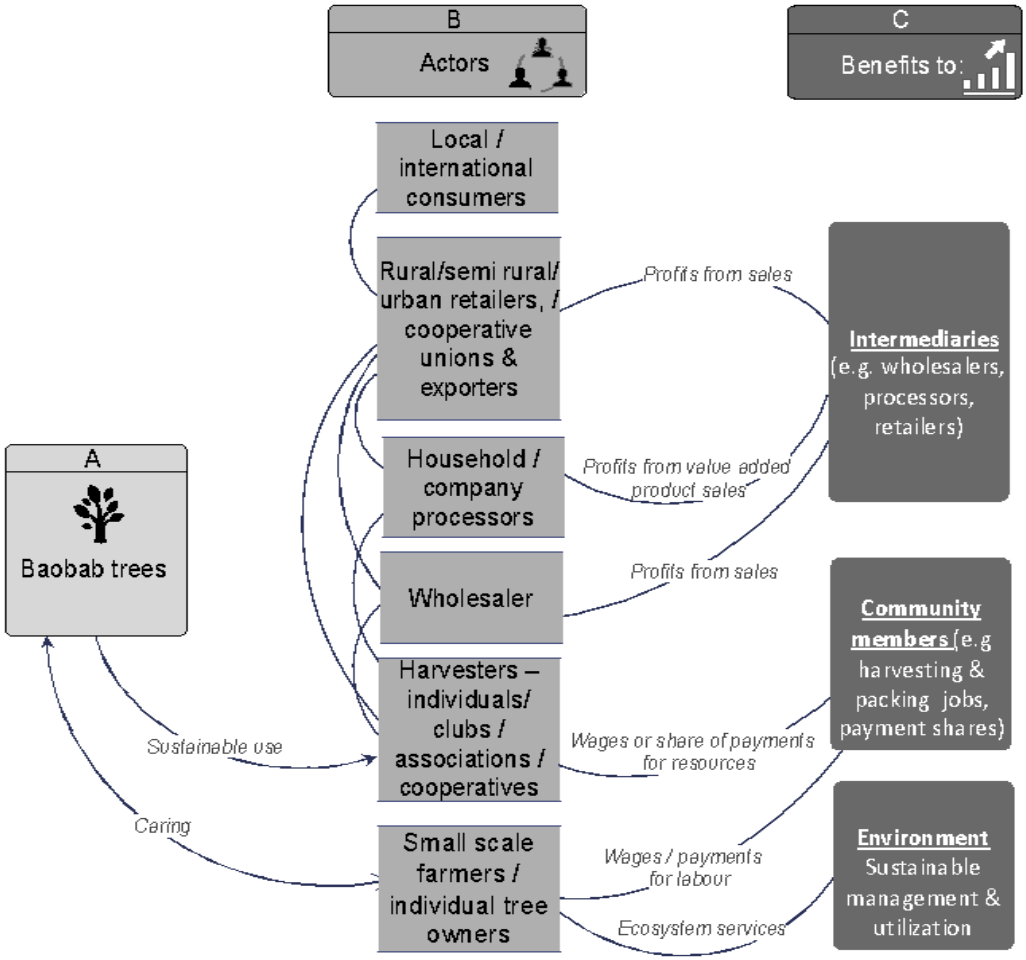
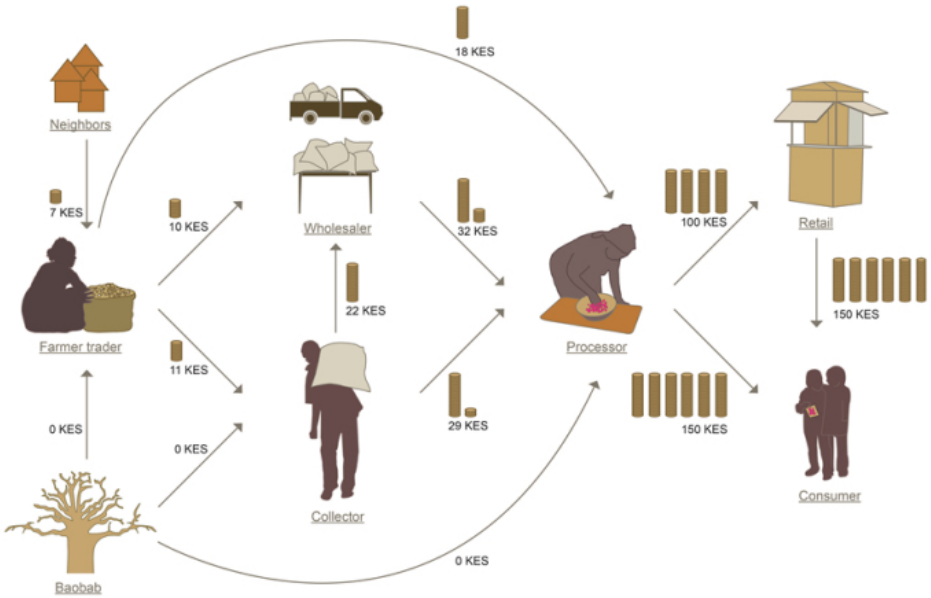


Figure 1. Value chain map of baobab (Adansonia digitata) trade in Africa

- Jäckering et al. (2019) illustrated the Mabuya (a sweet made from baobab) value network and its actors as well as prices of 1kg of baobab pulp/seed along the value chain in Kenya. See Figure 2.



Actor	Market channel	Value addition (KES)
Farmer (F)	Tree → F→ Wholesaler	10
	Tree → F → Collector	11
	Tree → F → Processor	18
	Neighbours → F → Wholesaler	3
	Neighbours → F → Collector	4
	Neighbours → F → Processor	11
Collector	Tree → Collector → Wholesaler	22
	Tree → Collector → Processor	29
	F → Collector → Wholesaler	11
	F → Collector → Processor	18
Wholesaler	F → Wholesaler → Processor	22
	Collector → Wholesaler → Processor	10

Actor	Market channel	Value addition (KES)
Processor	Tree → Processor → Consumer	150
	Tree → Processor → Retailer	100
	F → Processor → Consumer	132
	F → Processor → Retailer	82
	Wholesaler → Processor → Consumer	118
	Wholesaler → Processor → Retailer	68
	Collector → Processor → Consumer	121
	Collector → Processor → Retailer	71
Retailer	Processor → Retailer → Consumer	50

Figure 2. Value chain network and actors in the Mabuya (baobab sweet) value chain in Makueni and Taita, Kenya (Jäckering et al. 2019)

2 Enterprise Viability: baobab products

2.1 Enabling Context

- Although there is a legal framework for community-based forest management which recognizes indigenous community status in Kenya through several forest and land management policies and laws, the process of ascertaining, adjudicating and registering community land rights is slow, and there is weak delivery of land rights including no secure title, and limited power transfers. There are legal contradictions and breakdowns of community by laws and interference from county and national government. The country also ranks low on the worldwide rankings for governance.

- Furthermore, non-timber forest products and services are not yet fully developed and there is a weak policy framework for formal trade and benefit sharing from non-timber forest products in Kenya.
- The Kenyan law promotes and provides for community participation in land and forest management and there is a willingness to be involved which should be taken advantage of, but benefits derived from community forestry in Kenya is prone to elite capture and marginalization of the powerless.
- There is community participation among the stakeholders in the baobab value chain who either operate as independent agents or as collectives in cooperatives, clubs, committees and associations which provides an enabling environment for the sharing of costs and benefits and where decisions are made by vote.
- Kenya is a signatory to several multilateral environmental agreements, those most pertinent to forests and the environment include the Kyoto protocol, Montreal protocol or Vienna Convention, Convention on Biological Diversity and the United Nations Framework Convention on Climate Change (Ngare et al 2016).
- Customary tenure systems in Africa protects the communal land rights of citizens and have historically been used to place management of resources in the hands of local communities providing user rights of natural resources to communities. These types of land tenure systems do however mean that land remains predominantly unregistered and often tenure security is compromised under customary law and traditional administrative systems and can leave communities with a lack of land ownership and compromised user rights.
- While several forest and land management policies and laws have been adopted in Kenya, non-timber forest products and services are yet to be fully developed due to weak policy frameworks (FOA 2020). Duguma et al. (2018) found that details and specifics on incentives and disincentives associated with community-based forest management schemes were not explicit and weak.
- Communities in Kenya can apply for legal tenure of community forests and lands whereby they are given the rights of use, control and even transfer. Community Forest Associations (CFA) can also be formed by communities neighboring public forests where they are given the right to use the forests sustainably to generate income and improve their livelihoods (Okal 2020). Relevant legislation governing land tenure in Kenya include:
- **The Land Act (2012)** was enacted to govern the administration and management of all types of public land. The National Land Commission, the overall authority for management of all types of public land. It also provides the procedures to be followed during implementation of compulsory acquisition of private and community land (Kibugi 2021).
- **The Land Registration Act (2012)** provides for a unified registration system including private and community land. The act stipulates the appointment of a Chief Lands Registrar by the Public Service Commission. It also sets out the process to be followed in registration of land, the form taken by the land register, as well as the legal effect granted by the registration of ownership interest in land (Kibugi 2021).
- **The National Land Commission Act (2012)** gives effect to the establishment of the National Land Commission and provides for its institutional structure (Kibugi 2021).
- **The Forests Conservation and Management Act (2016)** retains the Kenya Forest Service as administrator of all public forests. It classifies forests as public, private or community forests (Kibugi 2021).

- **The Community Land Act (2016)** establishes the community as a collective legal entity, capable of being registered and issued with a title document over land and of making decisions regarding the use, control and transfer of the land. The act also eliminates discriminatory customary practice (e.g., patriarchy), by providing that all adult members (male or female) will comprise the community assembly. The act also provides for the election of a community land management committee by the community assembly to exercise day to day management of community land affairs (Kibugi 2021).
- Harvesters operate as individuals, cooperatives, clubs, committees and associations with benefit sharing arrangements and decision making occurring through votes. Wholesalers in the cities form committees for greater negotiation powers and cost sharing. Decisions are also made through votes. The organization of value chain actors into collectives has helped to reduce the costs, access credit and loans, and provide opportunities to take advantage of economies of scale. Some cooperative however obtain loans and capital from buyers prior to harvest which can trap harvesters into unfavorable revenue deals.

Strengths

- Legal protection of indigenous communities including recognition of indigenous community status is provided for in the legislative framework (Kibugi 2021).
- Strengths of the legal framework: Although there are restrictions on land tenure rights there are also aspects of the legal framework which imply greater tenure security. For Example, the stipulations on the duration of rights where land tenure rights can be in perpetuity or a defined duration and through the legal process of recognition, adjudication and registration of community land (Kibugi 2021). Duguma et al. 2018 explored community forestry frameworks in sub-Saharan Africa and found that countries were good at formulating policy and legal provision as well as articulating formalities for establishing community-based forest management.

Key risks and uncertainties

- Slow and delayed process: Slow pace at which Kenya in ascertaining, adjudicating and registering community land rights (Kibugi 2021).
- Burden on indigenous communities to secure land tenure: When indigenous communities who have occupied what is classified as public land and who have *de facto* possession must petition the National Land Commission to determine their land claims as historical land injustices and thereafter request Parliament to approve revocation of forest status on the land. Only then can land be transferred formally; this does however place a burden on communities.
- No secure title*:* Customary tenure systems assign a "manager" role rather than ownership role to custodians of the land which can reduce stewardship of the land.
- Legal contradictions: The Forests conservation and Management Act declares every gazetted (protected) forest as public forest however the Constitution excludes certain community forests from classification as public forests. This confusion has resulted in land claims (Kibugi 2021). Furthermore, the law recognizing communal ownership of land resources offers no clarity on whether communities can own the forest (Duguma et al. 2018).

- Weak delivery of land rights: Weak governance in land administration poses major concerns in terms of delivering land rights in an efficient and equitable manner.
- Government failure to regulate use and trade: Sardeshpande and Shackleton (2019) highlight that NTFPs often fall prey to corrupt politics and lack resources and ability to monitor the use and trade of NTFPs. They also note that state control over value chains leads to mismanagement and misappropriation of rights and funds.
- Breakdown of community by-laws: Amosi (2018) highlighted how there can be a breakdown of community by-laws regarding use of common property resources (open access baobab trees).
- Limited power transfers: Chomba et al. (2015) examined the extent to which the implementation of community forestry led to local empowerment in the Ngare Ndare Community Forest Association and found that national forest polices, and actors transferred minimal power that enabled local communities to execute forest protection and conservation roles.
- Risks of landlessness: There is concern expressed about the potential risk that formal registration of indigenous communities' *de facto* possession and occupation of the land could result in landlessness, as communities could opt for individual holdings that they eventually sell (Kibugi 2021).

2.2 Rights to land or resources

- Majority of small holder farmers and harvesters in Africa fall under customary tenure systems and are administered through traditional authorities. These land tenure systems are communal by nature and protect the communal land rights of Africans, and especially women and minorities.
- All land in Kenya belongs to the people of Kenya collectively as a nation, communities and individuals, and is either public, private or community land.
- Communities hoping to enforce land rights do either as community land that is lawfully held, managed or used by specific communities as community forests, grazing areas or shrines or ancestral lands, and lands traditionally occupied by hunter-gatherer communities without formal adjudication, registration and issuance of title (Kibugi 2021).
- Property rights in Kenya are protected by the constitution, classified as a human right and set out in the Bill of rights (Kibugi 2021).
- In Kenya, Individuals as part of the collective have an interest however indescribable, unrecognizable or transient in public land and forests (Kibugi 2021) but can also obtain land tenure rights on public or community land which include in part or in full:
- Use rights includes the right to utilize the land for a variety of purpose, such as grazing, growing subsistence crops, gathering minor forestry products such as fuelwood or fruit, or settlement.
- Control rights include the rights to make cessions on how the land should be utilized such as deciding what activities can be undertaken on the land and which crops to be planted.
- Transfer rights include the rights to sell or mortgage the land, to convey the land to others through intra community reallocation, to transmit the land to heirs through inheritance, and to reallocate use and control rights. Communally held land may have restrictions on

transferability to third parties or require collective action and consensus from the community (Kibugi 2021).

- Communities adjacent to public forest lands can apply for permission to participate in the conservation and management of public forests. They are required to formulate a Community Forest Association and forest management plans and sign a management agreement with the Kenyan Forest service (Kibugi 2021).
- Land is often awarded with preferential rights excluding the right to transfer the land to another or restrictions by which it can be done. For example, the Community Land Act allows for a community (with the approval of majority of its members) to allocate part of its registered community land to a member or group of members of the community for exclusive use and occupation which can be granted for a period to be determined by the community, in which case no sperate title is issued (Kibugi 2021).
- The Community Land Act provides that the registration of a community as the proprietor of land shall be held on behalf of the community, free from all other interests and claims and in which case the absolute ownership rights of the land including use and control which grants a community the power to reserve areas for farming, settlement, conservation, heritage preservation or purposes as determined the community county government. Use rights can also be given partially. The Forest Conservation and Management Act provides that a member of a forest community, together with other persons resident in the area can register a Community Forest Area and apply to the Kenyan Forestry Service for permission to participate in the conservation and management of a public forest, in which case they will be provided limited forest user right, which include collection of medicinal plants harvest and plantation establishment (Kibugi 2021).
- The county and national government do have the right to limit what the community can do with the land in the interests of defense, public safety, order, morality, public health or land use planning (Kibugi 2021).
- The scope of land tenure rights, whether complete, preferential or limited determines who can do what with particular land, and sometimes also when and how they can do it (Kibugi 2021).

Key risks and uncertainties

- Customary systems of land tenure common in Africa mean that land remains predominantly unregistered and often tenure security is compromised under customary law and traditional administrative systems. The customary residence system used in the governance of customary land fosters a lack of ownership and user rights of communities (Munyuki-Hungwe and Rukuni 2020).
- Lack of ownership and user rights: There is no sense of ownership for community as trees and access rights are free. The land tenure systems in Africa often discourages investment in land improvement and limits development. The rules of customary tenure do not guarantee an individual the use of a specific plot of land and the land is not "owned" by an individual. This lack of ownership prevents the use of the land as security against a loan or credit. In Kenya the tenure rights even when complete may not assure land tenure security if there is no certainty and if it is subject to inference (Kibugi 2021).

- Limited power transfers: In Ngara Ndare Community Forest Association it was found that there was limited transfer of powers to enable local communities to execute forest protection and conservation roles (Chomba et al 2015).

2.3 Participation

- The land policy principles of Kenya include inclusiveness, nondiscrimination and protection of the marginalized, and the Forest Conservation and Management Act identifies its guiding principles to include good governance and public participation as well as community involvement in the management of forests (Kibugi 2021).
- The law in Kenya provides for community participation in management of public forests through community forest Associations (CFA) and also the Community Land Act which makes the establishment of a community assembly (made up of all adult members of the community) and a land management committee (consisting of 7-15 elected members) mandatory. It creates a broad-based structure of participation by all members (Kibugi 2021). Furthermore, the Community Land Act requires that any proposed investment in the land must be preceded by a free, open and consultative process of consultation and needs to be approved by two thirds of adult members at a community assembly meeting where a quorum constitutes two thirds of the members (Kibugi 2021).
- Baobab harvesters often operate in cooperatives and associations. In the harvesting cooperatives members buy shares and can buy more than one share. For example, the baobab harvesters in Magoch and Dedze districts have formed clubs. The club members vote in a chairperson, vice chairperson, secretary, vice secretary, treasurer, committee members and an in-taker on an annual basis, and decisions are made by vote (Amosi 2018).
- Wholesalers from cities have market committees which allows its members to collectively market products. The market committees are governed through a chairperson, vice chair, secretary, vice secretary, treasurer and members. The members pay a monthly contribution (approx. US$0.6), and decision making is done through votes.

Strengths

- Willingness to be involved in participatory forest management: Wambugu et al. (2017) found that there was an awareness and willingness to be involved in participatory forest management which should be enhanced. The high levels interest to be involved in participatory forest management was however motivated by anticipated benefits that could meet household needs.

Key risks and uncertainties

- Elite capture: In the Ngare Ndare CFA representation within the association was skewed in favour of small and already powerful local elites (Chomba et al. 2015).
- Limited transfer of power: in the context of CFAs there is no provision for CFAs to make rules about conservation, and land utilization as well as harvesting and protection rules either in the forest Act or any other legislation. The decision-making powers rest with the Knysna Forest Service and the Minister of Environment, Water and Natural Resources (Chomba et al. 2015). For example, in Ngare Ndare CFA harvesting of products was indirectly controlled by the KFS through the price of license fees and the number of licenses issued to collectors.

Community members who cannot afford the license feeds continued to harvest illegally. Rulemaking powers still remain with state actors (Chomba et al. 2015). Local empowerment in CFAs was undermined by institutional structures, including policies and actions of the state that limited transfers of power (Chomba et al. (2015)

- Inequality: Preexisting social and economic inequality coupled with competition for resources at the local level marginalized groups who had a lack of power, agency and representation in the Ngare Ndare CFA allowing for elite capture (Chomba et al. 2015).
- Limited time projectization: Community based forest management has been projectized resulting in communities associating specific forest areas supported by projects to small groups or individuals who work on the projects. Projects are run on short time frames and are therefore dependent on NGO and government support (Duguma et al. 2018).

2.4 Viable business model

- Baobab is regarded as the highest earner of all non-timber forest products in the Southern Region of Africa and it has the potential to become a billion-dollar industry for the continent of Africa. There have been over 25 different uses for baobab and 78 processed products made available in formal and informal markets.
- There is much opportunity for product development, value addition and high profit margins related to trade in baobab products in Kenya.
- The informal and ad hoc nature of the trade in baobab currently limits the revenue potential of baobab enterprises as the formal market value is higher than the direct value. Furthermore, the informal trade results in the trade and conservation of the resource being divorced from government laws and regulations. It also limits actors in terms of accessing finance and other benefits.
- Baobab processing is currently limited to small scale enterprises offering low quality cheap food products for the low-income consumer, but there are a growing number of formal enterprises entering the market as more product differentiation and fragmentation takes place.
- There is a strong emerging international interest and a “willingness to pay” by high income customers for health-related food products, and therefore much potential for product differentiation and export exists, especially since the European Union and United states have approved the product for consumption.
- Costs, market literacy and market mechanisms, certification systems and export quality standards, road access to markets remain barrier for informal and rural actors to enter the formal market
- Harvesting is also seasonal and the shelf life limited unless preservation technologies and processes are used. Furthermore, there are poor fruit handling practices and wholesale storage shortages which compromise the quality of the product made available.
- Although some actors have organized many have not, acting as individuals or wage workers with a lack of networking and connectivity and means by which to access markets. There are also significant differences in the sharing of benefits where actors with higher costs earn more revenue. The harvester has the highest gross margin in the value chain as their costs are limited to packaging, but they make less profit as compared with wholesalers because they do not add much value to their products and sell at a low price.

- Revenues are prone to capture by intermediaries and elites and benefit sharing is limited. This is further exacerbated by the lack of a national benefit sharing rules or a national framework.
- There are significant sustainability issues related to the supply of baobab in the short to medium term, as the supply of fruits from baobab trees is not adequate to satisfy the demand for both raw fruits consumed, processed and exported, especially seeing poor quality forests are predominantly assigned to community-based forest management projects. This is exacerbated by the lack of cultivation and domestication programs on the continent, over exploitation, and the risk related to other land use opportunity costs.

2.5 Financial viability

- Baobab is regarded as the highest earner of all NTFPs in the Southern Region of Africa and has the potential to be a billion-dollar industry for the continent of Africa. Darr et al. (2020) identified over 25 different uses over 78 processed products in formal and informal markets. The fruit and pulp are being processed by both formal and informal enterprises to produce a variety of food and non-food products, but informal trade dominates with little evidence of commercialization.
- There is much opportunity for product development, value addition and high profit margins related to baobab in Kenya (Jäckering et al. 2019). Baobab processing is currently limited to small scale enterprises offering low quality cheap food products for the low income consumer, but there are a growing number of formal enterprises entering the market as more product differentiation and fragmentation takes place. These formal enterprises are satisfying preferences that are connected to economic development, urbanization, and the westernization of African lifestyles and societies (Darr et al. 2020). Being better resourced (managerial, technical, financial, networking) these formal enterprises can meet legal and quality supply chain requirements and therefore meet customer expectations. Targeting the formal high end market segment differentiating products is a successful strategy for such enterprises (Darr et al. 2020). In Kenya for example pulp and seed are the most commonly traded raw materials, however a processed candy made from the pulp called Mabuya, and products such as baskets, paintings printed on fibre from the baobab bark, seed oil and fruit pulp power were also traded in Nairobi but predominantly sold to tourists through niche markets (Jäckering et al. 2019).
- Jäckering et al. (2019) undertook a value chain analysis of baobab trade in Kenya and identified several actors, the activities they are engaged in and the main market channels they use to sell their product. See Table 3.

Table 3. Actors, activities and main marketing channels in the baobab value chain in Kenya (Jäckering et al. 2019)

Value chain actors	*n*	*Activity*	*Main marketing channel*	*Characteristics*
Farmer	41	• Harvesting • Pre-processing	• Sell mostly at farm gate	• 71 % female • 29 % male
Collectors	10	• Harvesting • Pre-processing • Collecting and bulking pulp/seeds • Transport pulp/seeds to markets	• Buy from neighbours • Sell to spot market	• 60 % female • Senior women • 40 % male • Unemployed young men
Collecting wholesalers	2	• Search for baobab pulp/seeds • Transport pulp/seeds to larger markets (Voi/Mombasa)	• Buy pulp/seeds in villages or local markets • Sell to large-scale processors or distributing wholesaler in urban areas	• 17 % female • 83 %male
Distributing wholesalers	4	• Own shops or fixed stalls at urban areas of Nairobi and Mombasa	• Buy pulp/seeds from collecting wholesalers • Sell to large-scale urban processors	
Large-scale processors	23	• Procure pulp/seeds • Prepare mabuyu • Sell mabuyu	• Sell to retailers • Exist in urban and rural areas	• 73 % female • 27 % male • Main activity petty trade
Small-scale processors	17		• Sell directly to consumers • Exist only in rural areas	
Retailers	37	• Purchase mabuyu • Sell mabuyu to customers	• Buy mabuyu from processors who deliver (50 %) or buy mabuyu at the market from wholesaling processors (50 %) • Sell directly to consumers	• 85 % female • 15 % male • Main activity petty trade of sugar, oil, vegetables, flour and other candies

Most baobab collectors sell their pulp through rural wholesalers as opposed to urban buyers. This choice is dictated by human capital, transactional and institutional factors indicating a need for capacity building around market development, research and education and institutional services. Kaimba et al. (2020) identified five marketing channels collectors use to sell their baobab pulp showing that 85% of collectors sold their pulp through rural markets and that the export market is conspicuously missing from the chain (see Figure 3). Kaimba et al. (2020) also found that a larger proportion of baobab pulp sold is harvested from collectors' own farms as opposed to neighbors' farms, communal lands and forests.

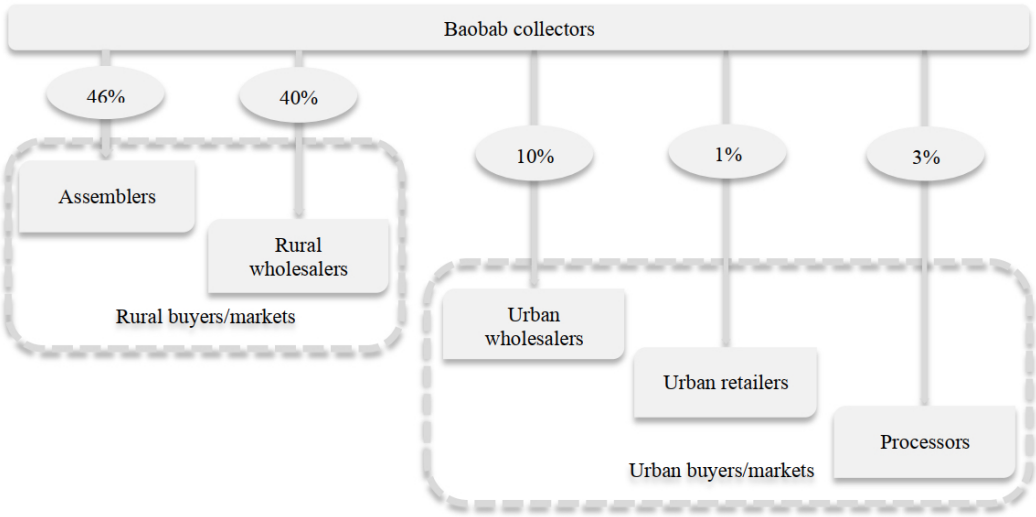


Figure 3. Marketing channels for baobab collectors in Kenya (Kaimba et al. 2020)

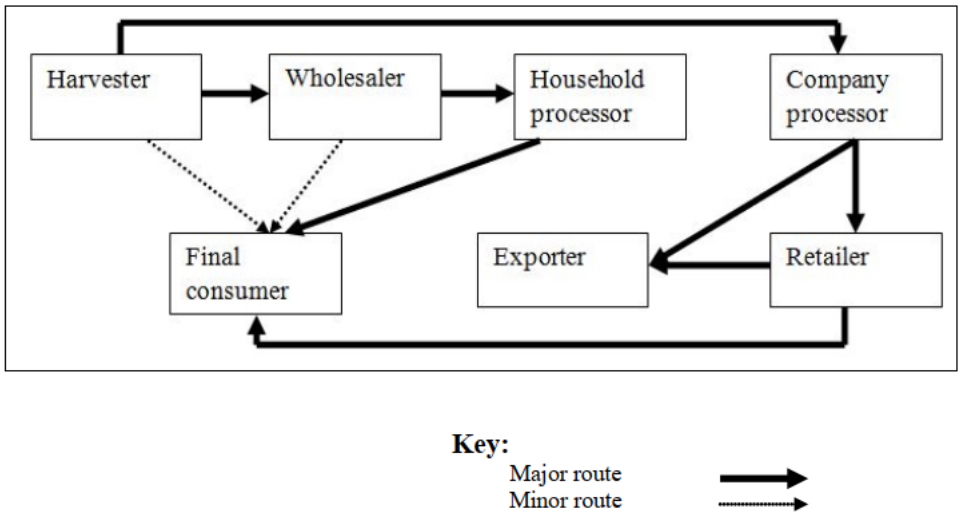


Figure 4.Various actors in the baobab value chain (Amosi 2018)

- Amosi (2018) identified several trade relationships between actors in the baobab value chain in Malawi, namely spot market relationship also known as arm's length or ad hoc relationships where the negotiation between buyer and seller happens on the spot; persistent network relationships where actors have a preference for transacting with each other more regularly in a formalised or unformal manner. Lastly horizontal integration relationships where both actors share the same legal ownership by signing contracts or agreements. Spot market relationships are the most common (Amosi 2018).
  - Wholesalers of baobab products buy in bulk and transport the products to semi-urban or city markets where they re-package the bulk in small and large quantities for household processors, middlemen and final consumers (Amosi 2018).
  - Potential income and value share: Very little has been published about the revenue earned by those in the baobab value chain. In Kenya a processor of products earns on average US$ 440 to 490, a collector on average earns US$ 11-227 and a farmer US$ 9-275 (Jäckering et al.

2019) and in Malawi harvester can earn in the region of US$ 322-698, a wholesaler US$ 496-4772, a processor US$ 6653 – 229 592, a retailer in the region of US$ 140-438 and an exporter in the region of US$ 5483 – 56 639 (Amosi 2018). In South Africa the annual gross income earned through baobab is US$ 108 -167. Baobab Products Mozambique purchase from women harvesters in the Manica Province of Mozambique creating an average income of US$ 70 per harvester (Snyman et al. 2021). In Zimbabwe there are over 20 000 people who benefit from baobab trade with approximately 4500 producers earning US$ 453 600 with an average annual income of USD$ 100.8 per producer (Mukeredzi 2019).

- Costs: Costs vary across the value chain. Harvesters obtain the highest gross margins as their costs are low allowing them to make greater returns. A harvester's costs include labor, time for harvesting and selling and packaging (Amosi 2018). Wholesale transportation costs are significant (Amosi 2018). Amosi (2018) provides a mean variable cost, revenue, gross income and margins for the various actors in the baobab value chain in Table 4.

Table 4. Mean variable costs, mean revenue, gross income and gross margin of actors of baobab trade in Malawi (Amosi 2018).

Actor and actor category	Variable Cost (MK) (Mean ± SE)	Revenue (MK) (Mean ± SE)	Gross Income (MK)	Gross Margin (%)
Harvester				
Zankhalango Association	24867 ± 1041	556,667 ± 151,914	517,800	96
Individual	20043 ± 340	263,712 ± 53,334	239,147	92
Wholesaler				
Pulp Mozambique	1,675,125 ± 41,123	5,213,605 ± 89,360	3,538,480	68
Pulp Malawi	612,461 ± 123,189	3,005,722 ± 46,844	2,393,261	80
Whole tree	371,633 ± 49,614	1,194,667 ± 42,667	823,034	69
Fruits in a bag	537,633 ± 87,084	905,956 ± 72,258	368,323	41
Processor				
Naturals M Limited	110,682,101	280,933,190	170,251,089	61
Home Oil Company	3,111,425	8,044,500	4,933,075	61
Household	11,017 ± 1,206	53,538 ± 5,606	42,521	79
Retailer				
Four Season Souvenir shop	300,000	625,000	325,000	52
Shoprite Supermarket	688,000	792,000	104,000	13
Exporter				
Tree Crops Limited	17,610,000	42,000,000	24,390,000	58
Maluso Cooperative Union	1,035,000	5,101,000	4,066,000	80

*1US$ = MK780

Strengths

- Willingness to pay: There is a willingness to pay for baobab product. Consumers from a high income sociodemographic are willing to pay for health-related food products in particular. The quality attributes necessary to tap into the high-income customer include product information on labels, packaging materials, nutritional properties, long shelf life, health

claims, and conformity with product quality standards (Darr et al. 2020). Product pricing could be improved through better labelling and marketing, subject to cost-benefit analysis and market research.

- Product differentiation potential: Darr et al. (2020) found that certain extrinsic product features promoted higher prices for baobab fruit juice products, irrelevant of the nutrient content of the product. Baobab product attributes such as packaging quality, labelling, conformity with food standards, and perceived health benefits provided differentiation potential which can substantially increase product value by 100% (Darr et al 2020).
- Cooperatives and associations: Harvesters and traders of baobab raw materials and products either operate independently or in cooperatives, clubs, committees and associations which provides small holders and traders with numerous benefits. Operating as collectives facilitates the members of the collective accessing market information, accessing resources (transportation, credit, loans and training) and gives them leverage to negotiate. The wholesale market committees help facilitate certification and labelling of products (Amosi 2018).
- Cooperatives and committees help reduce costs and provide gains through economies of scale: The market committees help the wholesalers to work in groups too where they can pool resources and share costs. For example, when wholesalers are purchasing goods, they hire a single truck, can negotiate for better prices and share the cost equally. The cooperatives and committees assist small-scale traders in benefiting from economies of scale (Amosi 2018).

Key risks and uncertainties

- Informal nature of the market: Informal trade is a problem with several consequences. It means that the trade in the product and the conservation of the resource remains divorced from the government laws and regulations, and the protection of right. It also inhibits actors in the value chain in accessing finances and other benefits. Furthermore, it results in informal labelling and a lack of quality standards (Amosi 2018).
- Spot market relationships: Ad hoc informal trade relationships do not foster trust between actors and encourages cheating on quality, quantity and even exaggerates prices because actors do not know each other well. This informal trade relationships are prone to various risks in relation to price, quantity, quality and comes with dishonesty which does not bode well for sustainable business relationships. Furthermore, quality assurance, value adding, and innovation are low because of it (Amosi 2018). Kaimba et al. (2020) however found that collectors would rather do business with reliable traders with whom they have interacted before than go for high prices in unknown market outlets in Kenya, this especially so because most collectors are women.
- Revenue capture by intermediaries: Analysis of NTFP value chains regularly bring to light issues of revenue capture by intermediaries (Sardshpande & Shackleton 2019).
- Seasonal trade: In cases where NTFP yield is inconsistent or perishable and production costs are dynamic, market prices may not succeed in capturing profits (Sardeshpande and Shackleton 2019). Baobab harvesters are only profiting on a seasonal basis (Three months per year) (Amosi 2018).
- Certification systems are a barrier to trade: The increasing demand for certified NTFPs in global markets acts as a barrier to trade for African producers (Amosi 2018). Certification is

expensive and MBS do not have differentiated inspection and certifying rates for small and large industries (Amosi 2018).

- Poor quality product: Wholesalers rely on household and individual processors for their supply, and in an effort to have baobab pulp available all year-round wholesalers store the product for extended periods which significantly reduces the quality of the product (Amosi 2018). Company processors avoid purchasing product through wholesalers as the poor-quality raw product spoils the quality of the final processed products.
- Lack of product differentiation: Darr et al. (2020) identify two consumer segments for baobab food products namely the formal and informal product divide. Each segment differed in terms of product packaging, labelling preferences and the presence or absence of preservatives. Amosi (2008) highlights that there is a lack of product differentiation and the additional value certification and packaging can bring.
- Inadequate monitoring of performance: Duguma et al. (2018) undertook an exploration of community forestry frameworks in sub-Saharan Africa and found that countries including Kenya fell short when it came to monitoring community-based forest management performance and product management.
- Loans and capital from buyers' traps harvesters: Although capital and loans obtained from buyers prior to harvesting is helpful it does bind the harvesters to the buyers in a debt or patron client relationship which prevents harvesters from obtaining higher prices for their product (Amosi 2018).

Data availability

- Despite the socio-economic importance of baobab in Africa there is very little data and information available about the market chain, marketing and commercialization of baobab products in Kenya and Malawi (Jäckering et al. 2019; Amosi 2018). This information deficit perpetuates the informal nature of the trade as well as the inefficiency and ineffectiveness of actors in the value chain. It furthermore reduces the revenue potential of the enterprise (Amosi 2018). Little research has been done in Kenya around marketing specialization and value addition either (Kaimba et al. 2020; Gebauer et al. 2016).

2.6 Market viability

- Production and informal commercialization of baobab products within Africa is common and most of the produce is exported to Zimbabwe and Malawi with an estimated production volume of 500 tons per year (Bioversity 2020).
- The global market for baobab products has been projected to reach USD$ 10 billion by 2027 and could potentially employ 2.5 million people in Africa (Future Market insights 2017). Competition from other similar tropical fruit with high nutritional value is however unknown.
- The consumers of baobab products are found in rural and urban environments where raw and processed products of both high and low value are purchased and consumed (Amosi 2018). Darr et al (2020) highlights the two distinct consumer segments for baobab juice products. The informal sector for baobab juice and food products were consumed by low-income consumer groups (e.g. school pupils, laborer) in urban and peri-urban street markets. The formal sector for baobab juice produced by food companies which is

consumed by higher-income urban consumers. The formal sector also includes high end products (e.g., baobab chocolate) sold in specialty stores supporting expatriates or international tourists, resembling the consumer patterns of western countries (Darr et al. 2020).

- Export: Despite the diversity of baobab products processed in Africa few (oil, powder, and soap) are exported. Baobab export product demand was catalyzed by the approval of the European Union and the United States for consumption in the 2000s (Bioversity et al. 2020). Now there is a growing export market for baobab products in Europe (Sardeshpande & Shackleton 2019) with more than 300 baobab products already exported to Europe (Jäckering et al. 2019). The fruit powder is exported to Germany, France, Netherlands, and the United Kingdom. The emerging international interest in the product is tied to the growing demand for baobab pulp as a nutritious natural ingredient for a variety of lifestyle food products in Europe, the US and other developed markets (Darr et al. 2020). Baobab Products Mozambique for example has become a significant exporter of organic baobab power purchasing 400 tonnes of pulp and seed in 2018 (Snyman et al, 2021).
- In Amosi's (2018) a baobab value chain analysis conducted in the Karonga, Salima, and Mangochi districts and Lilongwe, Blantyre, and Mzuzu cities involved two large scale processors and exporters of baobab products, namely Tree Crops Limited and Maluso Cooperative Union. These companies sell to both local and international markets (USA and UK) through an exporting powder company in Lilongwe. The baobab pulp is supplied by the Zankhalango Association and is processed into powder by Tree Crops Limited before being sold. Baobab oil and soap are bought from Home Oil Limited in Blantyre by Maluso Cooperative Union in Lilongwe respectively and is exported to Japan. Baobab oil is re-packaged in 100ml bottles and fragranced by Maluso Cooperative Union before being exported (Amosi 2018).

Strengths

- Formal market value higher than direct value: Trade in NTFPs is profitable when the formal market value of the product is higher than the direct use value of the product. For example, the baobab fruit can be sold at four times its domestic use value (Sardeshpande & Shackleton 2019) which is the case in Venda, South Africa where baobab fruits are helping to alleviate poverty (Jäckering et al. 2019).

Key risks and uncertainties

- Poor market mechanism: There are poor market mechanisms for baobab actors (Amosi 2018).
- Seasonal supply: The supply of raw baobab material is seasonal only lasting two months of the year, yet the demand for the products is all year round (Amosi 2018).
- Export marketing demands: Marketing for the export markets requires detailed information about the markets themselves, product specifications and standards which not all actors along the value chain can access and meet (Amosi 2018).
- Lack of HS-Code and standards: There is no Specific Harmonized Commodity Description System (HS- Code) for baobab fruit pulp for the EU market. The standards are currently

based on accepted raw supply practices for other industries such as out-sourced production of paprika products.

Data availability

- In their review of NTFPs Sardeshpande and Shackleton (2019) only found 12 studies were the economics of the wild edible fruit trade featured. The informal nature of the trade makes it difficult to quantify and much of the harvest is also exchanged informally through barter or cultural gifts. Even in cases where NTFP trade is an important contributor to household income, price setting may be uninformed by market dynamics or formal value. There is a lack of value chain analysis for baobab products and socio-economic data throughout the value chain (Amosi 2018). There are significant gaps in information on market value (Sardeshpande and Shackleton 2019)
- Lack of consumer product knowledge: There is also a lack of consumer knowledge about baobab products, especially regarding the socio demographic characteristics and quality preferences of baobab consumers (Darr et al. 2020). There is a need for processors to invest in product awareness campaigns to promote trade in baobab products (Amosi 2018).

2.7 Operational viability

- There are two categories of baobab harvesters, those working in clubs and individual harvesters. Skilled harvesters who work individually are either owners of the trees or casual labourers employed by the owner of the trees or wholesalers (Amosi 2018). Wholesalers in the baobab trade are vendors or middlemen who reside in the cities and semi-urban areas, respectively, but buy baobab fruits or pulp in bulk from harvesters in the villages. Wholesalers sell the products to household processors and final consumers. Baobab processors have been observed at household and company levels. Household processing uses basic kitchen equipment (e.g., pots and pails). These products are simple to make and do not require any specialized skills. Small companies typically produce juice only and sell locally, medium companies processes multiple products sold locally and large companies process products which are sold in both local and international markets. Processors sell their products to retailers, final consumers, and international markets. The large companies typically use mechanized equipment. Retails are both formal (e.g. Shoprite) or informal (e.g. vendor on the side of the road). The retailers sell their baobab products to the final local consumers and international markets (Amosi 2018).

Strengths

- Associations, clubs, and cooperatives: It is evident that when organized into groups or associations harvesters increase their bargaining power and access to training and equipment, all of which will help them to increase their value share (Amosi 2018).

Key risks and uncertainties

- Costs to enter the formal market: In a review of literature on NTFP Sardeshpande and Shackleton (2019) highlight the shortage of capital as a common constraint for actors in NTFP value chains. This is more evident in the informal trading sector as actors are unable to access funding, loans and other services or to meet the international standards and market requirements. The costs of packaging materials for small scale processors is one

example. Processors do not have financial resources to import the recommended packaging materials. Furthermore, Kiamba et al (2020) highlights that the difficulties related to accessing funds and other services is even more challenging for women who are predominantly the raw product harvester.

- Lack of organisation: Actors in informal markets remain unorganized which decreases their bargaining power and leaves them open to exploitation resulting in less favorable prices being achieved (Amosi 2018)
- Lack of networking and connectivity: Analysis of NTFP value chains highlight a lack of networking and connectivity between stakeholders (Sardeshpande and Shackleton 2019).
- Lack of market literacy and information: Communities and small holders are often trapped in the informal sector because they lack market literacy and information on international standards and linkages which are important in terms of entering new markets and maintaining a market share (Amosi 2018), and in some cases are easily exploited by potential buyers (Bioversity 2020)
- They also lack the ability to meet the legal requirements of the commercial sectors (Amosi 2018). However, the cooperative unions have been established as an institution which fills the gap and sells to the international markets.
- Shortage of wholesale storage: Wholesalers commonly store their raw material inappropriately because there is a shortage of storage space for them to utilise in the urban areas. The Mchesi market in Lilongwe was built by wholesalers in response to the limited storage in the city for their produce. Inappropriate and extended storage techniques that prevent air circulation between the bags can result in discoloured fruits rendering the product unacceptable in terms of international standards, and not fit for export (Amosi 2018). The cost of refrigeration may however be an obstacle to viability.
- Shelf life enhancing technologies and processes: The shelf life of baobab fruits and juices is limited unless artificial or natural preservatives, pasteurization, or cold stabilization using crossflow microfiltration is used. These technologies and processes provide the opportunity for juice processing enterprises to enter the formal sector and to target the consumer preferences in the formal market segment (Darr et al. 2020). Alternatively, its best to store the fruit on tree and only process into powder as late as possible (Meinhold et al. 2020).
- Poor fruit handling: Wholesalers and other value chain actors lack knowledge about fruit handling techniques and storage of baobab products which results in a poor-quality product (Amosi 2018). Lack of training or lack of access to training about post-harvest handling adds to the problem.
- Poor road infrastructure: Harvesters receive less value share in the value chain, not only because they trade in the raw material without any valued added but also because the road infrastructure inhibits their ability to access formal markets where they may get high prices for their raw product (Amosi 2018). Women are furthermore restricted by this (Kiamba et al 2020).
- Product certification as a barrier to trade: There is an increasing demand for certified NTFPs in global markets and Fairwild certification has become popular. Quality standards and certification of baobab products adds value, but small-scale producers find it expensive, time consuming and challenging to achieve the standards for certification or the internal control systems requirements. Certification is therefore is a significant constraint for the rural poor,

and acts as a barrier to entry into the formal markets, but without it they are unable to compete (Amosi 2018).

Data availability

- There is also little known about the quality of the products already in the market (Meinhold et al 2020) and product processing in general (Sardeshpande and Shackleton 2019). Little is known about how handling of baobab fruits and material along the value chain may impact on the quality of the end product, especially the vitamin C levels and microbial contamination. However, vitamin C level in pasteurized juice is known to decrease upon storage which suggests there is a demand for advanced processing methods including non-thermal pasteurization (Tembo 2016).

2.8 Benefit sharing potential

- Baobab trade has the potential to be a billion-dollar industry and could employ over 2.5 million households in Africa, if fully commercialized (Amosi 2018). Increased commercialization of baobab can provide a source of income and may improve food security for rural communities in Africa (Bioversity 2020).
- Duguma et al. (2018) undertook an exploration of community forestry frameworks in sub-Saharan Africa and found that countries including Kenya fell short when it came to benefit sharing. This said community-based forest management did have an overall positive impact on income, poverty alleviation and livelihoods across countries in Africa.
- Community based forest management can improve the health and wellbeing of communities if revenues are enough to invest in social development projects such as health facilities. It also improves access to sources of medicines and nutrition (Duguma et al. 2018).
- Baobab trees themselves remain important for subsistence, healthcare, energy, natural insurance in times of shock and for generating a seasonal household income (Sardeshpande & Shackleton 2019; Amosi 2018). There are over 25 different uses for the baobab tree, including food, fodder, medicine, and shelter (Sardeshpande & Shackleton 2019). Darr et al. (2020) identified 78 processed baobab products in formal and informal retail outlets comprising a number of food products made of baobab pulp, as well as cosmetic products mainly made of baobab seed oil.
- For example, an estimated 80% of Malawians depend on the baobab tree for subsistence, healthcare, energy, natural insurance in times of shock and for generating a seasonal household income (Sardeshpande & Shackleton 2019; Amosi 2018). The baobab has also been identified as an important food sources offering potential to combat food and nutrition security in Africa (Omotayo and Aremu 2020).
- There are over 25 different uses for the baobab tree, including food, fodder, medicine, and shelter (Sardeshpande & Shackleton 2019). Darr et al. (2020) identified 78 processed baobab products in the formal and informal retail outlets comprising a number of food products made of baobab pulp, as well as cosmetic products mainly made of baobab seed oil. Darr et al. (2020) provide a list of products and their characteristics in the baobab market in Table 5.

Table 5. List of products and their characteristics in the baobab market (Darr et al. 2020).

Product Type	Number of Products Identified	Main Product Features	Estimated Baobab Content	Main Retail Outlet	Price (MKW)
Baobab fruit powder	25	Packaged or in bulk, some products with organic certification.	100%	Open markets, street vendors, supermarkets.	800–3500 (500 g)
Malambe sweets	12	Coloured sweetened pulp pieces, packaged in plastic bags (15–70 g).	90%–100%	Schools, supermarkets.	10 (15 g)
Baobab ice-lollies	11	Frozen baobab juice raw or sweetened and coloured, packaged in plastic tubes (35–50 g).	20%–30%	Street side vendors, churches, informal markets, schools.	10 (10 g)
Baobab juice, bottled	7	Packaged in 250–1000 mL PET or recycled PET bottles, with or without MBS certification.	40%–60%	Supermarkets, filling stations.	500–750 (500 mL)
Baobab coffee powder	3	Packaged in branded plastic jars (180–200 g).	100%	Supermarkets, pharmacies.	1800–3500 (200 g)
Baobab jam	3	Packaged in branded plastic jars (350–500 g).	15%–20%	Supermarkets	1900–2500 (500 g)
Baobab pure oil	3	Packaged in 100 mL glass or PET bottles.	100%	Supermarkets, pharmacies.	2000–3500 (50 mL)
Baobab lip balm	3	Packaged in wooden cases (12 g).	100%	Specialty shop, flea market.	2000–3500 (12 g)
Baobab soap	2	Packaged in plastic or branded paper wrap (110–170 g).	15%–50%	Specialty shop, high-end tourist gift shops.	500 (170 g)–6500 (110 g)
Baobab delight smoothie	2	Packaged in PET bottles (250 mL).	30%	Supermarkets.	300 (250 mL)
Baobab smoothie served in cups	2	Served in polystyrene cups (100–150 mL).	30%	Restaurants, fast-food shops.	200–2000 (300 mL)
Baobab wine	1	Packaged in 750 mL glass bottles.	10%–15%	Agriculture fair/ trade exhibits.	6000 (750 mL)
Malambe face powder	1	Plastic jar (25–40 g).	60%	Local markets.	500 (40 g)
Baobab body cream	1	Wooden jar (250 g).	30%	High-end tourist gift shops.	6500–12,000 (250 g)
Baobab chocolate	1	White chocolate bar wrapped in paper.	15%	Flea markets, tourist centres.	2000–3500 (100 g)
Baobab body lotion	1	Imported from France.	100%	Drug stores, pharmacies.	25,000 (400 mL)
Total	78				

MKW 860 = EUR 1 at the time of fieldwork. Average per-capita income in Malawi amounted to MKW 293,700 (EUR 342) in 2018 [28].

- Interactions between harvested species and their ecosystem, together with the interactions with other land uses can influence the magnitude of the socioecological impacts of harvesting (Sardeshpande and Shackleton 2019).
- An annual income of US$ 412,95 is generated from participatory forests in Kenya, but a fifth of Kenya's CFAs were running at a loss (Duguma et al. 2018).
- In a study considering the socio-economic factors determining community participation in forest management and conservation in the Aberdare forest in Kenya found that distance to the resource was a significant factor. Households beyond a 5 Km radius from the forest ecosystem provided fewer opportunities and economic benefits suggesting that projects promoting participatory forestry should focus on communities living no more than 5 Km from the forest edge (Wambugu et al. 2015).
- There is a significant difference in the sharing of benefits amongst baobab actors. Actors with higher costs like processors earn more revenue selling value added products at a higher prices in chain stores and international markets. The actors selling low valued products in informal markets earn less revenue (Amosi 2018).
- Amosi (2018) also provides the percentage value share of baobab products earned through the value chain in Table 6. In terms of gross margins, individual harvesters get 92%; wholesalers selling pulp (80%), Juice Company (61%), household processors (79%), supermarkets (13%) and finally cooperative union exporting baobab products get 80% (Amosi 2018).

Table 6. Percentage value share of baobab products per chain actor from a value chain analysis done in Karonga, Salima and Mangochi districts including the cities of Lilongwe, Blantyre and Mzuzu (Amosi 2018)

Baobab product	Harvester	Wholesaler	Processor	Retailer	Exporter	(%)
Fruit	15	85				100
Pulp	48	52				100
Powder		8	22	12	58	100
Juice			80	20		100
Coffee			75	25		100
Oil			13	27	60	100
Soap			12	4	84	100
Jam			47	53		100
Lip balm			57	43		100

- The harvesters have the highest gross margin in the value chain as their costs are limited to packaging, but they make less profit as compared with wholesalers because they do not add much value to their products and sell at a low price. They also do not store their raw materials like wholesalers who prefer to store and release the product gradually into the market so they can sell at a higher price when the products are scarce, but the demand is still high. Harvesters also lack understanding of the quality standards and parameters resulting is low quality products which they can only sell at low prices (Amosi 2018).
- Profits from the sales made by harvester cooperatives is shared according to a shareholding.
- Amosi (2018) and Sardeshpande and Shackleton (2019) note that the formation of producer cooperatives and groups and having fewer intermediaries improved benefit penetration.
- Lack of national benefit sharing rules or national framework: There is an absence of national benefit sharing rules or a national framework. The roles, benefits and responsibilities of each actor are determined by the management agreement between the CFA and the Kenya Forest Service. In the Ngare Ndare CFA, the CFA was entitled to eco-tourism benefits while the Kenya Forest Service was entitled to revenue from grazing firewood and water access fees and other licenses (Chomba et al. 2015).
- Elite capture: Duguma et al (2018) found that elite capture of community-based forestry benefits was common and even among community members. The elites are those who are educated, from wealthy families, politically connected local officials or local chiefs or leaders. The poor are often the ones who carry the cost of forest management activities whereas the benefits go to the upper wealthy class of the community instead (Duguma et al. 2018; Chomba et al. 2015).
- Limited benefits shared in public forests: Chomba et al (2015) found that the economic benefits derived through the Ngare Ndare Community Forest Association in Kenya where maintained primarily by government actors and did not reach communities.
- Food security: Some perceive a strong focus on community-based forest management schemes in forest conservation could divert the work force and undermine the attention given to food security, decreasing the work force available for food production and therefore increasing the food security risk (Duguma et al. 2018).

2.9 Ecological viability

- There are significant sustainability issues related to the source resource in the short to medium term, as the supply of fruits from baobab trees is not adequate to satisfy the demand for both raw fruits consumed, processed and exported. Amosi (2018) observed that where whole baobab trees harvested or trees damaged by inexperienced climbers, trees were not being replanted which may reduce the number of trees per unit and result in a loss of productivity (Amosi 2018).
- There are also no reported domestication or cultivation programs, although on-going research in Ghana and Burkina Faso could pave the way for this. This shortcoming is a major obstacle to the future development of export markets. Processors of baobab products are removing seed from natural growing conditions where the seed cannot germinate (e.g., cities) (Amosi 2018). Also, because it takes many years for a baobab tree to reach maturity and begin producing fruit (8-23 years) there is a lack of interest in domesticating trees. Amosi (2018) found that harvesters were only interested in domesticating the trees if they were provided support and training on how to fast track maturity and fruit production.
- Little information is known about fruit yields in Kenya however yields have been estimated to be anything between 12 and 2675 fruits per tree with an average of 360 fruits per tree recorded (Gebauer et al. 2016).
- Promotion of domestication of baobab: The International Centre for Research in Agro-forestry (ICRAF) initiated a worldwide programme to domesticate the species identified by local people as their priority for cultivation in agroforestry systems and baobab was one of them (Amosi 2018). Jäckering et al. (2019) highlights that domestication of the species can increase quantity and quality for domestic and export markets. Kenya is currently investigating baobab domestication because of the high local demand and multiple uses of the tree (Jäckering et al. 2019).
- Over exploitation: Baobab resources like other NTFPs is subject to over exploitation even by those with legal permission to harvest (Sardeshpande and Schacklton 2019).
- Land use opportunity costs: NTFPs are often at risk from land use change for example agricultural or urban expansion, habitat fragmentation, invasive species, fire and grazing, and even a combination of threats for example livestock and baboon consumption of baobab fruit (Sardeshpande & Shackleton 2019).
- Marginal lands: The reluctance of government to transfer the power of resources to local communities is due to the state loses of the commercial value or revenues, which means poor quality forest are predominantly assigned for community-based forest management and good quality forests remain under the custody of the state (Duguma et al 2018).

2.9.1 Data availability

- Characterization of baobab trees has been well studied were studies have concentrated on phenotypic variation, tree characteristics, genetic differentiation and diversity, domestication, and nutrition (Amosi 2018). There are however gaps in information on sustainable practices (Sardeshpande and Shackleton 2019). The population of female trees that produce fruits and supply the commercial industry is not known and this information is fundamental in gauging the sustainable supply of the trees and fruit. Baobab research has been given little attention in Kenya in particular, creating a knowledge gap in terms of

harvesting and consumption (Kaimba et al. 2020; Gebauer et al. 2016) which restricts sustainable management and harvesting.

2.10 Socioeconomic values

- Not only does the baobab tree provide a seasonal income for many the raw fruit and other food products produced from the Baobab contribute to meeting the nutritional needs and tackling food and nutrition security. Baobab trees are also utilized for their medicinal value, fodder and in cosmetics. Furthermore, they hold important cultural identity and lifestyle values for the people in Africa.
- Commercialization fuels harvester competition often resulting in premature harvesting which reduces the availability of the fruits for consumption by poor and vulnerable population. Furthermore, as high values are obtained for baobab products the poor populations may be pushed out of the market.

2.11 Consumptive use of forest and non-forest products, hunting, fishing

- The rural poor typically maintain a diversified livelihood including agriculture and forest products. Wambugu et al. (2017) found that 98% of community members in the Abedare forest ecosystem in Kenya utilized the forest ecosystem as a source of water, fuelwood and grazing. Water is the most dominant service provided by the forest. Any actions limiting access to forest resources would limit livelihood opportunities in Kenya (Wambugu et al. 2017).
- Premature harvesting: Circumstantial evidence suggests that increasing commercialization of baobab fruits will result in higher harvester competition where fruits are collected before they can mature, especially when harvesting is unregulated and property rights in baobab trees are ill-defined or poorly enforced. The impact of premature harvesting reduces the availability of the fruits for consumption by poor and vulnerable populations. Furthermore, as higher values are obtained for processed baobab products the poorer population might be unable to afford to consume the fruit (Darr et al 2020). The case is however different in Mwanza district in Malawi where by-laws on who has access to the community trees and the times when harvesting is recommended is in place. The traditional leader in the area has developed and enforced by-laws and this has led to harvesters harvesting fruits which are well dried and mature rather than prematurely due to competition between harvester (Amosi 2018).
- Loss of access to the food source: As commercialization of baobab fruit increases there is a risk that communities may lose the food source (Bioversity 2020).

2.12 Intangible values

- Forests provide a regulating function in ecosystems were the services include clean water, soil protection, and climate regulation. Additionally, forest foods hold importance in terms of the cultural identity, lifestyle and intangible values of those living in urban areas (Chamberlain, Darr and Meinhold 2020).

2.13 Biodiversity and ecosystem services

- Community based forest management has the potential to reduce forest degradation and loss, protecting critical habitats for wildlife and thereby improving biodiversity conservation. Furthermore, it reduces the rate at which agricultural land use encroaches on forest ecosystems.
- Community based forest management can also foster conservation stewardship where Community Forest Associations are contractually obligated to protect the forests. Forest rangers are employed, and the self-regulation of Community Forest Association members are seen to curb illegal activities.
- It has also been shown that the higher the level of dependence on the forest and its resources the high the levels of participation in forest management, however poor households and particularly women are often unable to afford levies and fees to benefit from the forest products leaving illegal harvesting their only option.

2.14 Species conservation

- Community based forest management has the potential to reduce forest degradation and loss. Forests provide critical habitats for wildlife and therefore community-based forest management can also improve biodiversity conservation (Duguma et al. 2018).

2.15 Conservation stewardship

- The Forest act allows CFAs to apply to participate in forest monitoring and enforcement of forest protection rules. In Ngare Ndare CFA management agreement the CFA was obligated to control forest activities that could lead to forest degradation (incl. overgrazing and tree cutting). The CFA enforced the protection rules through user groups and rangers who had the power to arrest offenders. The forest area was patrolled by rangers employed by both the KFS and the CFA trust. The ranger patrols together with internal monitoring by the community members curbed illegal activities, and incidences of fire. Also, user group internal self-regulatory rules led to stewardship of the forests where users reported ingression by outsiders and monitored the resource (Chomba et al. 2015).
- Wambugu et al. (2017) found that the those who valued ecosystem services for economic reasons showed a higher motivation to be involved in participatory forest management indicating the importance of ecosystem benefits in motivating stewardship of the forests. However, Wambugu et al. (2015) found low participation in participatory forest management by women and poor households. The poor are unable to afford levies and fees to obtain forest products or the time to participate in activities related to forest management. Women find it difficult to participate in a predominantly male activity (Wambugu et al. (2015).
- Land tenure impacts stewardship of forests. Wambugu et al. (2017) found that where households had secure land tenure a feeling of ownership was fostered, and they were more willing to protect and maintain the resources. Also, a higher level of dependence on the forest also fostered higher levels of participation in forest management (Wambugu et al. 2017).

- Community based forest management reduces the rate of at which agriculture encroaches into forest ecosystems (Duguma et al. 2018).

2.16 Ecosystem services

- Baobab is a keystone species in many dryland ecosystems (Sardeshpande and Shackleton 2019)
- Rural communities are highly dependent on forest goods and services for their livelihood and therefore encouraging the sustainable management utilization of forest resources has the potential to reduce forest loss and contribute to local development targets (Duguma et al. 2018). Improved forest condition equates to better forest food and energy and also acts as a buffer in times of shock.
- Forests also provide intangible regulating services including clean water, soil protection, and climate regulation. Additionally, forest foods hold importance in terms of the cultural identity, lifestyle and intangible values of those living in urban areas.
- Monitoring and reporting on the community management of forests is weak and often not clear. The reporting formats, reporting details and frequencies are not made clear and often indicators for monitoring are not described. Without regular and accurate reporting forest loss and unsustainable utilization is inevitable (Duguma et al. 2018).
- There are concerns that community-based forest management could promote the exploitation of natural resources by fueling expectations and access (Duguma et al. 2018)

2.17 Climate Change

- Community based forest management has potential for addressing climate change. The conservation of forest ecosystems can result in reducing deforestation and forest degradation, increasing biomass and soil carbon sequestration and reducing gas emissions (Duguma et al. 2018).
- The risk that climate change imposes on baobab production is generally low with mitigation strategies identified for farmers in Bioversity (2020) and provided in Table 7.

Table 7. Climate change impact and mitigation strategies for aspects of the baobab value chain (Bioversity 2020)

BAOBAB FRUIT	INPUT	ON-FARM	POST-HARVEST	MARKETING
Decreased length of the rainy season	• No information/does not apply	• Affects tree's leafing process	• No information	• No information
Magnitude of impact	LOW	MODERATE-MAJOR	LOW	LOW
Promising adaptation strategies	• Improving storage and hygiene for baobab pulp or seeds • Creating protected areas			
High temperatures[11]	• May affect seedlings for new plantations	• May affect fruit development	• No information	• No information
Magnitude of impact	LOW	MAJOR	LOW	LOW
Promising adaptation strategies	• Creating protected areas; this adaptation strategy was identified through the literature review			
Strategies to mitigate both hazards				
Farmers' coping strategies	• No information was available regarding farmers' coping strategies			
On-going adaptation strategies	• No information was available regarding farmers' ongoing adaptation strategies			

APPENDIX 2. BEEKEEPING

Beekeeping [6]

October 2021

[6] One of 6 reports on the viability of community-based natural resource enterprises (baobab products; beekeeping; Carbon markets; charcoal production; wildlife credits) in Africa. Produced for WWF's Nature Pays program by CARMa-Afrika, Nelson Mandela University, South Africa. The authors are Christo Fabricius, Bianca Currie, Monicah Mbiba and Herbert Ntuli. Contact us at christo.fabricius@mandela.ac.za

1 Introduction to the initiative

1.1 Problem being addressed

- How to enhance livelihoods and ecosystem stewardship through beekeeping
- Localities: Kenya, Mozambique, Rwanda, Tanzania, Uganda, Ethiopia

1.2 Value chain

- Level 1: Producers (beekeepers). At this level of the value chain, many beekeepers are engaged in honey production, actively taking advantage of the Ethiopian honey market's high domestic demand and relatively low supply (when compared with demand). Beekeepers actively seek the best possible (highest) prices for honey.
- Level 2: Direct buyers of honey. Honey collectors/traders, cooperatives, tej houses, and agribusinesses/processors that buy directly from beekeepers ..includes a high number of participants in the honey value chain who compete with each other in terms of the purchased quantity, quality, and price of honey.
- Level 3: Agribusiness companies that market honey in domestic and export markets and honey wholesalers in Addis Ababa (Mercato). This level of the honey value chain also includes multiple participants. Wholesalers in Addis Ababa (Mercato) and agribusiness companies that cater to domestic markets compete with agribusinesses that are engaged in sales for export markets in terms of quantity (reliable and timely supply), quality, and price of honey.
- Level 4: Domestic retail honey sellers (supermarkets, retail stores) and honey exporters (agribusiness companies/processors). Many participants at this level compete with each other in terms of quantity, quality, and price of honey. Additionally, some agribusinesses/processors that supply honey for export markets are also engaged in sales within the domestic market, so they compete with the wholesalers in Level 3.

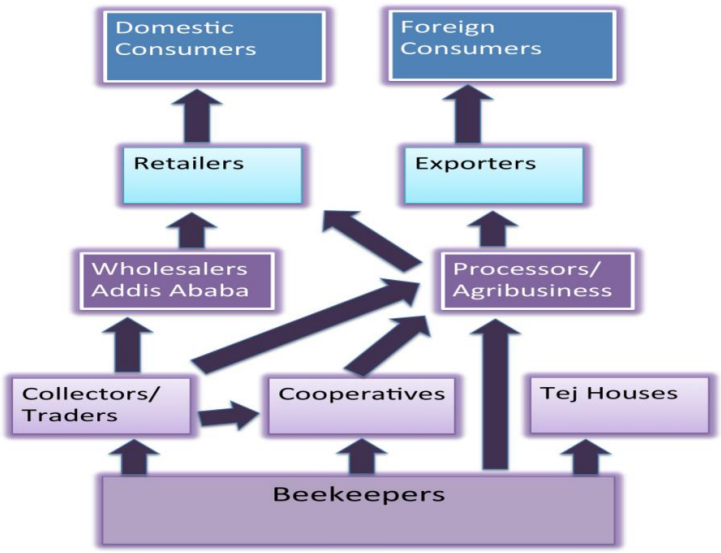


Figure 22. Honey value chain in Ethiopia (Jenkins & Miklyaev 2014)

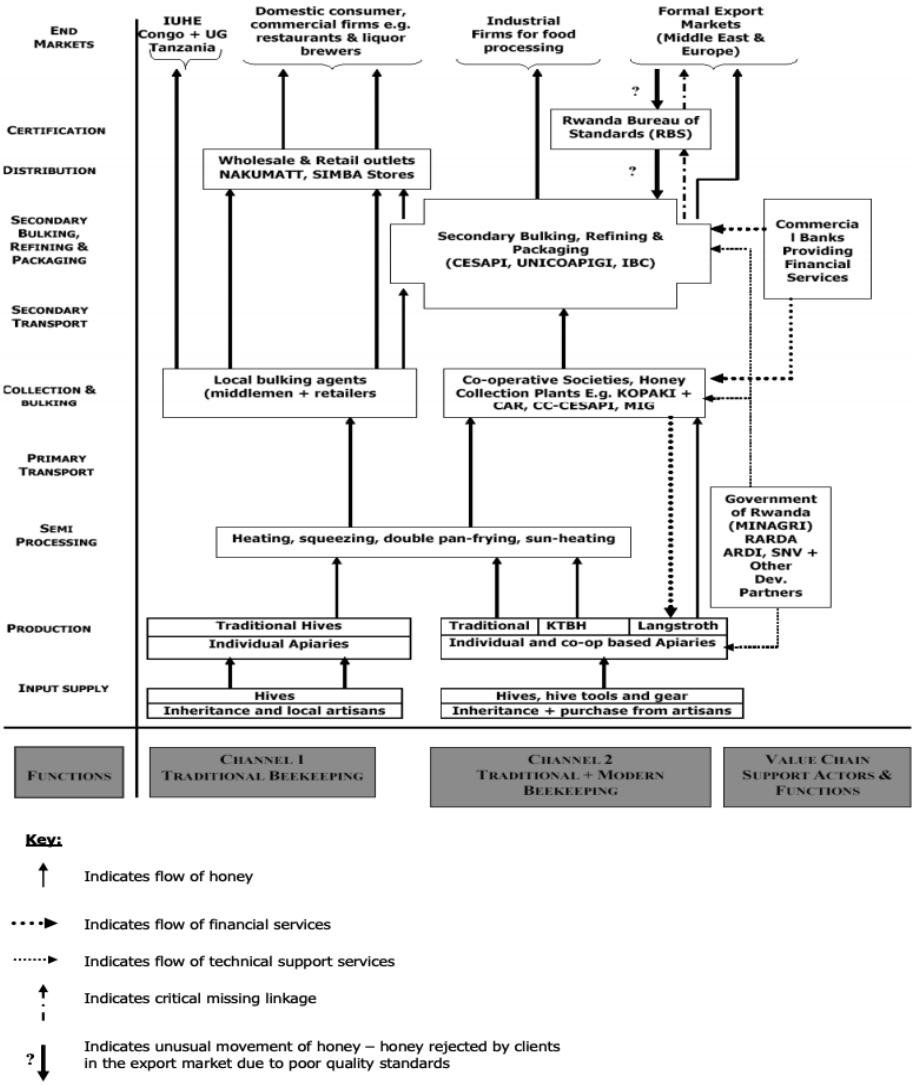


Figure 23. Beekeeping value chain map (CODIT 2009)

1.3 World Bank Governance indicators

Indicator	Country	Governance (-2.5 to +2.5)	Percentile Rank
Voice and Accountab	Kenya	-0,29	36,45
	Mozambique	-0,51	31,53
	Rwanda	-1,08	18,72
	Tanzania	-0,50	32,02
	Uganda	-0,62	30,05
Political Stability and /	Kenya	-1,12	12,38
	Mozambique	-0,75	20,00
	Rwanda	0,12	52,38
	Tanzania	-0,36	32,86
	Uganda	-0,65	22,86
Government Effective	Kenya	-0,38	38,46
	Mozambique	-0,82	18,75
	Rwanda	0,19	60,58
	Tanzania	-0,88	17,31
	Uganda	-0,59	31,25
Regulatory Quality	Kenya	-0,28	41,35
	Mozambique	-0,72	23,08
	Rwanda	0,08	58,17
	Tanzania	-0,64	27,88
	Uganda	-0,37	37,98
Rule of Law	Kenya	-0,45	35,58
	Mozambique	-1,02	14,90
	Rwanda	0,08	56,25
	Tanzania	-0,58	29,33
	Uganda	-0,31	43,75

1.4 UNDP development indicators

UNDP indicators	Kenya	Mozambique	Tanzania
HDI	0,6 (world = 0737)	0,456	0,592
Rank	143	181	163
Trend	positive	positive	positive
Population	66,4 million		79,2
Per capita income (USD)	4244	1377	2600
Multidmensional poverty	38,7 %	72,5%	55,4%
Employment (% of popln 15 and older)	72,7%	75,6%	81,88
GINI coefficient	40,8	54	40,5
Internet users ; mobile phones	17,8% internet; mobile phones 96,3%	10% internet; mobile phones 47,7%	25% internet; mobile phones 77,2%
Skilled labour force	40,5%	7,1%	5%
Mean years of schooling	11,3	3,5	6,1
Ease of doing business ranking (1=highest rank)	56 / 180	138 / 180	141 / 180

2 Viability of beekeeping enterprises

2.1 Success factors

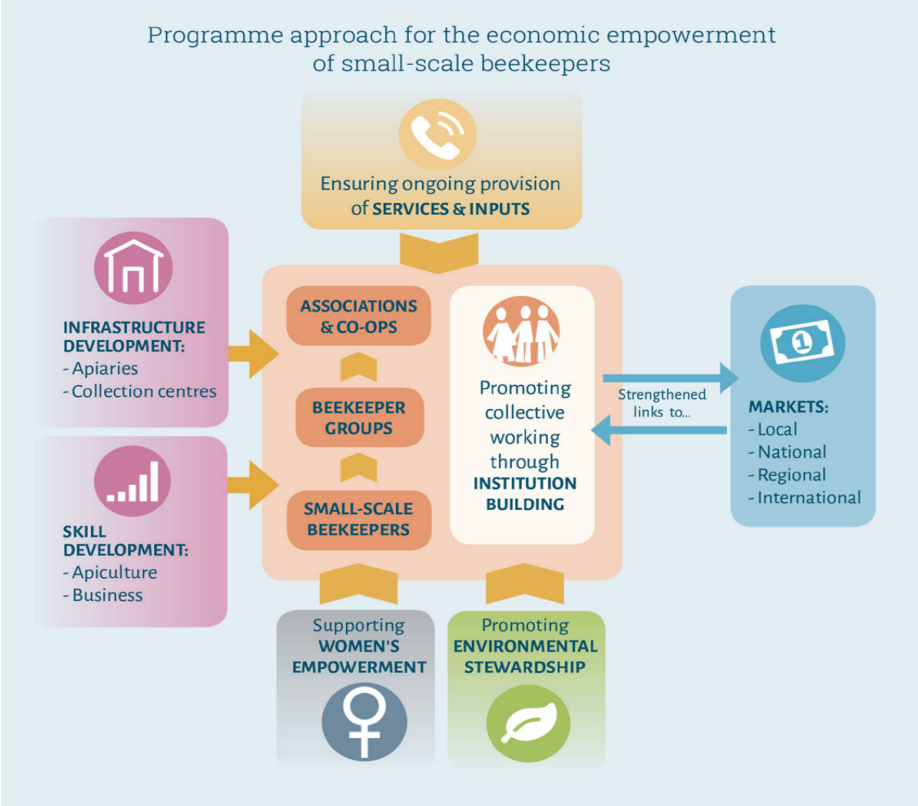


Figure 24. A programme approach to create an enabling environment for beekeepers (TraidCraft 2019)

- It is important to encourage beekeepers to diversify income in the farm to include other complementary activities such as beekeeping and agro- forestry.
- Farmer to farmer advisory services is strengthened in response for services and collaboration with other partners in promoting beekeeping.
- Enhance development of the subsector through strong extension, research, conservation and rehabilitation of vegetation with integration of beekeeping.
- Organize beekeepers for efficient marketing of bee products, establishment of colony multiplication center, distribution and conservation of indigenous honeybee race. Women and youths are encouraged to take up beekeeping enterprise.
- Develop beekeepers' skills and extension agents on bee management. Utilize beeswax through intensive trainings, enhance bee forage production and integrate beekeeping with water harvesting.
- Modify traditional log hive to include a queen excluder section for improved honey quality.
- Kenya: Institutional factors such as membership to farmers' group, access to credit facilities, type of market, access to extension services, and training at farmer's training centre's determined honey production. Economic factors such as land size, land under crop, land under forest cover, price of honey, labour cost and capital cost significantly determined honey production.

- Beekeepers should be equipped with bee management skills to enable them perform all management activities through use of modern bee equipment
- Improved extension programmes or organization of co-operatives and training in the use of modern hives and hiving techniques are also required
- Increase the number of extension personnel in the region as number of beekeepers is high. Proper management practices need to be enhanced and intensified to facilitate production increase per unit; otherwise the viability and potentiality of beekeeping will continue to be compromised.
- Farmer advisory services should be strengthened through promotion of farmers' groups in response to demand for services.
- Contract production to guarantee market and stabilize price of honey. The environment should guarantee availability of resources (including productivity in increasing inputs), product prices, which do not fluctuate.
- Strengthen policy and legislation.
- Develop appropriate institutions - cooperatives, trade platforms.
- Strengthen the value chain.
- Build capacity - extension officers, producers, processors, traders to produce international quality honey.
- Strengthen research and development along the value chain.
- Improve marketing of the apiculture sector – labelling, packaging, market information, link beekeepers to markets, etc.
- Facilitate improved access to finance for honey producers especially from financial institutions.
- Improve conservation of key forests and other habitats that provide vegetation for bees.
- Partnerships and institutions - e.g. Ethiopia Ethiopian Apiculture Board (EAB) has been established to support sector development efforts and to ensure coordination of the apiculture sector. The Ethiopian Society of Apiculture Science (ESAS) and Ethiopian Honey and Beeswax Producers and Exporters Association (EHBPEA) support farmers organised into cooperatives with capacity building, coordination, etc.
- Bridging finance - e.g. Jenkins 2014 for Ethiopia (Table 6).

Table 6. Cash flow projections. Values are in Ethiopian TB (Jenkins & Miklayev 2014)

Inflows	2012	2013	2014	2015	2016 and later
Value of in-house honey consumption	0.00	0.00	0.00	0.00	0.00
Revenue from honey sales	635.00	5,537.00	5,537.00	5,537.00	5,537.00
Training Cost Subsidy	1220.00				
Subsidized Loan Inflow	5346.00				
Market Loan Inflow	2280.18				
Total inflows	9,481.18	5,537.00	5,537.00	5,537.00	5,537.00
Expenditures					
Training Cost	1,220.00				
Investment costs					
Traditional beehives	0.00				
Bee colonies for traditional beehives	0.00				
Modern beehives	3,300.00				
Bee colonies for modern beehives	2,100.00				
Queen excluder	330.00				
Wax	675.00				
Smoker	140.00				
Overall coat	150.00				
Veil	90.00				
Glove	80.00				
Extractor	320.00				
Wax mold	150.00				
Plastic container	90.00				
Service costs					
Sugar for feeding	283.50	283.50	283.50	283.50	283.50
Beehive maintenance	0.00	330.00	330.00	330.00	330.00
Labor cost	551.88	551.88	551.88	551.88	551.88
Rental value of land	0.80	0.80	0.80	0.80	0.80
Cost of beehive replacement due to ant attack	0.00	–37.50	–37.50	–37.50	–37.50
Cost of bee-colony replacement due to ant attack	0.00	–75.00	–75.00	–75.00	–75.00
Subsidized loan debt service	0.00	2,019.60	1,534.50	1,155.00	0.00
Market loan debt service	0.00	2,463.73	429.81	0.00	0.00
Total outflows	9,481.18	5,537.00	3,017.97	2,208.68	1,053.68
Net cash flows (ETB)	0.00	0.00	2,519.02	3,328.33	4,483.33

- Introduction of a package solution that includes introduction of three modern beehives per beekeeper's household; the tools needed to properly manage the beehives; and training on modern beekeeping methods (Jenkins 2014).
- It is expected that with Intervention C, the total amount of honey produced per beekeeper's household starting in the second year of the intervention will increase from 32.5 kg (as in the base-case scenario) to 47.5 kg per year in the traditional beehives (due to the beekeeper's training on the proper management of apiaries). In addition, the total annual honey yield from the three modern beehives will reach 114 kg. (Jenkins, Ethiopia)
- Beekeepers will need access to financing resources to obtain modern-style beehives and tools, preferably packaged together to prevent significant delays. Training sessions on modern beekeeping will need to be organized before the beekeepers attempt modern-style honey production, and follow-up workshops will most likely need to be organized to ensure continued proper management of modern apiaries.

2.2 Enabling Context

2.2.1 Enabling policy environment

- Kenya: National Livestock Policy; Livestock Strategic Plan; Constitution; Vision 2030; Beekeeping policy is in the process of being developed; honey monitoring plan. Honey hunting and beekeeping have been practiced since ancient times by a number of ethnic groups in agropastoral systems; indigenous knowledge and skills are locally available; honey beer is essential in traditional ceremonies
- Rwanda: A national beekeeping law was prepared and approved by Parliament (No 25/2013 of 10 May 2013 determining the organisation and functioning of beekeeping in Rwanda); and two ministerial decrees were prepared to support the beekeeping development.
- Rwanda: Many development organisations and government institutions have been involved in supporting beekeeping activities of producer organisations in Rwanda. The number of beekeepers increased from 30,000 in 2008 to 83,000 in 2015. Rwandan beekeepers have been supported to participate in national and international exhibitions and Rwanda is now allowed to export honey to EU markets.

2.3 Participation

- Women's empowerment. Independent evaluation of phase two of TraidCraft's beekeeping projects in Tanzania found that after three years 52% of leadership positions within institutions were filled by women, and that over 90% of participating women were utilising entrepreneurship skills in their honey and other businesses. In addition, Traidcraft Exchange's unique 'wellbeing assessment methodology' was used to assess changes in non-material dimensions of wellbeing amongst participating beekeepers. Findings included positive changes in women's sense of agency and participation.

2.4 Period of time the community has been involved in the enterprise

- It's a traditional practice.
- Honey is used as a food product for home, medicine and for brewing traditional liquor, but the trend is changing and community members are increasingly taking up beekeeping as a business enterprise.
- Commercialization is new.

2.5 Technology and infrastructure

- Technology adoption has been very slow among Kenyan beekeepers.
- Unsophisticated technology is used for honey production, which includes traditional beehives and results in low quantity and poor quality of honey produced. Currently, most of the honey produced in Ethiopia comes from traditional beehives. Statistics show that as of 2011, Ethiopian beekeepers and honey producers possessed about 4,993,815 beehives. Traditional 11 beehives make up 95.57 percent of the total quantity of beehives in Ethiopia, while the percentage of transitional (Kenya top bar) and modern beehives are 1.63 percent (81,596) and 2.8 percent (139,682), respectively (CSA 2012a). Traditional beehives yield low

quantities of honey (around 5 to 7 kg/beehive/year) that is also generally low quality, because it contains brood, wax, and other impurities (Jenkins 2014).

- Supply-related barriers to properly managing modern beehives. The supply of tools necessary to manage modern beehives is not readily available. For instance, some beekeepers possess modern beehives (just boxes), but they lack the tools required for the proper management of these beehives (such as a smoker, queen excluder, or honey extractor).
- Lack of proper training regarding efficient management of a modern-style apiary. In general, the beekeepers who do have modern beehives do not have the skills or knowledge needed to properly manage them, and training is not readily available. Therefore, the beekeepers tend to rely on ineffective extractive harvesting methods and inappropriate tools for this type of hive. Additionally, they usually do not provide additional feed (water and sugar syrup or flour) during droughts and have little knowledge about prevailing honey-quality requirements in export markets.
- Modern hives are not always the best solution. Some practitioners believe that when extending the unit of measure from single hives to 'hive systems' and when looking more closely at productivity over a longer period of time, so-called 'traditional' hives are just as productive and sometimes more productive than modern ones. Traditional hives have higher occupancy and setup costs are lower

2.6 Viable business model

2.6.1 Financial viability

- Overall, Africa produces a paltry 12% of its total potential of 1,690,000 tonnes (FAOSTAT, 2020) because of low productivity, poor quality, untrained personnel, low research, inadequate adoption of improved technologies, ineffective control of pests and diseases among other factors (AU-IBAR, 2019). There is huge opportunity for Africa to increase production to close the productivity gap. The low production indicates that African forest honey has been relatively overlooked as a NTFP despite its potential to contribute to livelihoods and forest conservation (Lowore et al., 2018).
- Kenya: Honey production has been steadily growing and has now reached 25,000 MT annually valued at USD 40.4 million (Kitparus et al., 2011; Republic of Kenya, 2019). This is below the production potential of 100,000 MT per year with an estimated value of USD 1.72 billion (author calculations). The current annual value of wax is estimated at USD 12.8 million (Nyariki & Amwata, 2019). The beekeeping sector employs 91,000 people directly and supports livelihoods of 547,440 people (Kitparus et al., 2011).
- Honey – USD 32.3 million; Beewax – 12.8 million, Nyariki & Amwata (2019)
- Kamega Forest's aggregated annual value for NTFP (honey, fruits, vegetables, firewood, charcoal, grazing, thatching grass) = 10.6 million, (Kisaka & Sitati, 2014).
- Ethiopia: 2011 was estimated to be 39.89 million kilograms (kg) (CSA, 2012). These non farming business activities have the potential to provide a wide range of economic contributions. Honey and beeswax products are part of the apiculture market, which encompasses a wide range of products, from primary commodities to highly processed, high value consumer goods

- The total amount of honey produced per beekeeper's household starting in the second year of the intervention will increase from 32.5 kg (as in the base-case scenario) to 47.5 kg per year in the traditional beehives (due to the beekeeper's training on the proper management of apiaries). In addition, the total annual honey yield from the three modern beehives will reach 114 kg. The total yearly honey loss due to pests (ants) will decrease from 3.25 kg/year in the case of the — to 2.38 kg/year (due to the beekeeper's increased knowledge of modern apiary management techniques obtained during trainings). As in the previous scenarios, it is also assumed that the annual household consumption of honey (10 kg) will stay at. This will leave the beekeeper's household with 149.13 kg of honey available for sale (Jenkins 2014).
- Careful business planning is crucial.

Table 7. Intervention C investment and operating expenditures for expansion with modern beehives, tools, and training, year 1

Expenditures	Cost in ETB (Amhara)	Cost in ETB (Tigray)
Traditional beehives (5)	750.00	1,250.00
Bee colonies (5)	1,500.00	2,750.00
Modern beehives (3)	3,300.00	3,300.00
Improved bee colonies for modern beehives (3)	2,100.00	2,100.00
Beehive maintenance for traditional beehives (10%)	0.00	0.00
Beehive maintenance for modern beehives (10%)	0.00	0.00
Bee-colony replacement due to ant attack	0.00	0.00
Labor for traditional beehives	146.88	256.25
Rental value of land for traditional beehives	1.60	1.60
Traditional-beehive replacement due to ant attack	0.00	0.00
Queen excluder	330.00	330.00
Wax	675.00	675.00
Smoker	140.00	140.00
Overall coat	150.00	150.00
Veil	90.00	90.00
Glove	80.00	80.00
Extractor	320.00	320.00
Wax mold	150.00	150.00
Plastic container	90.00	90.00
Sugar for feeding	283.50	283.50
Labor for modern beehives	698.75	1,337.50
Rental value of land for modern beehives	2.40	2.40
Initial 28% down payment for three beehives (loan 1 @12% interest rate)	2,079.00	2,079.00
Loan 1 repayment	2,423.52	2,423.52
Loan 2 repayment	2,956.47	1,260.11
Training		
Trainer's salary	400.00	400.00
Trainer assistant's salary	80.00	80.00
Farmer's accommodation	250.00	250.00
Trainer's accommodation	50.00	50.00
Trainer assistant's accommodations	50.00	50.00
Cost of stationery materials	100.00	100.00
Other demonstration materials	240.00	240.00
Total per diem for each beekeeper	50.00	50.00

**Note: These are expenditures for the first year in nominal terms. These values will change, and additional costs for beehive maintenance, bee-colony replacement, and beehive replacement will occur in the later years of the project.*

Costs per beekeeper unit, in USD (2014 prices) (Jenkins et al. 2014)		
Item	**Lower limit**	**Upper limit**
Traditional beehives (5)	$ 37,50	$ 62,50
Bee colonies (5)	$ 75,00	$ 137,50
Modern beehives (3)	$ 165,00	$ 165,00
Improved bee colonies for modern beehives (3)	$ 105,00	$ 105,00
Beehive maintenance for traditional beehives (10%)		
Beehive maintenance for modern beehives (10%)		
Bee-colony replacement due to ant attack		
Labor for traditional beehives	$ 7,30	$ 12,80
Rental value of land for traditional beehives	$ -	$ -
Traditional-beehive replacement due to ant attack	$ -	$ -
Queen excluder	$ 16,50	$ 16,50
Wax	$ 33,75	$ 33,75
Smoker	$ 7,00	$ 7,00
Overall coat	$ 7,50	$ 7,50
Veil	$ 4,50	$ 4,50
Glove	$ 4,00	$ 4,00
Extractor	$ 16,00	$ 16,00
Wax mould	$ 7,50	$ 7,50
Plastic container	$ 4,50	$ 4,50
Sugar for feeding	$ 14,15	$ 14,15
Labor for modern beehives	$ 34,90	$ 66,85
Rental value of land for modern beehives		
Initial 28% down payment for three beehives (loan 1 @1	$ 103,95	$ 103,95
Loan 1 repayment	$ 121,20	$ 121,20
Loan 2 repayment	$ 147,80	$ 63,00
Training Trainer's salary	$ 20,00	$ 20,00
Trainer assistant's salary	$ 4,00	$ 4,00
Farmer's accommodation	$ 12,50	$ 12,50
Trainer's accommodation	$ 2,50	$ 2,50
Trainer assistant's accommodations	$ 2,50	$ 2,50
Cost of stationery materials	$ 5,00	$ 5,00
Other demonstration materials	$ 12,00	$ 12,00
Total per diem for each beekeeper	$ 2,50	$ 2,50
	$ 974,05	**$ 1 014,20**

- The production of honey in Kenya has great potential given the large area suitable for production, the high local demand, low levels of investment required and ability to provide complementary income and employment for rural populations. Beekeeping is also a complementary land use to wildlife and livestock keeping, and has been proven to be useful for mitigating human-elephant conflict among rural farmers
- Independent evaluation of TraidCraft's phase two in Tanzania found participating beekeepers were benefiting from price increases of 5-28% over 3 years, due partly to improved quality product and improved market access. In addition, over 90% of participating beekeepers increased their incomes from honey by 25% or more; in some cases the magnitude of the income increase was as high as 80%. In Kenya's ASAL, participating beekeepers enjoyed increased honey prices of up to 150% (over four years) – in part due to improved bargaining and bulking at collection points. Independent evaluation found 65% of participating beekeepers had increased their incomes from beekeeping by 70%.
- Kenyan tea growers appreciate the increased income and improved cashflow from honey sales. In the longer term, diversification via beekeeping offers the potential for small-scale

producers gaining greater power to leverage change in the tea supply chain by reducing their dependency (Williams 2019) (see http://www.traidcraftexchange.org/tea-briefing)

- Honey production is frequently promoted as a pro-poor income generation activity as it is accessible to many members of a rural community, has low start-up costs and requires little land or labor
- Export potential: the total volume of Ethiopian honey exports in 2007–2011 was 1,297,716 kg, with a total value of US$4,066,528
- Certification of honey can add value.
- Rwanda: Between 2015 and 2018, natural honey exports improved by 50%, bringing Rwanda USD 0.05 million for the year 2018 (Selina Wamucii, 2020). Rwanda's average export market price in 2018 for natural honey was USD 4.23 per kilogram, with the country exporting 8 tonnes during the year (Ibid.). However, in 2018, the exports declined by 20% from 2017's total natural honey export value of USD 0.06 million (Ibid.). Rwanda's top export market destinations for natural honey include Singapore, Côte d'Ivoire, Kenya, Ethiopia and Switzerland (Ibid.). The 2020 estimated price for Rwanda natural honey is USD 7.5 per kilogram (Ibid.). Ruzizi Tented Lodge in Akgera NP - In 2019, eight community beekeeping cooperatives produced 9 tonnes of honey along the park boundary.
- Diverse product range

Table 4.22: Revenue generated by bee products other than honey by Ubwiza bwa Nyungwe Beekeepers' Union

Items (USD1=RWF 890)	2013	2014	2015	2016	2017
Candles	983,650	1,483,160	1,189,900	845,800	1,052,800
Beeswax lip balm	0	10,500	23,800	153.500	145,100
Skin lotion	0	0	0	0	183,700
Pure beeswax	0	0	0	0	1,317,600
Total sales (RWF)	983,650	1,493,660	1,213,700	999,300	2,699,200
Total sales (USD)	1,105	1,678	1,364	1,123	3,033

Source: Profit & loss account of Ubwaiz bwa Nyungwe, 2013-2017, in Hakizmana, 2018.

- Higher-value bee products such as wax, pollen and venom offer additional income-earning opportunities. But beekeepers need to first try to consistently produce high quality honey before diversifying.
- Income diversification via beekeeping reduces producers' dependence on a single cash crop without affecting this established primary source of income (TraidCraft undated).
- Positive cash flow for beekeepers if bridging finance provided in Year 1.
- If the medicinal quality of foraging plants were confirmed the discovery could potentially open export markets for African honey, as happened with the widely consumed Manuka honey from New Zealand and Australia (cf. Jenkins 2014).
- Learn from experiences of NGO partners, e.g. Traidcraft Exchange (TX) ran beekeeping programmes from 2013-2015.
- Low adoption of modern technology; traditional beehives hamper production.
- Monoculture crops; agrochemicals are a threat.
- Droughts, exacerbated by climate change, have a profound impact on honey production.
- Ethiopian honey is uncompetitive in international market due to quality problems.

- Chemwok 2019: quantity of honey in Kenya declined from 27,379,481 Kilogram's in 2005 to 12,036,910 kilogram's in 2008.
- Kenya: lack of market knowledge and the poor quality of honey from rudimentary hives meant that honey was used to produce local liquor (Chemwok)
- Beekeepers also faced numerous constraints including inadequate credit, pests and diseases, bee's aggressiveness, environmental degradation, bee absconding, theft, inadequate technical assistance and poor marketing. Some problems in the activities of beekeepers were stated as; deficiency of qualified queen, lack of standards in beehives and materials, using of pesticide, problems in choosing suitable place, inadequate advertising of bee products to consumers and poor marketing channels.
- Jenkins 2014: Lack of financial resources (such as access to loans) for beekeepers to obtain modern beehives and other tools necessary to increase honey production. Beekeepers have little access to financial products that would allow them to switch from traditional beehives to improved versions. Moving to transitional and modern beehives requires an initial investment of capital that most beekeepers do not have, so they continue to produce honey using traditional methods.
- Minimize the risk of loans defaulting, so they tend to lend money to those who are most likely to be able to repay the loans
- Cash flow projections lacking (but see Jenkins 2014 for Ethiopia)

2.7 Market viability

- At the end of phase one in Tanzania, independent evaluation of TraidCraft's programme found that through collective working, beekeepers were able to establish standard minimum prices for their honey. The minimum price was set at around 25% higher than the previous season's prevailing price. The majority of beekeepers, though selling individually, were able to demand this price; in some cases higher (TraidCraft, undated). Detailed time-lines, beyond the scope of this report, will shed light on the length of time required to set up a viable enterprise.
- Ethiopia: inadequate marketing mechanisms (Jenkins 2014). weak access to profitable export markets due to low productivity; limited knowledge of export-market requirements; and lack of or weak connections with processors.
- Lack of access to finance.

2.8 Operational viability

- Beekeeping can work almost anywhere. It is multi-functional; bees provide honey, a high energy food supplement that can be sold to bring cash into a small farm. Bees also provide wax, which has almost unlimited uses. Both honey and wax are valued for their medicinal use in traditional cultures.

2.9 Biodiversity and ecosystem services

2.9.1 Conservation stewardship

- In Tanzania over 1500 beekeepers have been trained on environmental stewardship. As a result, beekeepers have adopted practices such as: using smokers for harvesting instead of setting forest fires, reduced use of bark for hive construction, providing water ponds for bees near apiaries and establishing tree nurseries. In Kenya's ASAL, 'Natural Resource Management' (NRM) committees were formed amongst pastoralist communities. NRM committees developed "Action Plans" and collaborated with local government on implementation. The committees work closely with community elders to ensure adherence to environmental codes. These encompass key local issues such as reduced charcoal burning and responsible water-use. Critically, the NRM committees have worked to reduce conflicts related to access to grazing lands and water sources. After three and a half years, independent evaluation found 90% of participating beekeepers had improved understanding of environmental management practices (TraidCraft, undated)
- Disappearance of bee-foraging areas due to crop intensification and the growing use of agrochemicals; extreme weather conditions in some parts of Ethiopia (droughts).

2.10 Ecosystem services

- Improved pollination services.
- Managed honey bees can harm wild pollinator species, providing an urgent incentive to change honey bee management practices (Geldmann & González-Varo 2018).

2.11 Climate Change

- Impact of climate change on foraging species.
- Honey bees and other species that pollinate plants life are declining at alarming rate which has threatened the existence of plant life and this downward trend could damage dozens of commercially important crops. A decline in pollinator populations is one form of global change that actually has credible potential to alter the shape and structure of terrestrial ecosystems. The decline in pollinator population and diversity presents a serious threat to agricultural production (Slathia & Tripathi 2016).

Voluntary Carbon markets [7]

October 2021

[7] One of 6 reports on the viability of community-based natural resource enterprises (baobab products; beekeeping; Carbon markets; charcoal production; wildlife credits) in Africa. Produced for WWF's Nature Pays program by CARMa-Afrika, Nelson Mandela University, South Africa. The authors are Christo Fabricius, Bianca Currie, Monicah Mbiba and Herbert Ntuli. Contact us at christo.fabricius@mandela.ac.za

1 Introduction to the initiative

1.1 Problem being addressed –

- How to use conditional incentives to catalyze measurable triple goals of reducing emissions, conserving nature and promote human well-being or sustainable development outcomes.
- Theories of Change for REDD+ are presented in Figures 1 and 2 (Martius et al. 2018; UNFCC 2011)

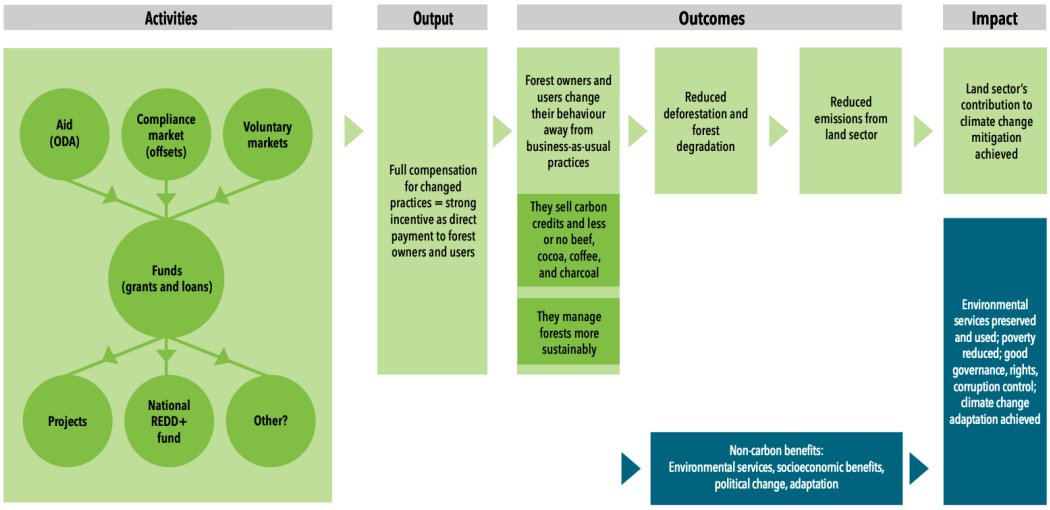


Figure 25. REDD+ Theory of Change (From Martius et al. 2018)

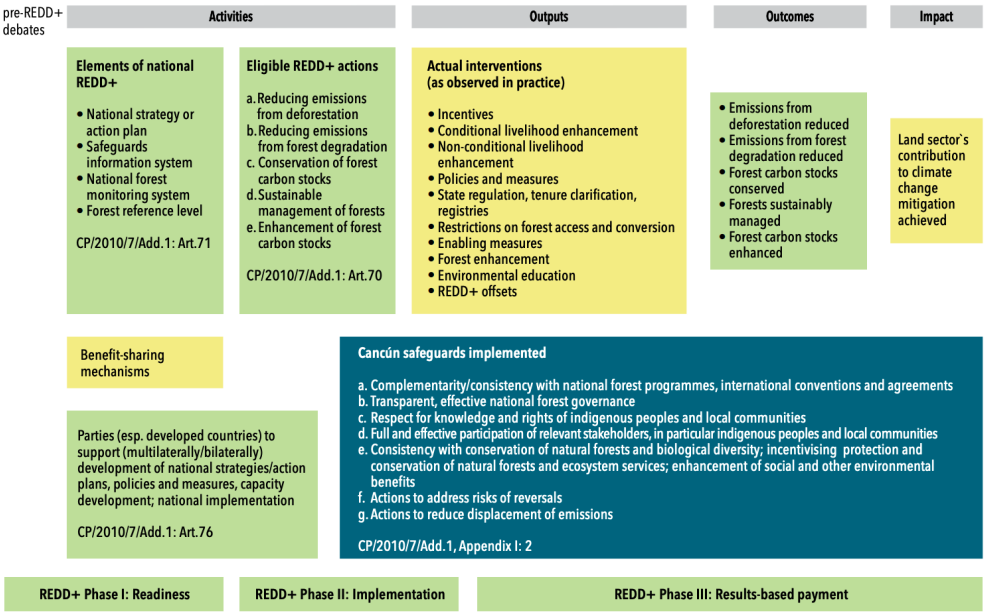


Figure 2.2 The UNFCCC REDD+ decisions in a theory of change (Warsaw Framework)

Note: Green and blue boxes represent formal decisions on carbon (green) and co-benefits (blue). Yellow boxes represent crucial elements in the ToC that are not formally part of the Warsaw Framework. The corresponding ToC steps are shown in grey boxes at the bottom.

Source: UNFCCC 2011

Figure 26. Theory of Change of REDD+ according to UNFCC (From Martius et al. 2018)

1.2 Localities

- Kenya, Mozambique, Tanzania

1.3 Value chains

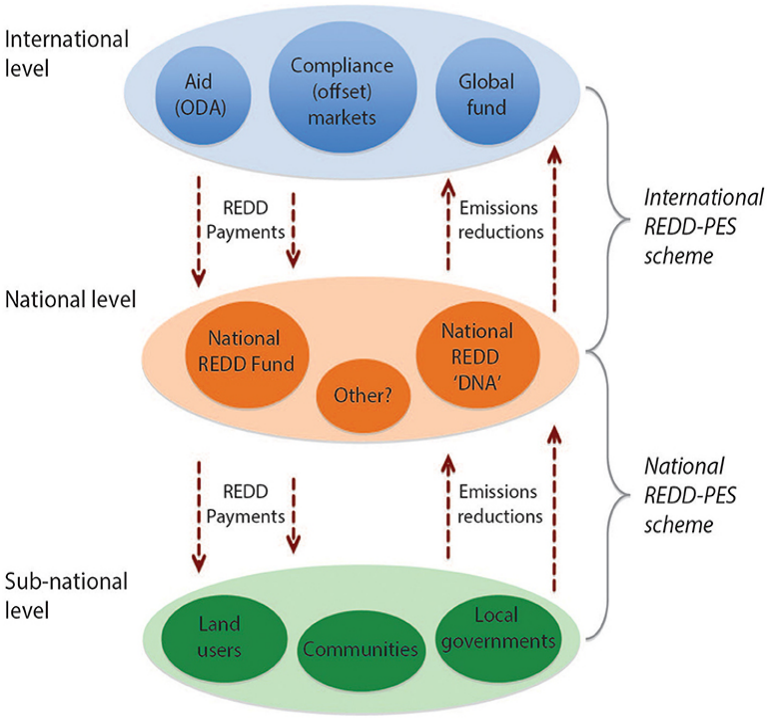


Figure 27. Conceptual model of REDD+ as a multi-level PES scheme (from Wunder et al. 2020)

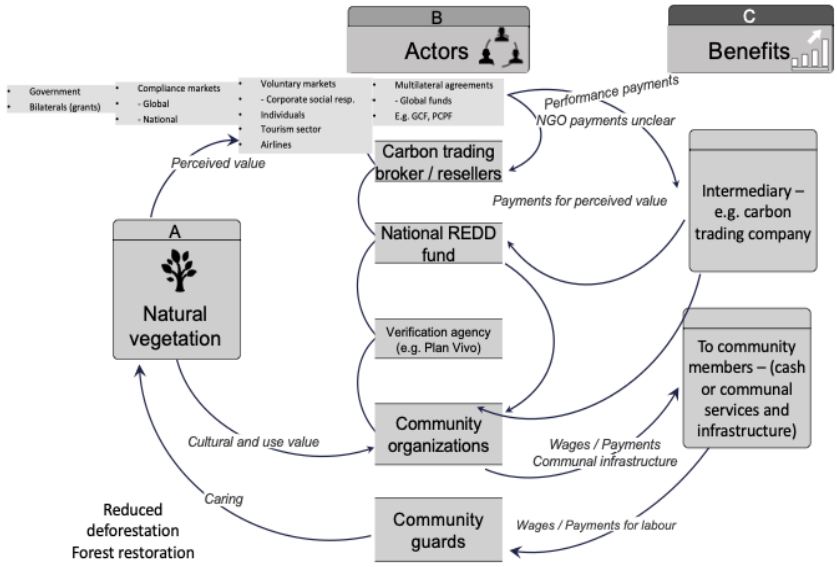


Figure 28. Stylized value chain for carbon credits (source: authors' own work)

1.4 World Bank Governance indicators (Kenya, Mozambique, Rwanda, Tanzania)

Indicator	Country	Governance (-2.5 to +2.5)	Percentile Rank
Voice and Accountab	Kenya	-0,29	36,45
	Mozambique	-0,51	31,53
	Rwanda	-1,08	18,72
	Tanzania	-0,50	32,02
	Uganda	-0,62	30,05
Political Stability and /	Kenya	-1,12	12,38
	Mozambique	-0,75	20,00
	Rwanda	0,12	52,38
	Tanzania	-0,36	32,86
	Uganda	-0,65	22,86
Government Effective	Kenya	-0,38	38,46
	Mozambique	-0,82	18,75
	Rwanda	0,19	60,58
	Tanzania	-0,88	17,31
	Uganda	-0,59	31,25
Regulatory Quality	Kenya	-0,28	41,35
	Mozambique	-0,72	23,08
	Rwanda	0,08	58,17
	Tanzania	-0,64	27,88
	Uganda	-0,37	37,98
Rule of Law	Kenya	-0,45	35,58
	Mozambique	-1,02	14,90
	Rwanda	0,08	56,25
	Tanzania	-0,58	29,33
	Uganda	-0,31	43,75

1.5 UNDP development indicators (Kenya, Mozambique, Tanzania)

UNDP indicators	Kenya	Mozambique	Tanzania
HDI	0,6 (world = 0737)	0,456	0,592
Rank	143	181	163
Trend	positive	positive	positive
Population	66,4 million		79,2
Per capita income (USD)	4244	1377	2600
Multidmensional poverty	38,7 %	72,5%	55,4%
Employment (% of popln 15 and older)	72,7%	75,6%	81,88
GINI coefficient	40,8	54	40,5
Internet users ; mobile phones	17,8% internet; mobile phones 96,3%	10% internet; mobile phones 47,7%	25% internet; mobile phones 77,2%
Skilled labour force	40,5%	7,1%	5%
Mean years of schooling	11,3	3,5	6,1
Ease of doing business ranking (1=highest rank)	56 / 180	138 / 180	141 / 180

2 Viability of voluntary Carbon markets

2.1 Keys to success

- The key criteria used by Carbon Tanzania in seeking to find communities with which to establish a REDD+ project were:
    - Clear land and resource tenure, allowing the community to control resource access and use and enforce local forest management regulations
    - An area with high carbon storage potential that is under some level of threat – a critical element for satisfying the requirement of "additionality" in carbon markets – including evidence of the threat, e.g. data showing historical rates of deforestation; essentially, a project activity is additional if it can be demonstrated that the activity results in emission reductions or removals that are in excess of what would be achieved under a "business as usual" scenario and the activity would not have occurred in the absence of the incentive provided by the carbon markets.
    - A sufficiently large area (and large amount of stored carbon) to warrant the high up-front costs of project design and third-party verification and validation.
- The projects should also be nested in a country's jurisdictional REDD+ program. Jurisdictional nested REDD+ programs allows for governments to combine site-specific activities happening at different levels and supported by different sources of funding and expertise to allow for efficient deployment of resources while scaling up impact. "Nesting" allows for such a joining of forces to be possible, coherent, and credible. Consequently, this approach provides a pathway for projects to be transparently and robustly aligned with national REDD+ reference levels and other REDD+ program elements, which will allow these projects to be accepted much more readily into emerging market mechanisms (for example, CORSIA[8]) and provide longer-term financing certainty.
- Respect for the knowledge and rights of indigenous peoples and members of the local communities b taking into account relevant international obligation, national circumstances and laws.
- The basis for generating emission reductions is the community committing to concrete measures that will improve forest management and reduce forest loss or degradation.
- Flexible finance from financial institutions to pay for the high start-up costs of operationalising REDD+ projects as Kasigau did. Communities will still need to verify that the emission reductions generated by these projects are actually occurring, and that's where a carbon standard will come into play.
- Reforms that strengthen community rights over lands and forests are a critical enabling condition for unlocking the growing value of international carbon markets. Countries like Tanzania that have created strong legal frameworks for community forest management, will be best positioned to enable communities to benefit from these emerging economic opportunities and investments.
- Mikoko Pamoja: Good science is required to develop such projects (for example, determining the baseline scenario which represents the activities and greenhouse gas emissions that would occur in the absence of a REDD+ project activity); community buy-in

[8] https://www.icao.int/environmental-protection/CORSIA/Pages/default.aspx

and government support are critical for success. Carbon benefits alone may not be sufficient and must be complemented by other alternative benefits; the transitory nature of carbon offsetting requires development of alternatives for future income.

- A successful REDD+ strategy is effective planning and investment. By development of national and sub-national investment plans, focused on clearly defined objectives, stakeholders can be incentivized towards better forest management (or dis-incentivized from forest destruction)
- Participatory monitoring highlighted its importance in enabling greater local participation in REDD+, but noted that community participation was often limited to data gathering.
- Recommendations for increasing participation in REDD + projects included improving implementers' outreach [16,24], mapping locations of potential beneficiaries [36], and cultivating trust throughout the process [32]. Others stressed the importance of giving community members opportunities for meaningful engagement [33], engaging with institutions that local communities see as fair [27], and allowing for incremental engagement over time (Duchelle et al. 2018). It is also important to document and put in place mechanisms for ongoing communications with local communities and other relevant stakeholders.
- Reconciling REDD+ goals and policies with the need for forest communities to retain adaptive capacity will be a challenge moving forward, and interventions such as REDD+ should consider unintended consequences that can limit long-term resilience.
- A shift towards adaptive governance of REDD+ projects is needed, where representative stakeholder groups are involved in community resource management embedded in strong social networks, and where space is created for opportunities to self-organize while nurturing reserves. Data beyond C monitoring.
- Adaptive management of REDD+ requires enabling legislation, funds for responding to change, and information sharing that allows for collaborative learning among actors at different scales (Haijar et al. 2021).
- While REDD+ cannot succeed without changes in broader development trajectories, rule of law, transparency, etc., it alone cannot solve all these concerns. REDD+ requires an enabling policy environment.
- For REDD+ to succeed in the context of the Paris Agreement, decision-making must become more realistic and pragmatic – in both national and local contexts – in deciding what and what not to include (Martius et al. 2018).
- The success of REDD+ project can also be enhanced by accurately identifying any potential negative environmental and socio-economic impacts and the steps that will be taken to mitigate them. It is critical to design and implement REDD+ actions to mitigate or avoid the risk of negative impacts and bring additional benefits.

2.2 Enabling Context

2.2.1 Enabling policy environment

- In order to obtain and receive results-based finance for results from the implementation of REDD+ activities, developing country Parties should have the following in place:
    - A national strategy or action plan

    - An assessed forest reference emission level and/or forest reference level
    - A national forest monitoring system
    - A system for providing information on how the safeguards are being addressed and respected
    - And the results-based actions should also be fully measured, reported and verified (MRV).
- Tanzania that have created strong legal frameworks for community forest management
- In mid-2019, South Africa was the first country on the African continent to pass a national carbon tax law, which is being implemented in a phased approach. The tax is applicable to the majority of sectors and the price is set at approximately USD 8 per tonne of CO e and is adjusted annually
- Carbon Tanzania depends on effective local resource governance institutions that support community forest management for their projects to deliver the long-term reductions in forest-based carbon emissions that they are based on. This also requires support for local conservation measures from district and national governments.
- Corruption and policy reversal continue to hamper implementation success.
- Tanzania: Within the past five years there have been concerns about rollbacks of community rights over Village Land Forest Reserves, which could impact initiatives that seek to generate community benefits from sustainable timber or carbon.
- While Carbon Tanzania has been able to work with local partners to build relatively strong village-district partnerships and generate buy-in for its model, national carbon and climate policies in Tanzania are less certain. Within the past five years there have been concerns about rollbacks of community rights over Village Land Forest Reserves, which could impact initiatives that seek to generate community benefits from sustainable timber or carbon.
- Legal and regulatory uncertainty is also a significant constraint to community forest enterprises, and to expanding their social and environmental benefits. Initial carbon offset initiatives such as the Yaeda Valley REDD+ project have emerged based
- Lack specific regulations around carbon rights related to forests that could provide greater security to project developers and local communities seeking to benefit from carbon offset initiatives.
- Convoluted objectives, unclear donor commitments, and competing ideas about what REDD+ is and should pay for (compensation level, beneficiaries), complicate its implementation (Martius et al. 2018). Length of time donors are willing to be engaged; carbon projects are typically in place at least 20 years.

2.3 Rights to land or resources

- Certificate of Customary Right of Occupancy (CCRO) through which individual villagers could gain legal tenure of land their family had traditionally farmed.
- Ujamaa Community Resource Team (UCRT) UCRT has continued to help create CCROs for other groups in the Yaeda area and beyond, by 2017 putting around 600,000 hectares in total across northern Tanzania under group CCROs for hunter-gatherers and pastoralist rangelands. UCRThas been able to secure legally recognised communal land rights for 20,466ha of land occupied by the Hadza.

- For these communities, managing and protecting natural resources requires the legal rights to plan and control how resources are used, which in turn requires establishing formal rights to govern land and control use.

2.4 Participation

- The majority of cases n=43 reported increased local participation in decision making, management, and monitoring (Haijar et al. 2021) (Figure 2).

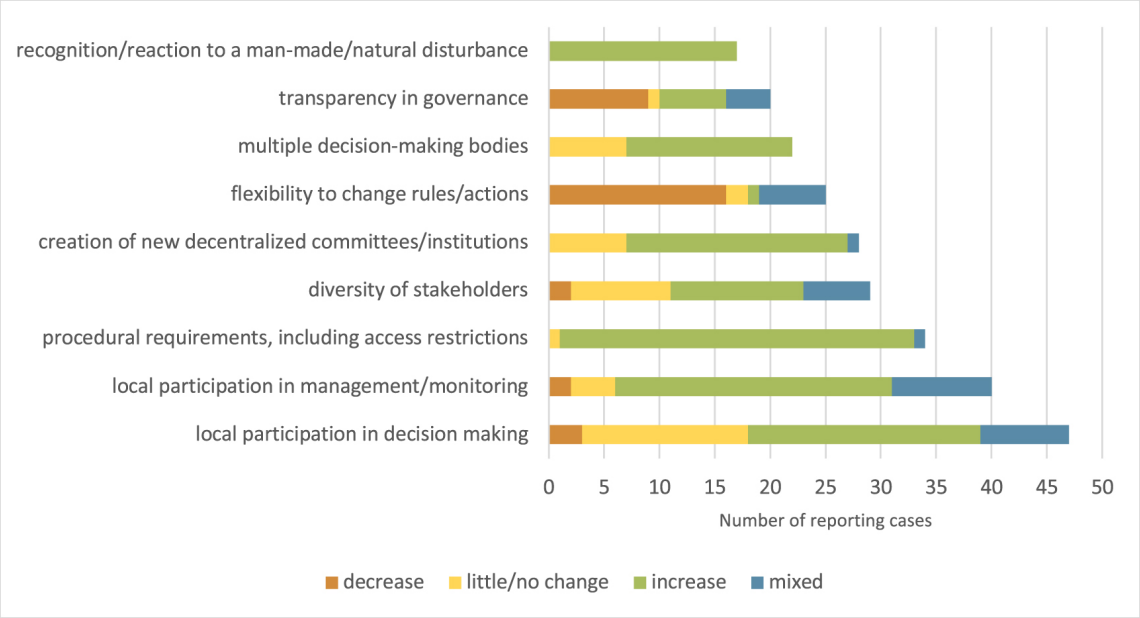


Figure 29. Outcomes of Carbon market initiative (Haijar et al. 2021)

- Unpopularity amongst grassroots environmental groups who are skeptical about top-down implementation, elite capture and political interference.

2.5 Strength of community institutions and structures

- Establishment and functionality of the Chyulu Hills Conservation Trust (CHCT) brought together all stakeholders operating in the landscape
- Two government entities (the Kenya Wildlife Service and the Kenya Forest Service), three local NGOs and four Maasai group ranches, thereby forming a true multi-stakeholder, all-inclusive management entity. The CHCT is testament that through collaboration, landscape-level management is possible and in fact, highly productive. It is also the first terrestrial REDD+ project in Kenya that is fully locally owned.

2.6 Period of time the community has been involved in the enterprise

- Lessons from projects Implemented since 2009 e.g. Kasigau

2.7 Technology and infrastructure

- Tech partners
- Above- ground biomass surveyed and LandSat and Google Earth satellite imagery
- Certification - Plan Vivo Foundation
- increasing focus on developing methodologies that assess the impact of enhanced rangeland management and restoration on carbon storage and sequestration
- M-Pesa payments through mobile phones
- To maintain the carbon integrity of REDD+ by ensuring additionality and permanence and avoiding leakage, REDD+ schemes have had to develop complex monitoring and reporting schemes with baseline reference levels. These have required complex time- consuming technical calculations, often provided by expensive experts, which have eaten into the budget available for actual REDD+ payments.
- Of the 12 studies reviewed by Duchelle et al. that addressed changes in forest carbon/ land use outcomes, two used remotely sensed data, while two others included plot-based on-the-ground biomass estimate. The remaining 8 were based on subjective perceptions and secondary data.

2.8 Viable business model

2.8.1 Financial viability

- Yaeda Valley project, Carbon Tanzania partnered with another local organization – the Ujamaa Community Resource Team (UCRT) - partnership has succeeded in selling all of the project's credits produced to-date on the voluntary carbon market, including advance sales through 2020
- In 2019, Gabon received funding from Norway to preserve its rainforests to mitigate the effects of climate change. This was part of a 10-year deal in which the partnerships sets a carbon floor price of $10 per certified ton (precedent payment of Norway to Gabon)and paid on the basis of verified results from 2016 —2025.
- Surge in demand for carbon credits since 2018, from individuals, companies or governments seeking to purchase greenhouse gas or carbon credits to mitigate or offset a portion of their own greenhouse gas emissions by financing the avoidance or reduction of emissions form other sources or the removal of greenhouse gases from the atmosphere.
- The private sector and governments, through their NCDs, seems ready and eager to invest into climate projects and has shown a significant interest in financing nature-based solutions. For example, Microsoft committed to pay $15 per metric ton of carbon, as part of its effort to go "carbon negative."
- USD 679 million approved for projects in sub-Saharan Africa (Watson & Schalatek 2021) (Figure 3)

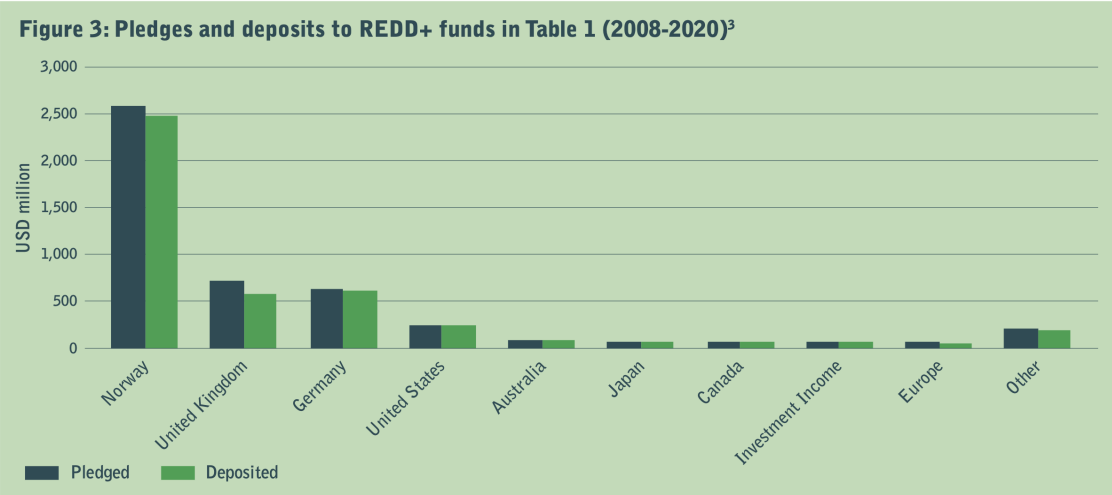


Figure 30. Pledges and deposits to REDD+ funds, 2008-2020 (Watson & Schatalek 2021)

- Mikoko Pamoja, a community-led mangrove PES project has so far, sold 11,923 tCO2e worth USD 109,189 of which USD 76,253 has been paid to the communities, USD 15,000 annually. The income is used to support local development projects, that is, job creation, livelihood support (ecotourism, efficient stoves), community services (education, water and sanitation) and mangrove restoration.
- Category 1: Compliance markets
    - Buyers purchase and retire (‘cancel' or ‘use' the credits, meaning they cannot be resold) emissions permits (allowances) or offsets (carbon credits) in order to meet predetermined regulatory targets. In the case of cap-and-trade programmes, participants are allowed to trade allowances in order to make a profit from unused allowances or to meet regulatory requirements (Ecosystem Marketplace, n.d.).
    - The Clean Development Mechanism CDM remains one of the largest greenhouse gas programmes, with half of all carbon credits ever issued coming
    - National emission trading schemes (which may take the form of a carbon tax or carbon market/cap-and-trade scheme). According to the World Bank, as of 2020 there are 46 national carbon-pricing initiatives around the world that have either been implemented or are scheduled to be implemented
        - South Africa was the first country on the African continent to pass a national carbon tax law, which is being implemented in a phased approach. The tax is applicable to the majority of sectors and the price is set at approximately USD 8 per tonne of CO e and is adjusted annually. The tax is imposed; tax-free up until 2022..
- Category 2: Voluntary carbon markets
    - Space for buyers to purchase carbon credits voluntarily to mitigate or offset their own emissions by financing the avoidance or reduction of emissions from other sources, or the removal of greenhouse gases from the atmosphere. The voluntary carbon markets presents a market based approach to controlling greenhouse gas emissions that are not part of meeting regulatory compliance requirements.

    - Starting from a low level throughout the mid-2000s, the voluntary carbon market has grown significantly and since 2015, its compound annual growth rate (CAGR) has been around 30%.[9]
    - Motivation to participate in this market ranges from corporate social responsibility, the desire to offset their carbon footprint to become carbon neutral, be an ethical business, to contribute to climate change mitigation, and pledges to move forward on the path to reach net-zero emissions. Individuals and governments can also participate.
    - May also include carbon brokers who either act as a "middleman" between the offset producer and the end buyer, and pre-compliance buyers who procure offsets before they are obligated to make reductions under a future policy, hoping to obtain a lower price than the same offset may eventually fetch when it becomes required (Ecosystem Marketplace, n.d.).
    - Value the significant community and biodiversity benefits that forest- and conservation-orientated carbon projects can generate, contributing to socio-economic development and biodiversity conservation
- Category 3: Bilateral/multilateral agreements and results-based payments
    - Results-based payments (RBP) are a form of climate finance where funds are disbursed by the provider of climate finance, often a multilateral fund, to the recipient upon achievement of a pre-agreed set of climate-related results (World Bank, 2020).
    - establishing large-scale climate mitigation programmes at jurisdictional or national level
    - BioCarbon Fund: The World Bank's BioCarbon Fund Initiative for Sustainable Forest Landscapes (ISFL) - USD 360 milllion
    - Forest Carbon Partnership Facility (Carbon Fund): The Forest Carbon Partnership Facility (FCPF) currently works with 47 countries and has allocated a total of USD 1.3 billion in direct contributions and commitments
    - Green Climate Fund: The Green Climate Fund (GCF) was established under the UNFCCC in 2010 to help developing countries reduce their greenhouse gas emissions and enhance their climate resilience
    - February 2020, the GCF had 123 approved projects for a total value of USD 18.9 billion in the categories of climate adaptation and mitigation, covering all IPCC sectors
- Category 4: Emerging Carbon markets
    - Article 6 of the Paris Agreement
    - Aviation organizations
- Significant benefits
    - 2,500 beneficiaries in the three partner communities in Yaeda Valley
    - • At least 60,000 community beneficiaries across 16 villages from the three established REDD+ projects (Yaeda Valley, Ntakata, Makame)

[9] https://www.shell.com/shellenergy/othersolutions/carbonmarketreports/_jcr_content/par/textimage_614371670.stream/1634319513185/324d2a05fb394ebbbb2d6ff2e7aee87fc8b2366a/shell-bcg-brochure-report-v10.pdf

    - 320,216 credits were divided over the 20 years of the project, to reach 16,011 tCO2e in saleable carbon credits each year (Trupin et al. 2018)
- Increase of credits issued from forest and land use activities on the voluntary carbon market alone is even more impressive: volumes increased by 264% between 2016 and 2018
    - of USD 235.3 million over the two-year period
    - Africa's share of the global market increased slightly between 2016 and 2018, from 11% to 15% of overall volume
- Able to sell ex-ante credits, as a way to generate finance flows at the beginning of the project. This helps support sellers, who are local farmers in most cases, to defray the initial costs of planting and caring for tree saplings until they mature.
- When the PES stop and the community has no external motivation to maintain the forest cove
- Finance flows slow to develop
- No international compliance mechanism
- Market has not kept up with growing supply of offsets
- limited government investment and incentives. Support from foreign development agencies has declined steeply over the last decade.
- Uncertain market
    - volume of credits issued under CDM has declined significantly, from 4.8 million tCO2e in 2016 to 2.2 million tCO2e in 2018, a drop of 54%
    - In 2019, however, volumes from land-based activities dropped by approximately 30%, from 50.7 MtCO2e in 2018 to 36.7 MtCO2e in 2019. Nevertheless, the per unit price increased from USD 3.2 in 2018 to USD 4.3 in 2019, thereby generating a total value of USD 159.1 million that year
- It would take at least $20 per ton to dramatically slow deforestation.
- "Then the Coronavirus hit"
    - a large number of companies put buying carbon offsets on the back burner for some time.
    - Airline industry demand has disappeared. airlines will not have to offset emissions until air travel returns to last year's levels, and that could take several years.
- Reliance on voluntary markets not jurisdictional

2.9 Market viability

- Developing markets: PlanVivo has been able to sell verified carbon credits to international buyers. Carbon Tanzania has successfully sold all the project's credits produced to date on the voluntary carbon market, including advance sales through 2020.
- Strong global marketing relationships have been key to Carbon Tanzania's initial success in marketing and growing their carbon credit sales within a competitive global marketplace.
- Currently, the leading standards for credit certification include the Voluntary Carbon Standard, Plan Vivo, the Gold Standard, the American Carbon Registry, Climate Action Reserve, and the Verified Carbon Standard Program.

2.10 Operational viability

- The initial funding is meant for project development. Once the project is registered and verified under a standard, the credits issued should sustain the project throughout its crediting period.
- Partnerships, e.g. Carbon Tanzania.
- Land use is monitored by local community guards, who are elected by the community and trained in conducting patrols, monitoring, and enforcement.
- Industry standards are evolving.
- Plan Vivo (Plan Vivo, n.d.) is a certification body that administers the Plan Vivo Standard. The Standard is a tried-and-tested framework for land-use and forestry projects. It certifies projects that generate emissions reductions and prove sustainability over the long-term. Its development costs are lower than some of the other voluntary carbon standards, making it more accessible for small-scale projects, such as mangrove conservation or restoration programmes. Plan Vivo has been used, for example, by the Kenyan-based mangrove carbon project, Mikoko Pamoja.
- Of 9 Norway funded projects, only 3 produced project development documents
- Projects not going to market due to costs and lack of bridging finance[10]
- The drivers of deforestation are deeply embedded in our global economic system and in global commodities, such as beef, palm oil, soybeans, cocoa, and timber.
- Practical steps and considerations needed to establish such an offset programme as well as designing enabling conditions that allow access to the suite of emerging carbon market, as well as compliance of national accounting systems
- Avoiding double accounting: a risk if governments claim the credits as NDCs and the projects are selling the same credits on the voluntary market[11]. Third-party auditing body will also validate and verify this to avoid double counting.
- High standards for environmental integrity. This means they must be real, additional, verifiable, and have a system to ensure permanence, including to address any risk of reversals.
- Buffer system, a percentage of emissions reductions from a project, e.g. a REDD+ activity, is considered ineligible for transfer and set aside into a pool of units (known as a buffer) that cannot be used as credits.
- Are there excess emission reductions? all emission transfers need to be approved or authorised by the host country before they can be transferred to a government or private sector actor in another country.
- Appopriate infrastructure systems and processes are needed.

[10] Or projects are not maintained for the entire lifecycle due to lack of financing for ongoing verification audits or other costs, NGOs who supported establishment are no longer involved

[11] Also - many African countries have not clarified the ownership of carbon & some governments may claim ownership, which would create uncertainty in viability of community carbon projects.
Project developers have to determine at the beginning whether or not the government intends to use credits towards NDCs or whether the credits can be sold by project implementers (communities)

- Political questions must be addressed on how site-scale activities will be managed and accounted for, how performance will be rewarded, as well as ensuring validity of credits generated.
- Methodology that addresses the alignment of stand-alone projects or a jurisdictional programme into a national REDD+ programme - Verra has developed it
- In order to be eligible to participate in compliance market schemes, project developers would thus have to meet all new criteria, in addition to coordinating closely with government.

2.11 Benefit sharing potential

- Important mechanisms exist to sustain equitable livelihood benefits, including short-term and long-term benefits and enhancement of security and empowerment of community members.
- Appropriate institutional and governance arrangements should be put in place to enable full and effective participation of community members in decision-making, implementation, and management of the project.
- Livelihood benefits are shared equitably not only with community members but also among community members, ensuring that equitable benefits also flow to more marginalized and/or vulnerable individuals within the community.
- 60% of revenue sales go directly to the community, 20% supports Carbon Tanzania's operational costs for the Yaeda project and the remaining 20% covers Carbon Tanzania's administrative and programme costs. The sale of carbon offsets generated around US$219,000 in revenue for local communities between 2013 and 2017.
- Revenue expenditure - Yeda, Tanzania (Figure 7).

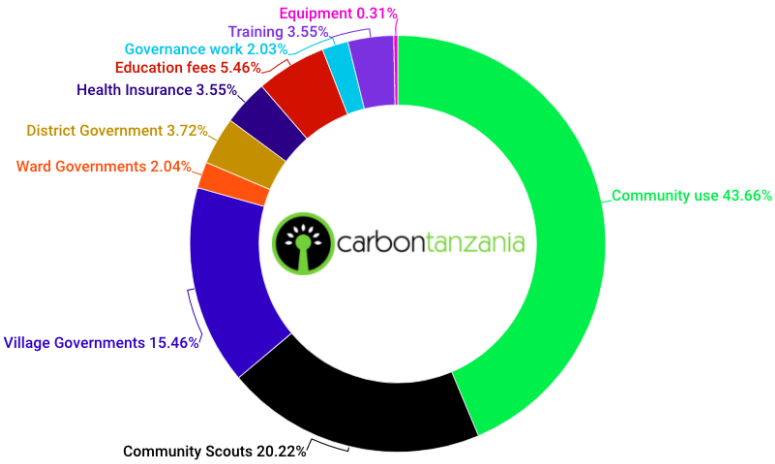


Figure 31. Revenue expenditure at Yeda, Tanzania (Carbon Tanzania, undated)

- A case report from Kenya showed how a REDD+ project involved local communities in decision making more effectively than ICDPs in the area (Duchelle et al. 2018)

- Two case reports from Tanzania found that despite the prevalence of information-focused interventions, awareness was uneven, with women and poorer villagers less informed about project activities (Duchelle et al 2018).
- Low project participation (32%) in Uganda was mostly due to lack of information, complex enrollment logistics, and fears of land grabbing. Similarly, low participation in an ARR project in Mozambique (30%) was related to high charcoal extraction, as well as low trust, education, and cash income levels (Duchelle et al. 2018)

2.12 Socioeconomic values

2.13 Consumptive use of forest and non-forest products, hunting, fishing

- REDD+ has sometimes limited communities' ability to manage for uncertainty through restrictions on local forest practices, rigidity in rules, and 'locking-in' of communities' natural capital through carbon contracts (Haijar et al. 2021).

2.14 Intangible values

- Local adaptability may be enhanced by increasing network ties and connectivity across scales that allow for new resources and information to reach communities, as well as by increasing participatory decision making (Haijar et al 2021).
- Tenure: for many rural areas where land rights and forest tenure are contested and unclear, REDD+ projects registered under a standard requires legal ownership of land or forests to allow the effective transfer of payments. There is need to demonstrate that community members or communities either own or have management rights, statutory or customary, individually or collectively, to land in the project area. For projects registered under a standard, eg. VCS, the project proponent is required to identify and demonstrate compliance of the project with all and any relevant local, regional and national laws, statutes and regulatory frameworks. Legal ownership is critical.
- Consent: engagement with affected households living in and around forests. Initial attention to local participation and engagement have now given way to an overall commitment to free, prior and informed consent for affected households. This suggests that local people have an effective veto over whether a REDD+ project should go ahead or not. However, Carbon projects are difficult to understand fully for anyone not directly involved.
- Poverty: the third social issue is related to poverty, with poor affected households often struggling with the timelines involved with REDD+ payments. For example, poor farmers in Vietnam were promised REDD+ payments would be forthcoming if they stopped deforestation for agriculture. However, they have either not been made fast enough to make up for people's lost income or have not been made at all.
- Questions about impact on perceptions of well- being or income sufficiency; early critiques from local NGOs. In the randomized control trial (RCT) study in Uganda, there were positive carbon outcomes, but welfare impacts were insignificant vis-a`-vis control households.
- Building or retaining local decision making, rule-making flexibility, systems reserves, and livelihood diversity, that are potentially being undermined by REDD+. (Haijar 2021).

- Gender equality and women's empowerment have been used as a catalyst for enhancing the effectiveness, efficiency ad sustainability of REDD+.

2.15 Biodiversity and ecosystem services

2.15.1 Species conservation

- Kasigau, Kenya: increased abundance and distribution of High Conservation Value species such as lion, elephant, cheetah, wild dog, and Grevy's zebra, Secretary Bird and Martial Eagle, all of which are threatened
- Biodiversity impacts are seldom evaluated. In Duchelle et al. 2018, only two studies examined biodiversity: one through a review of 80 REDD+ projects and their self- reported impacts on biodiversity, and the other through a quasi-experimental approach that examined REDD+ project impacts on tree cover loss as a proxy.
- There are too few studies focused on biodiversity outcomes to draw any firm conclusions.

2.16 Ecosystem services

- Uganda: Self-reported tree cutting also declined among treated households, while local land monitoring was strengthened (Duchelle et al. 2018).
- Yeada Valley project Tanzania project has demonstrably reduced the rate of deforestation and local communities have received substantial financial benefits that have been used transparently and democratically to address local development priorities.
    - Total forest area under improved management across three project sites: 653,316 hectares.
    - Since 2012, remote sensing data shows that forests in the core Hadza territory of 20,790ha (the project area) have declined by 9%, compared with over 50% in the wider region (the reference area).
- Sustainable rangeland management and restoration activities are far-reaching in the African context, given that rangelands cover approximately 42% of the African continent. Economies of scale could be reached by sheer size, and the role of improved rangeland management in climate change mitigation should not be understated. The Northern Kenya Grassland Carbon Project is the first grassland and rangeland project verified in 2020 and selling carbon VCS credits on the voluntary carbon market.
- Countries with larger forest coverage and more sustainable forest management were also rewarded by REDD+.
- Increases in natural capital (71% of 38 reporting cases) were mostly due to reforestation and afforestation efforts brought by REDD+ interventions (Haijar et al. 2021).
- 'Leakage' according to REDD+ refers to the displacement of emissions from deforestation or forest degradation from one area to another, or to another ecosystem. The potential for leakage should be identified and leakage management zones be included as part of the overall project design, i.e. REDD+ activities should promote and support actions to reduce leakage.

- Continuous pressure on land for large-scale infrastructure projects, including roads, rail, mining, and electricity transmission without proper mitigation of environmental and biodiversity impacts is also a key challenge in the project area.
- Carbon– biodiversity synergies or trade-offs have arisen, depending on the activities involved, for example, projects that seek to generate carbon credits with reforestation using fast-growing, non-native species planted in plantations. While this may maximize carbon capture, it has much lower biodiversity benefits than native natural forests, and often has negative impacts on downstream water flows
- Poor design and implementation of REDD+ interventions could result in substantial opportunity costs through loss ecosystem services. For example, if forests as part of REDD+ are only managed for carbon (that, in primary and other naturally regenerated forests is mostly in woody biomass and in the soil), it could lead to the loss of important non-timber forest products, such as fruit, wildlife, fungi, and others. On the other hand, REDD+ interventions that focus on and prioritize diverse forests could contribute to the flow of ecosystem services associated with these forests.
- Ultimate drivers of degradation (over-consumption in the global North, population growth, need for infrastructure development to meet other SDGs) are not addressed. Reports from a REDD+ site in Kenya showed that limited access to water and land among poorer households raised pressure on protected forests.

2.17 Climate Change

- REDD+ is an essential part of the global efforts to mitigate climate change and estimates from Project Catalyst (Mc. Kinsey) and the UN Foundation indicate that REDD+ can deliver a disproportionate share of overall needed emissions reductions (24% of reductions versus 15% of the emissions sources).
- Kasigau Wildlife Corridor projected to result in approximately 40 million tonnes of avoided CO2e emissions over 30 years.
- Verified carbon emissions reductions to date from Yaeda Valley project: 105,266 PVC/VCU
- Mikiko Pamoja seeks to reduce 106,929 tCO2e in emissions over 20 years by reforesting and conserving 117 hectares of mangroves along the southern coast of Kenya. Communities have invested the income in education, health, water and sanitation projects for the benefit of 700 households comprising 5,400 members.
- Carbon markets are a key vehicle for mobilising investments in climate action
- Heterogeneous treatments pose a challenge to any rigorous impact evaluation; it is hard to account for all treatment components, while also controlling for all complex variables. Many measured impacts are small and/or statistically insignificant (Duchelle 2018).
- There is far too little carbon outcome measurement to understand REDD+ effectiveness; yet what little there is so far paints a moderately encouraging picture, especially at the local level of focused interventions (Duchelle)

Charcoal production [12]

October 2021

[12] One of 6 reports on the viability of community-based natural resource enterprises (baobab products; beekeeping; Carbon markets; charcoal production; wildlife credits) in Africa. Produced for WWF's Nature Pays program by CARMa-Afrika, Nelson Mandela University, South Africa. The authors are Christo Fabricius, Bianca Currie, Monicah Mbiba and Herbert Ntuli. Contact us at christo.fabricius@mandela.ac.za

1 Introduction to the initiative

Charcoal is the primary source of cooking energy in Tanzanian urban areas, but its production also causes widespread forest degradation. Charcoal is an easily produced and a low-cost forest product, with untapped potential to provide sustainable revenue flows from community managed forests in Tanzania. Under the right conditions sustainable charcoal production can help preserve forests in Tanzania (Trupin et al. 2018). Since 2012, the Tanzanian Forest Conservation Group (TFCG) and the Tanzania Community Forest Network (MJUMITA) has been promoting sustainable charcoal production in Kilosa, Movmero and Morogoro Rural Districts showing some success.

Table 7. Tanzanian national context (http://hdr.undp.org/en/countries)

Country:	Tanzania
HDI:	0.52
Rank:	163
Trend since 1990 (Positive / Neutral / Negative):	Positive
Total population (millions):	72.2
Per capita Gross National Income:	$2600
Multidimensional poverty %:	55.4
Inequality (Gini Coefficient):	40.5 (2017) World bank estimate
Employment %:	81.8
Internet users %:	25
Skilled labour force %:	5

- *Problem being addressed* – Deforestation and poverty alleviation.
- *Locality* - Tanzania.
- *Activities* – VLFR establishment and harvesting of timber for charcoal production.
- *Intermediate outcomes* – Income generation for village communities and short-term gains from VLFRs.
- *Ultimate impacts* – Sustainable forest management and utilization and sustainable socio-economic development.
- *Value chain* – VLFR village councils - harvesters and producers – wholesalers and traders-retailers – end consumer.

Table 2. Value chain analysis of charcoal production enterprises in Tanzania. [*Swedish Development Corporation (SDC); European Union (EU); Tanzania Forest Conservation Group TFCG; Tanzania Community Forest Network (MJUMITA). Tanzania Traditional Energy Development Organisation (TATEDO); Transforming Tanzania's charcoal Sector Project (TTCS): Tanzania Forestry Services (TFS)]

Value chain	Activities	Direct beneficiaries	Indirect beneficiaries	Supporters*	Outcome
1. Management / cultivation / conservation of the resource	Establishment of VLFRs VLFR land use planning Establish Charcoal forestry unit in plan	Village councils Forest rangers	Consultants and village forest service providers	TTCS	Conservation and sustainable management of forest resources
2. Use / harvesting / extraction	Sourcing, cutting debranching and cutting wood into pieces	Village councils (harvesting license fees and royalties) Government (transit pass fees, license fees and royalties)	Transporters	SDC EU TFCG MJUMITA TTCS	Sustainable utilization of forest resources
3. Value added industries	Processing in kilns to convert wood to charcoal. Bagging charcoal and transporting by bicycle and motorbike to market	Charcoal producers	Intermediaries, Transporters Packers	TFCG TATEDO	Charcoal product
4. Sales	Selling, Transportation by trucks, Trade of charcoal product	Traders / charcoal sellers (retailers, wholesalers)	Intermediaries, Transporters Packers	TTCS	Trade
5. Benefits to households / individuals	Consumption and use in burning appliances for cooking and other uses	Jobs	Jobs		Cooking fuel
6. Benefits (contributions) to the natural environment	Foresters caretaking the forests	Responsible and sustainable utilization	Well guided management of forest resources	Supported conservation	Conservation and sustainable management of forest resources
7. Supporting organizations	NGOs & Govt agencies	Civil organisations NGOs Government agencies	Government sectors and agencies	National Tanzanian govt District government	Sustainable forest management and utilization in Tanzania

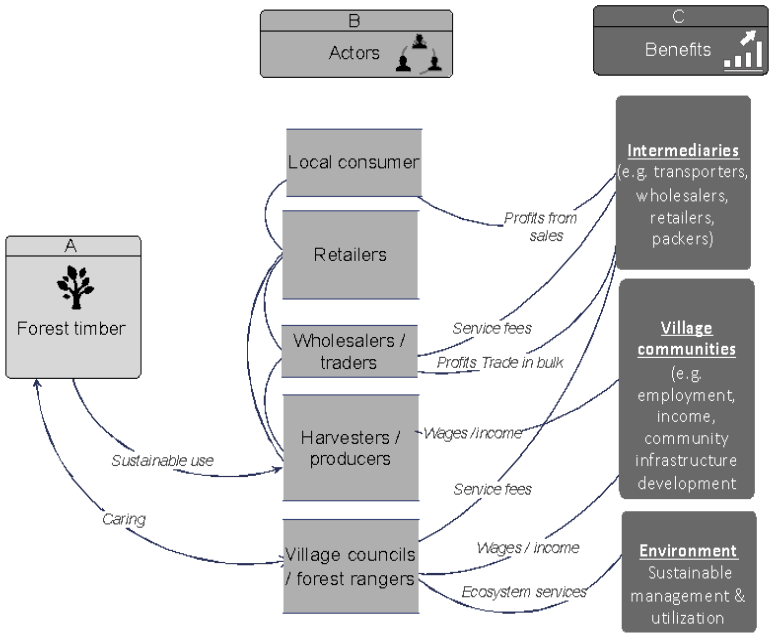


Figure 32. Value chain diagram for charcoal production in Tanzania

2 Enabling Context

- The legislative and policy framework related to land use and conducive economic liberalization policies provide an enabling environment for charcoal production enterprises on Village Land Forest Reserves (VLFRs). However, Tanzania ranks low on the worldwide rankings for governance and the legal and policy framework is not harmonized, with over lapping and conflicting mandates together with weak regulatory frameworks and barriers inhibiting development of VLFRs. Furthermore, there is a paradoxical response from government resulting in conflicting and misguided policies related to charcoal enterprises, and a lack of government support. As a result, there are high levels of corruption and illegal harvesting of timber inhibiting the development of VLFRs and charcoal production enterprises, together with weak governance of the sector.
- Although there is a legal framework for the rights to resources there is no secure land title, weak delivery of land rights, and limited power transfers. The ease by which VLFRs can be established is concerning, but VLFRs also offer flexible and multiple land use options within forest land use planning. There is little data provided on the status of village land tenure and land disputes are known to occur in the absence of village boundary surveys and undocumented private sales of land by village councils.
- The process of gazetting forest reserves is onerous and costly and requires technical expertise. Many VLFRs lack land us plans to guide utilization of the resources. The elected village government often lacks the capacity to undertake land use planning and forest management making them vulnerable to elite capture. Land use planning is made more

challenging in the absence of information and monitoring and no national assessment of forests.

2.1 Enabling policy environment

- The underlying essential conditions and abilities to undertake and manage a community charcoal production enterprise in Village Land Forest Reserves (VLFRs) are there. There is a supportive legislation and policy environment for community-based forest management in Tanzania through the communal tenure of village lands administered by village councils which provides an environment for the development of community-based forest and woodland management, and community benefits sharing (URT 2008).
- International obligations: On an international level the government of Tanzania has legally, and non-legally binding forest related international agreements and processes, including the Convention on Biological Diversity (CBD) the Ramsar Convention, the Convention on International Trade in Endangered Species of Fauna and Flora (CITES), the United Nations Convention to Combat Desertification (UNCCD) and the United Nations Framework Convention on Climate Change (UNFCCC).
- Important national legislation: Relevant legislation, governing land tenure and use, environmental management, and the community forest landscape include:
- **The Forest Act No. 14 of 2002** provides the legal framework for conservation and management of forest resources as well as regulations for trade in timber products. Under this Act, traders in wood products and harvesters are required to have a license and any transporter must possess a valid transit pass.
- **The Forest Amendment Regulations of 2006** describes the procedures and responsibilities of different entities in relation to permits for the production, trade and transportation of charcoal.
- **The Forest Regulations of 2013** set the royalties for charcoal and the annual registration fee for charcoal dealers.
- **The Village Land Act, number 5 of 1999**, refers to governance and administration of village land.
- **The Local Government (District Authorities) Act, 1982** under section 118(2)(n) empowers the local government subject to the provisions of this Act or any other written law, to establish, preserve, maintain, improve and regulate the use of forests and forest products. Section 142 of the same Act empowers the village council to plan and co-ordinate the activities of and render assistance and advice to the residents of the village engaged in agricultural, horticultural, forestry or other activity or industry.
- **The Land Act of 1999** provides for land tenure and the administration of land other than village land in Tanzania.
- **Land Use Planning Act No. 6 of 2007** makes provision for the procedures and processes in accordance with which land use in a planning area or zone are prescribed, managed, monitored and evaluated.
- **The Environmental Management Act of 2004** provides the legal and institutional framework for sustainable management of the environment.
- Policies and programs: On a national level forestry conservation and management is the responsibility of the **Ministry of Natural Resources and Tourism (MNRT)**. The MNRT

established the **Tanzania Forest Service (TFS)** to oversee management and administration of the forestry sector. Furthermore, the **National Forestry Program Facility** was created in 2002 and is governed by a steering committee. The National Forest Program Facility is an instrument meant to implement the **National Forest Policy** which was approved by the Government in 1998 and which is under review, a **new 2008 draft** now exists. The notion of participatory forest management in Tanzania is provided for in the policy which takes cognizance of macroeconomic and other sectoral policies ranging from environmental conservation to sustainable development of the land based natural resources. The National Forest Policy promotes and provides for the establishment of **Village Land Forest Reserves** and the management thereof.

- There are several sectorial policies for forestry, land wildlife, agriculture, tourism, mineral, water and rural development together with national and transboundary policies, actions and plans such as the **National Environmental Policy of 1997.** The policy defines the environmental framework for the forest policy since forestry is a component of environment. The region also benefits from, and depends on, the country's conducive investment and trade policies, political stability and well-prepared development frameworks based on the **National Development Vision 2025** (URT 2019). The **National Energy Policy** classifies charcoal as a renewable energy. The energy policy objectives are to "Promote efficient biomass conversion and end-use technologies to reduce deforestation (Renewable Energy);" and, "Promote the application of alternative energy sources other than fuelwood and charcoal, in order to reduce deforestation".
- Enabling legislation: A supportive legislation and policy environment for community-based forest management in Tanzania exists. The communal tenure of village lands administered by village councils provides a legal environment for the development of community-based forest management and community benefit sharing.
- Regular reporting to CITES: Tanzania ratified CITES in 1979 and has been reporting regularly since 1892 (Lukumbuzya and Sianga, (2017).
- Flexible arrangements: VLFRs offer flexible arrangements that are quick to set up compared to wildlife management areas (formally protected conservation areas) and are widely used to protect corridors in Tanzania (Debonnet and Nindi 2017).
- Conducive liberalization polices: The economic liberalization policies in Tanzania provide a conducive environment for markets and trade in forest products.
- Low worldwide governance rankings: Tanzania ranks 163 on the worldwide rankings for governance (http://hdr.undp.org/en/countries).
- Weak governance of the sector: Charcoal production cross cuts multiple domains of various government agencies including forestry, energy, environment, agriculture and rural development making inter agency coordination complex and difficult, leading to weak governance in the sector (FAO 2020)
- Non-harmonized legal and policy framework: Logging on non-reserved village lands will continue without proper forest resources assessments and harvesting plans because the Land Act and Village Land Act are not harmonized. This is unsustainable and leads to further deforestation and degradation. Controversies and inconsistencies between the Land and Village Land Acts are cited to be among the challenges causing forest degradation, and therefore require harmonization. According to the Village Land Act, 'general land' includes all land that is not reserved land or village land, whilst the Land Act says 'general land'

means all public land which is not reserved land or village land and includes unoccupied or unused village land (MNRT 2019).

- Overlapping mandates: The Tanzanian Forest Service (TFS) district forest officer and the villages on VLFR jurisdictions have overlapping mandates. The TFS is reported to be collecting forest royalties or issuing licenses to harvest trees from VLFRs (which is against the Forest Act of 2002). There are also conflicting intra-sector policies favoring forest conversion (Mwangi et al. 2018).
- Weak regulatory framework and regulatory barriers: The regulatory framework is generally weak in the east and southern African regions, which when combined with low accountability and capacity has led to poor law enforcement (Lukumbuzya and Sianga, (2017). Talvela and Mikkolainen (2019) also mentions slow bureaucratic procedures to process harvesting licenses. Effective law implementation is inhibited by a lack of financial support, technical and human capacity, stakeholder coordination, conflict resolution and grievance mechanisms (Mwangi et al. 2018). Regulatory barriers such as licensing requirements for communities to transport timber have been a major risk and constraint for community-based forestry enterprises, and without any positive incentives to reward good practice (Pederson 2017).
- Corruption and illegal utilization: Corruption and illegal logging are common. The contributing factors include weak law enforcement, high political interference and poor resource governance at all levels (MNRT 2019, Mwangi et al. 2018). Talvela and Mikkolainen (2019) also mention government's unwillingness and or inability to control illegal logging.
- Paradoxical response from government: Policies that enable, ban, and regulate charcoal production by large industries and small local producers are questionable. Government revenues are collected from the activity even though policymakers and foresters are seen to publicly condemn and make charcoal production illegal. Although the activity is considered necessary for the economic development promised in policies and programs, they publicly dismiss charcoal's importance as an economic and energy resource (Mabele 2020).
- Misguided policies: A paucity of data related to charcoal trade has become an obstacle to promoting greater understanding of the trade amongst policy makers and resulted in misguided policies marginalizing sustainable charcoal production in national policy (Doggart and Meshack 2017). Little guidance is given in national policy including a lack of objectives or statements giving specific direction on sustainable charcoal production in the country (Doggart and Meshack 2017).
- Lack of government support: Community based forest management and charcoal production has not been widely promoted or seen as a national development priority by the Tanzanian government (Trupin et al. 2018). Despite being part of the forest policy, the concept of community-based forest management has not been fully embraced by national forest authorities. Local TFS managers see community-based forest management as a threat, reducing the royalties they can collect.
- Bureaucratic and technical demands of sustainable forest management inhibit progress, as it makes implementation costly for government officials and villages (Sungusia et al. 2020).
- Lack of budget: There is no allocated budget at a national or district level to support community-based forest management (Trupin et al. 2018).

2.1.1 Data availability

- Lack of a national assessment of forests: As per SADC protocols forestry state parties are required to undertake and regularly update a national assessment of forests, to establish and maintain a regional database on the status and trends, management and use of forest resources, to develop a market information system for the collection, organization and exchange of forest market and industrial information in conformity with the SADC Protocol on Trade. There is no evidence that Tanzania has yet done a national assessment (Lukumbuzya and Sianga 2017).

2.2 Rights to land or resources

- Since the colonial period until now all land in Tanzania is considered public land. The Village Land Act 1999 provides the legal framework for land rights recognizing customary tenure and empowers local village governments to manage village land. The Village Land Act provides for equal rights to access, use and control the land.
- Little data is provided on the status of village land tenure in the Ruvuma Province however the last published figures from 2003 to 2011 are provided in Figure 2.

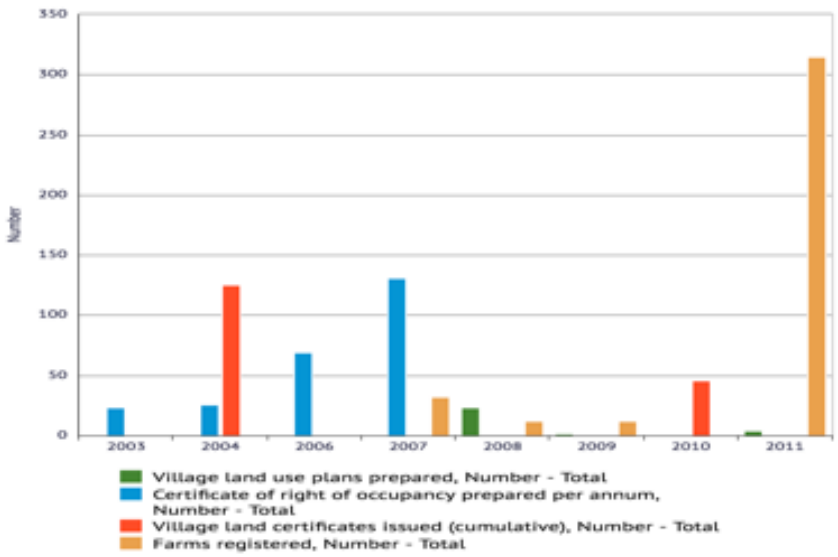


Figure 33. Village land tenure in the Ruvuma Province, Tanzania from 2003 to 2011 (https://tanzania.opendataforafrica.org/TZSOCECD2016/social-economics-of-tanzania-2016?region=1000110-ruvuma-region&indicator=1001300-population-size-number)

Village Forest Reserves

- The Village Land Act of 1999 provides two mechanisms through which a village can establish areas for forest management. They can declare a woodland inside the village area as common land or provide for the ownership of all rights to be titled to a group in the community, or the community as a whole. VFRs are dominated by indigenous trees, and invasive trees are typically removed rather than cultivated.
- VLFRs may also be established on general lands.

- VLFRs are forests owned by villages and managed by committees established under the village councils. Defined in the Tanzanian Forest Policy of 1998 a VLFR is "*a forest which is owned and managed by the village government. The village institutions will be granted appropriate user rights as incentives for sustainable forest management including rights to indigenous trees*". Three years after a VLFR is registered villagers may request the reserve be formally gazetted.
- Community forest reserves are found on village land and are similar to village land forest reserves, except that the village council delegates the management of the forest to a group of people within the community (e.g., timber operators). In such a case the "owner"/manager is not the whole village but a subgroup or sub village.
- In 2015, the Ruvuma region had a total of 1,283,870 ha of natural forest reserves, which is equivalent to 20 percent of the region's total land area of 6,476,400 ha (URT 2019). See a summary of the VLFR status in the FORVAC programme area in Table 2 and growth of the VLFRs supported by the MCDI during 2009-2017 in the Ruvuma region in Figure 3.

Table 8. Summary of the status of established and mobilization of VLFRs in the FORVAC programme area in Tanzania (MNRT 2019).

1	2	3	4	5	6	7	8	9
Cluster	District	No. of existing VLFRs	Total area of existing VLFRs (ha)	No. of new VLFRs to be established (villages)	Total number of villages with VLFRs + VLFRs to be established (No. 3 + 5)	Total area of selected villages for the FORVAC intervention, ha (VLFRs + additional VLFRs to be established)	LUP needed/new VLUPs to be developed	No. of VLFRs with timber harvesting commenced
Tanga	Handeni	2	14,169	3	5	19,462	3	
	Kilindi	2	1,072	3	5	4,410	4	
Lindi	Liwale	24	139,420	3	27	216,995	9	17
	Nachingwea	2	9,789	6	8	33,498	0	6
	Ruangwa	2	9,075	8	10	25,725	8	5
Ruvuma	Namtumbo	6	29,900	1	7	32,900	7	
	Songea	5	14,177	2	7	24,177	5	
	Mbinga	4	7,140	2	6	15,723	6	
	Nyasa	10	23,046	0	10	26,046	10	
Total		**57**	**247,789**	**28**	**85**	**398,938**	**52**	**28**
Anticipated increase in area of VLFRs during the life time of the programme (ha)						**151,149**		
Anticipated increase in area of VLFRs during the life time of the programme (%)						**61**		

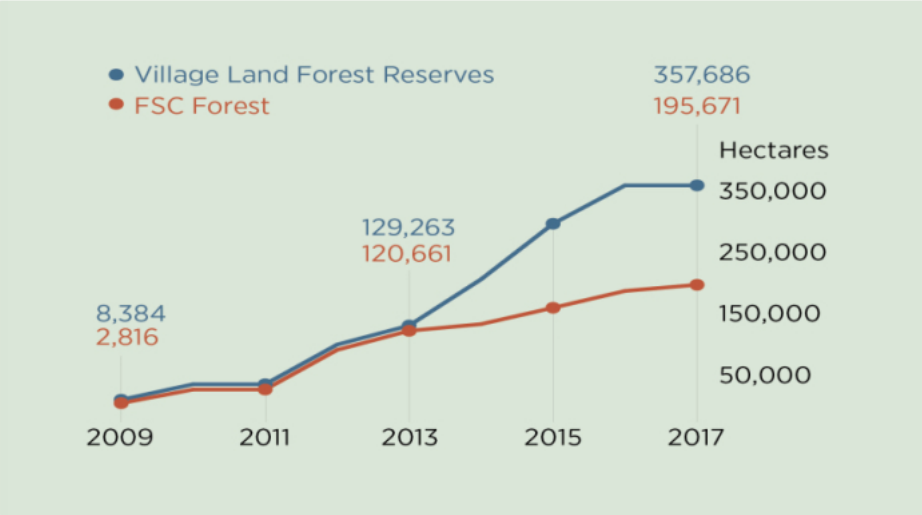


Figure 34. Growth of VLFRs supported by the MCDI between 2009 and 2017 in the Ruvuma region (Trupin et al. 2018).

- By law the VLFRs are managed for both production and protection purposes. Once the process of declaring is done villagers gain the right to harvest timber and forest products, collect and retain forest royalties. They may monitor resource use, make and enforce rules about harvesting and management as well as exclude others from having access. They may undertake patrols, arrest and sanction violators. They are exempt from regulations regarding the harvesting of reserved trees species and are not obliged to share their royalties with central or local government.
- Tenurial status: The tenurial status of the village is strengthened by the Land Act which allows the village membership to hold land as a cooperative; and by the Investment Promotion Act to put such land to work as part of a joint enterprise.
- *No secure title:* Although the Village Land Act and policy enables community-based forestry it does however remove the right of a village council to own the land, rather providing the council with a "manager" role as apposed an ownership role.
- Land disputes: Forest village land was primarily communally owned as communities only claimed customary right of occupancy over areas where they had historically established farms. However, villages are now selling land to private individuals and corporations from outside the villages. Many of these land purchases are of a speculative nature and therefore much of the land remains unused and still covered in forest. These sales have not been clearly documented making it difficult to know about them without visiting the specific area to determine if areas are claimed by multiple adjacent villages or outsiders and if any village boundary conflicts exist (Trupin et al. 2018).
- *Marginal land allocations:* The National Forestry Policy (1998) clearly indicates the government priority to bring unreserved forests, such as those found in village lands, under the jurisdiction of local communities, but some of these lands devolve rights to small low value, degraded forests to communities, which means that the delivery of benefits is delayed far into the future (MNRT 2019).

- *Ease by which reserves can be established:* Given the current global demand for land, the ease by which village land can be appropriated is a concern.
- *Weak delivery of land rights*: Overlapping roles of the ministry of land and the prime minister's office, regional administration and local government, and weak governance in land administration pose major concerns in terms of delivering land rights in an efficient and equitable manner (Land Links USAID https://land-links.org/country-profile/tanzania/).
- Lack of significant power transfer and elite capture: The transfer of power to communities remains slow, especially where high value resources are at stake. Government and their officials as well as private enterprises and local elites often co-opt the decision-making processes on the basis of professionalization claiming communities are unable to meet the requirements, and that certain expert skills to properly manage the forest are needed (Gross-Camp 2019; Mwangi et al. 2018). Furthermore, technically demanding land use plans are costly and when paid for by governments, private enterprises or local elites the capture of the assets and benefits are facilitated and used to justify the lack of meaningful management rights transfer to the communities (Sungusia et al. 2020; Gross Camp et al. 2019).

2.2.1 Data availability

- Little data is provided on the status of village land tenure in the Ruvuma Province with the last published figures only covering the period from 2003 to 2011 (provided in Figure 2.) Furthermore, the sales of land to speculators by villages is not clearly documented leaving room for land disputes.

2.3 Participation

- The Village Land Act provides for the establishment of institutions responsible for village land governance, such as the village council, the village assembly and the land adjudication committee, as well as the village land council, which is responsible for mediating land disputes. The registered village members elect the village council, which is an independent legal entity holding executive powers, which can sue and or be sued, and which acts on behalf of the village members. The village council is responsible for gaining agreement from the village community on village matters and define village land areas for an interim period or in perpetuity, as land held in common (communal land) or issued as private deeds to groups, clans, households, spouses and individuals. The village council can hold property and enter into contractual arrangements.
- Village lands require a village land use plan to obtain a certificates of village land. Village land use planning is supposed to be an inclusive and integrated participatory process in assessment and planning which enables communities to develop their own community action plans, by-laws and local institutions to oversee rural management.
- Forest management planning in VLFRs involves dividing the forest into overlapping management units for different forest uses (Trupin et al. 2018), but the exercise is expensive and requires expertise that villagers are lacking. This vulnerability leaves villagers susceptible to the interests of the powerful and often external actors (Cross Camp 2017).
- Multiple land use options within forest land use plans: Village land use planning makes it easier for villages to plan larger VLFRs while remaining confident that they have set aside

sufficient land for other uses. Thereby villages are not limited to managing forest for charcoal alone, most plans include a mix of multiple sustainable uses of the forest resources, including charcoal production, beekeeping and medicinal plants (Trupin et al. 2018).

- Cautious community approach to establishment and expansion of VLFRs: Small community forests are perceived by community members to provide greater control over the land and potential financial benefit through timber sales. However, communities perceive larger community forests as less desirable due to the decrease in available land and ability to use it for other activities especially agriculture (Gross-Camp et al. 2019). Communities were most concerned about land outside of the community forest where there is less restriction placed on collecting resources and expanding agriculture practices.

2.4 Strength of community institutions and structures

- Although the democratization of forest management is commendable, community forestry is strongly dependent on the capacity of communities to manage and govern the access and use of forest resources. Elected village governments often lack capacity to manage forest resources (Lukumbuzya and Sianga, (2017). Nzali and Kaswamila (2019) found that there was inadequate capacity building, passive community participation and involvement in VLFRs management.
- The bureaucratic challenges involved in establishing a VLFR are significant leaving local village governments limited in their ability to navigate the legal process of establishing a VLFR. Nzali and Kaswamila (2019) mentioned that no village has navigated the process without the assistance of external organizations.
- Lack of community capacity; Elected village governments may give customary authorities control over forests which exceeds the community capacity to manage it. Other consequences include local elites gaining control and using the resources for political or economic gain, or control may be given with limits on the rights of the village communities.
- Lack of capacity for improved governance advocacy: Civil society organizations capacity to advocate for improved governance is uneven through the east and southern Africa region, with most lacking long-term strategies and funding, and lacking the ability to organize at national and regional levels (Lukumbuzya and Sianga, (2017).
- Lack of village boundary surveys and village land use plans: There are only about 1,000 villages of a total of 10,500-11,000 who have had their village land area surveyed and a village land use plan put in place. The number of the villages adjacent to forests or natural woodlands is not known but is estimated to be in the region of 6,000-8,000. Even if the villagers know the traditional village boundaries, they often have no legal documents stipulating the boundaries, they have no statutory power to control invading pastoralists. In addition, the villages with land use plans have no resources to put plans into action (MNRT 2019).

2.4.1 Data availability

- Absence of information and monitoring data: In the absence of up-to-date basic forest monitoring information and high-resolution data, forest management plans and harvesting plans are either non-existent or severely lacking. The Green Advocates International (2014) concluded that even in cases were resource off take is monitored it is not evident that

resource usage rates are optimal or efficient, and in some cases the sustainable levels of forest resource use in unknown and harvesting quotas are not adequately determined or based on actual inventories (Green Advocates International 2014) all of which compromises the sustainable utilization of the resource.

2.5 Period of time the community has been involved in the enterprise

- TFCG and MJUMITA began working to promote sustainable charcoal in 2012 through a project called Transforming Tanzania's Charcoal Sector (TTCS). The first phase of the project (2012-2015) established sustainable charcoal production in ten villages in the Kilosa District. The second phase of the project (2016-2019) scaled up the project to ten more villages in Kilosa District, five in Morogoro Rural District, and five more in Mvomero District. Additionally, the project was introduced to five villages in northern Mvomero District through the Adding Value to the Arc (AVA) project.

2.6 Viable business model

- Charcoal is used by the majority of the Tanzanian population as their main energy source for cooking and although use of liquid petroleum gas has grown in the urban centers, charcoal still remains competitively priced.
- As supply of unsustainable charcoal declines, prices will continue to rise and the market for sustainable charcoal will continue to expand.
- There is however limited data on market demand and wholesale prices appear to differ significantly depending on the location. The government FORVAC programme has been established to fill the value chain information gap.
- The business of charcoal production is easy to enter and the start-up costs are low (aside from VLFR establishment and management). Many charcoal traders already operate in many villages in Tanzania and VLFRs can offer competitive harvesting fees as well as being tax exempt, and not having to pay royalties to the government.
- Charcoal making offers a higher return for labor compared to casual farm labor and villages may be able to earn more from charcoal than timber sales, especially in historically over harvested forests and marginal lands. Agricultural opportunity costs however remain high and inefficient production processes limit revenue potential.
- One of the strategies in charcoal programmes is training charcoal producers on using improved kilns, as these can substantially reduce the amount of wood required to make charcoal
- Obtaining FSC certification acts as a barrier into the formal markets meaning trade remains predominantly informal
- The high costs of forest management remain a challenge for many VLFRs
- Negative perceptions plague the market and policy sector with bans on charcoal having been put in place in the past.
- There is poor compliance among producers and traders compromising the revenue stream.
- Traders control the market and the closer the operation is to urban areas illegal harvesting and production becomes challenging to control.

- There is enabling legislation supporting the benefit sharing potential of charcoal production enterprises within VLFRs which can offer a diversity of benefit sharing arrangement.
- It appears that benefits rarely remain with local communities and remain open to elite capture and unequal distribution due to a lack of transparency and corruption.
- Limited income generated in VLFRs is predominantly spent on administration and forest management as wells on social infrastructure developments and services. The lack of direct benefit to villagers compromises the benefit sharing potential.
- A wood deficit is projected for Tanzania and VLFRs are often too small with marginal or poor forest resources limiting their revenue potential.
- Much harvesting in done in the absence of forest management and harvesting plans although monitoring is considered easy.
- Charcoal species rapidly regenerate and have a far shorter harvesting rotation compared to extractive timber, and therefore sustainable charcoal production offers a viable option for degraded VLFRs where little return for timber sales can be expected in the short term.

2.7 Financial viability

- In the Kilosa, Mvomero and Morogoro Rural Districts 13 village governments under TFCC projects earned a combined $203 000 from charcoal royalties on 3 153 tons of charcoal between June 2013 and December 2017 (Trupin et al. 2018).
- Ishengoma and Abdallah (2016) report that the average earning per month from charcoal can range from $492.45[13] to $2985.28 (US$ to TZS conversion rate of $1 =TZS 2319) with traders of the opinion that monthly earnings from charcoal has increased from $62.96 to $188.66 (US$ to TZS conversion rate of $1 =TZS 2319) in one year. The prices obtained from the sale of charcoal has been provided by Doggart et al. (2020) in Table 3.

Table 9. Prices of charcoal sold in units of different volumes in Tanzania (Doggart et al. 2020).

Price of charcoal sold in units of different volumes.

Unit charcoal sold in	Mean unit price TZS/unit	Price range (min–max) TZS/unit	Mean weight kg/unit	Weight range (min–max) kg/unit	Mean price per kg TZS/kg	Price range per kg (min–max) TZS/kg	n
Small plastic bag	1206	500–2000	1.50	0.7–2.60	831	455–1429	17
10-l bucket	2567	1000–4000	3.44	2.8–4.2	755	385–1071	15
20-l bucket	7500	7000–8000	8.00	8.00	938	875–1000	2
Large sack	37,857	24,000–52,000	73.04	47.5–100	561	400–947	7
Overall	N/A	N/A	N/A	N/A	776	385–1429	41

- The most common costs involved during charcoal making include tree cutting and processing, kiln construction, carbonization, charcoal unloading, charcoal packing, tools, empty bag costs, transport and labor costs (Fitwangile 2017). According to Dobie et al. (2015) tree cutting, and preparation is the highest single cost. Most of the charcoal producers in Tanzania use family labor which can substantially reduce the labor costs associated to production, however, the labor cost is still an important cost factor common to all charcoal producers. Tools used in charcoal production can be reused over a number of years, until completely depreciated (Fitwangile 2017). Doggard et al. (2020) illustrate the

[13] All currency in this report is provided in US dollars at an exchange rate of $1=TZS 2319, the exchange rate as at 25 June 13:26 UTC.

fees, taxes and royalties paid by the various actors in the charcoal value chain in Tanzania in Figure 4.

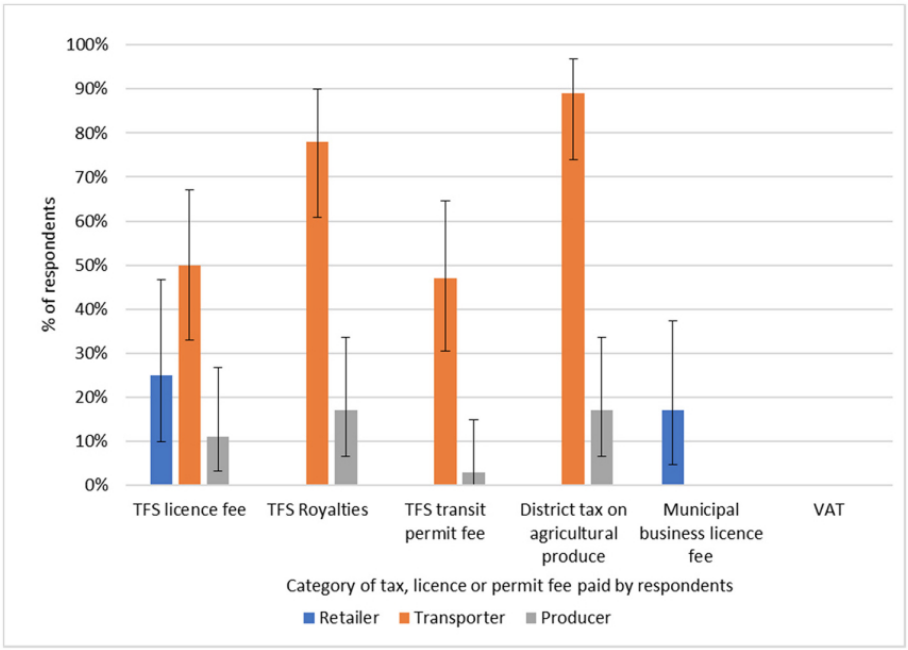


Figure 35. Fees, taxes and royalties paid by actors in the charcoal value chain with error bars showing a 95% confidence interval (Doggart et al. 2020)

- Competitive pricing: Charcoal prices can rise by as much as 20 percent and still remain competitive. Gas has a substantial upfront cost that serves as a barrier to entry (Alem et al. 2017). So long as villages can supply charcoal at a price that is competitive with gas, they will continue to find an expanding market as other supplies of charcoal decrease and urban populations continue to grow (Trupin et al. 2018).
- Charcoal making offers a higher return for labor than casual farm labor: Villages can make more income from charcoal making than casual farm labor work. While charcoal making is hard work and labor intensive, charcoal makers can earn up to $3.36 a day compared to casual labor rates in most villages of around $1.29 a day (Trupin et al. 2018).
- Low start-up costs: Charcoal production requires minimal start-up capital, and the enterprise can become establish within a year (Trupin et al. 2018). The capital outlay required for the trade in charcoal by retailers was also small ranging from $19.94 to $24.15. Startup capital is primarily self-funded with very few retailers acquiring capital from financial institutions (Ishengoma and Abdallah 2016).
- Viable option for degraded forests where little return from timber sales can be expected: Charcoal can often earn more than extractive timber enterprises. Many villages in the country have large areas of Miombo woodland, but poor timber stocks due to historical over-harvesting. Furthermore, some of the most common Miombo species have no commercial value as timber. Charcoal production can offer an interim income while

woodlands recover, as smaller trees (15 cm dbh) are utilized for charcoal production[14]. Thus, in many circumstances, villages may be able to earn more from sustainable charcoal than from timber. For instance, in Ulaya Mbuyuni, a TTCS village, 33 percent of the stems recorded on timber transects were *B. boemhii*, a species with no commercial timber value, but which makes excellent charcoal. The village has 3,066 hectares of VLFR which has been zoned for sustainable timber harvesting. The value of the annual harvesting quotas for commercial timber species is $9,590, though the village has not yet found a buyer. In comparison, the village has earned $4,519 annually from its 244-hectares of forest for charcoal production since 2015. If the village expanded its charcoal forest management unit, the village would earn $11,593 annually. Villages with poor timber stocks or difficulty accessing timber markets can use limited charcoal harvesting to make up the revenue gap while they wait for their timber stocks to improve, or to find markets.

- Tax exemptions: Community revenue from timber sales is exempt from taxes and levies imposed by central government or district councils.
- Generation of value chain information: The FORVAC program initiated by the MNRT is intent on conducting a market system analysis including a socio-economic study of existing participatory forest management in the FORVAC districts. The study will contain a review of existing VLFRs, VLFRs timber pricing, demand and supply and prices of forest products in domestic and international markets, as well as undertaking a mapping exercise of value chains (MNRT 2019).
- Standards for FSC certified charcoal have been approved in 2018 (Forestry Stewardship Council 2017).
- High costs of forest management*:* Frey et al. (2021) found that community forestry was not economically viable, with forest management costs being 2.6 times more than forest revenues over a five-year period. However, revenues appeared to be increasing and costs decreasing over the same time bringing the costs down to 1.5 times the revenue generated. High transport costs are a significant challenge (Talvela & Mikkolainen 2019) and the cost associated with the formulation of technically demanding forest management plans, which often comes with a hefty price tag for expertise (Sungusia et al. 2020; Gross Camp et al. 2019).
- Poor or limited forest resources: Community based forest management sites tend to be too small to generate significant revenue from forest products, and benefit sharing among multiple communities can also reduce income benefits (Pailler et al. 2015; Akida and Bromley n.d.)
- Competitive VLFRs harvesting fees: Village councils issue harvesting licenses and keep the licensing fees (Trupin et al. 2018). Outside of villages, district forest officers issue harvesting licenses and collect fees on behalf of TFS. The TFS charges $5.39 per 50 kg bag. Villages managing VLFRs for charcoal have reduced their harvesting license fees to $3.02 per 50 Kg bag so that village produced charcoal can remain competitive (Trupin et al. 2018).
- Wholesale prices differ depending on the location. The average wholesale price in villages in Kilosa was $3.81 while the prices obtained in Morogoro ranged between $19.40 to $28.03

[14] Regenerating forests provide valuable habitat for some species, so biodiversity may be affected if these used exclusively to harvest small wood for charcoal production

depending on the weight of the bag and location. In Dar es Salaam the unit of measurement varies between 10kg and 70kg. In Dar es Salaam there were no charcoal bags observed to weight 100kg as reported in Morogoro (Ishengoma and Abdallah 2016).

- Opportunity cost of agriculture: There remains high returns from agriculture compared to charcoal production in most villages (Trupin et al. 2018) which positions agricultural land use as a threat to charcoal production enterprises.
- Negative perceptions of the charcoal industry: Fueled by perceptions of illegality, charcoal production is viewed negatively by many bureaucrats and politicians. Charcoal's reputation as being bad for the environment, dirty, and backwards dominates the policy discourse. In 2006, the Minister of Natural Resources and Tourism tried to introduce a ban on charcoal which resulted in the development of a massive black market overnight, and dramatically increased the price of charcoal. The ban did not stop the trade in charcoal and was lifted after just two weeks. A similar proposal to ban production was discussed in 2017, but ultimately not implemented (Trupin et al. 2018).
- Poor compliance: Compliance among charcoal producers is very low, ranging between 17% (of those who paid for harvesting trees for charcoal) and 57% (for those who paid fees to municipal departments for charcoal trade). Majority paid transit pass fees for transporting charcoal beyond the Kilosa District. Transporters, wholesalers, retailers and customers in Morogoro and the Dar es Salaam area were not aware that they required a license or permit to trade in charcoal, and those selling charcoal to them also required licenses and permits. Majority of transporters, wholesalers, retailers and consumers acknowledged that taxes and fees were not paid (Ishengoma and Abdallah 2016).

2.8 Market viability

- Charcoal is the primary source of cooking energy in Tanzania, and in 2016 households in the country spent an estimated $767 million on the product, which equates to 1.6 percent of the country's GDP. Demand for charcoal stood at 2.6 million tons in 2016 which can be equated to 350 000 hectares of standing woodland (Trupin et al. 2018). Tanzania is the 5th largest charcoal producer in Africa (FAO, 2016) yet the charcoal value chain remains largely informal (Doggart and Meshack 2017). See Table 4 for the estimated number of charcoal consumers, consumption and value in 2016.

Table 10. Estimated number of charcoal consumers, consumption and value in 2016 by segment using the National Bureau of Statistics 2016 population estimates, and charcoal usage and expenditure reported from a 2016 Energy Access Situation Report (Trupin

Segment	Total Population	% Population Using Charcoal	Number Using Charcoal	Consumption (tons)*	Value
Dar es Salaam	5,465,420	88.2%	4,820,500	698,973	$333,388,859
Other Urban	10,111,124	79.3%	8,018,121	1,162,628	$325,394,859
Rural	33,100,155	16.3%	5,395,325	782,322	$108,352,520
Total	48,676,699	37.0%	18,010,379	2,611,5050	$767,136,238

*Assumes annual per capita consumption of 145 kg. of charcoal per year amongst charcoal consuming households (Mwampamba, 2007; Ajao, 2011; GVEP, 2012)

- Charcoal is the most popular form of cooking energy even in comparison with kerosene and liquid petroleum gas (Trupin et al. 2018; Doggart et al. 2020), see Figure 5. Charcoal production will continue in the Miombo woodlands as large-scale transitions from wood fuels to alternative energy sources are unlikely to materialize in the foreseeable future (Adenle 2020; Mabele 2020; Doggart et al. 2020), this because affordability is a primary concern for consumers and charcoal is cheaper than gas, electricity and Kerosene. Charcoal's affordability will continue to make it the preferred fuel for many households (Doggart et al. 2020).

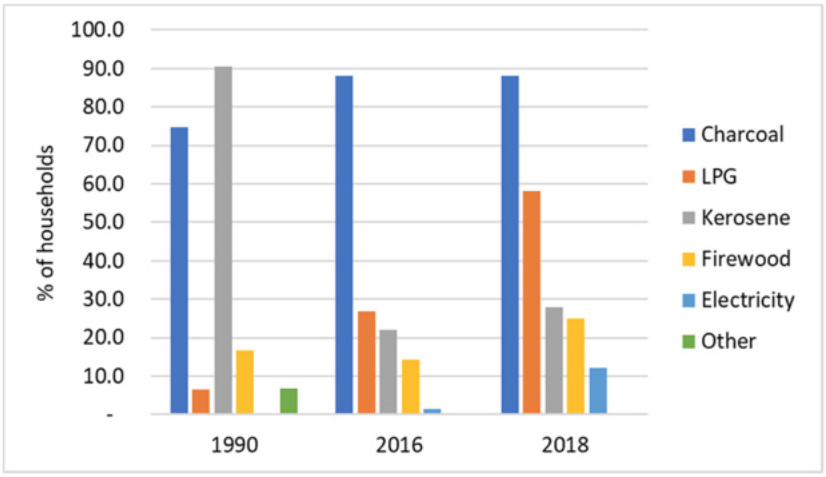


Figure 36. Changes in the percentage households using five cooking fuels in Dar es Salaam between 1990 and 2018

- Urbanization, lack of alternatives and population growth drives the increasing demand for charcoal (Doggart and Meshack 2017). The urban population in Tanzania increased by 12 million in the past 50 years with 71% of the urban households depending on charcoal for their energy needs. If the consumption patterns in Dar es Salaam, other urban areas, and rural areas remain the same as in the 2016, future projections indicate that total household charcoal consumption in 2030 could reach over 4.8 million tons with a value estimate of $1.9 billion (Trupin et al. 2018).
- Nominal charcoal prices in Dar es Salaam have increased steadily for the past decade (Trupin et al. 2018). As charcoal demand continues to rise, growth supplies near urban areas decrease, and as the TFS continues to improve charcoal revenue collection and increases license fees, prices are likely to continue to rise. See Table 5 for the retail charcoal prices achieved between 2006 and 2018 in Dar es Salaam.

Table 11. Dar es Salaam retail charcoal prices between 2006 and 2018 (Trupin et al. 2018)

	Retail per kg. Price (TSH)	
Year (source)	Nominal	Real (May, 2018)
2006 (Malimbwi, 2008)	232	585
2007 (Malimbwi, 2008)	393	925
2009-2010 (Schaafsma, 2012)	501	890
2013 (Camco, 2014)	444	604
May, 2018 (own data)	800	800
% Change (2006-2018)	223%	28%

- Scarcity: Seventy two percent of 32 charcoal sellers in the city of Dar es Salaam reported difficulty finding charcoal to purchase. Fifty percent of them also said business had decreased in the last year, with 34 percent of the 50% attributing the decrease to a decrease in consumer demand brought upon by poor quality charcoal made from non-native (wattle) hardwoods (Trupin et al. 2018). From the perspective of the villages producing charcoal sustainably from VLFRs, the future supply constraints are good news as it means that they will be able to increase the prices they charge for charcoal. Additionally, they are producing the type of charcoal which is most preferred in the market, and which is becoming harder to find, i.e., native hardwoods.
- Easy market access: The charcoal market is domestic and relatively easy to access (Trupin et al. 2018). Charcoal traders already operate in many villages with many of them being willing to switch to sustainable charcoal from VLFRs, especially large-scale charcoal traders who would otherwise have to pay higher fees to TFS. With no external support for marketing, villages can potentially start selling sustainable charcoal within months of establishing a VLFR with harvesting plans. This contrasts with the timber market, which has been much more difficult for villages to access without external assistance (Trupin et al. 2018).
- The rise of liquefied petroleum gas usage in urban centers: Thirty percent of residents in Dar es Salaam use gas for cooking (Trupin et al. 2018) which is set to increase, although charcoal is still consider the cheapest cooking fuel.
- Agricultural opportunity costs: Despite the higher labor wages earned in charcoal production compared to agriculture labor wages, the demand for agricultural land is the most significant economic threat to charcoal production enterprises (Trupin et al. 2018).
- Traders control the market: The dealer-transport-wholesaler networks control the charcoal sector and are powerful and politically connected. Dealers, in collaboration with transporters and wholesalers, dominate all other stakeholders including government. The finance sector is privy to all information and connects non-government actors with central, district and village level authorities. As such, they have a strong interest in maintaining the current status of a largely informal system (Neufeldt et al. 2015). VLFRs would be in competition from charcoal producers who illegally harvest wood and pay no costs for forest management.
- Negative perceptions about charcoal: Charcoal is viewed as an energy source primarily for the poor, and perceptions are that charcoal use for cooking will decrease automatically as a country becomes more developed. Charcoal production is also seen to cause deforestation

and as a sector that is economically irrelevant. These negative perceptions stifle investment and development in the sector and has resulted in a lack of government support, and misguided policies marginalizing sustainable charcoal production from national policy (Doggard and Meshack 2017).

2.8.1 Data availability

- Lack of information regarding demand: Due to the informality of charcoal trade in Tanzania little is known about the factors effecting charcoal demand (changes in prices, income, and policies) and about the possibilities of establishing forest plantations for producing charcoal. Information is needed about the total and distributional impacts of policies and the development of bio-economic models (Nyamoga and Solberg 2019).

2.9 Operational viability

- Charcoal harvesting and production is relatively non-technical and easy to manage (Turpin et al. 2018), but forest management is only as good as the village government and the forest management plans put in place. The lack of village government capacity necessitates the need for forest management service providers for villages (Trupin et al. 2018) which come at a cost and exposes the village to elite capture depending on who funds the service providers.
- Charcoal forest management units need to be accessible by vehicle or bicycle so charcoal makers can access the resource.
- Very low barriers for entry into charcoal production: Charcoal making is already widespread across the country. Charcoal making is something often done by farmers in their spare time. It requires little technical ability and can be done with many of the same tools that farmers already have available to them. In just two days of training, charcoal makers from TTCS project villages learned how to make improved charcoal kilns that raised charcoal yields and led to more rapid carbonization, improving charcoal quality (Trupin et al. 2018).
- Inefficient production: Inefficient processing technologies limits the social and ecological gains of charcoal producers. Less product is made, and greater amounts of forest are needed to supply the demand. There have been recent advancements in kiln technologies which can increase gross margins from 47% using old technologies to 62% using new technologies. This implies that with every $4.31 sale of charcoal $2.67 and $2.03 are retained as profits when using improved and traditional kilns respectively (Fitwangile 2017). Despite these advancements uptake has varied. The older, more experienced and trained producers who are a part of producer networks are more likely to adopt new kilns (Fitwangile, 2017).
- Proximity to urban areas: While market access is important, too much market access can make it difficult to curb illegal charcoal making (Trupin et al. 2018). Most of the charcoal buyers are large scale traders who want charcoal that is properly licensed but charcoal sellers on the highway are common, selling to consumers using small vehicles and back haul truck transporters who are eager to avoid TFS fees, and who charge higher prices than legitimate traders (Turpin et al. 2018). As urban demand grows the forest resources are found further and further away (Smith et al. 2019).

2.10 Benefit sharing potential

- Enabling legislation: The communal tenure of village lands administered by village councils provides a legal environment for the development of community-based forest management and community benefits sharing in Tanzania.
- Diversity of benefit sharing arrangements: There are also a variety of benefit sharing arrangements which Jacob and Brockington (2017) identified in the Ayasanda and Riroda areas in Tanzania (provided in Figure 6). Access to non-timber forest products through free access, free permits and paid permits to the village government. Some arrangements involved providing financial benefits to special groups (e.g., orphans or disabled children) and or using the benefits for social services in the village (Jacob and Brockington 2017).

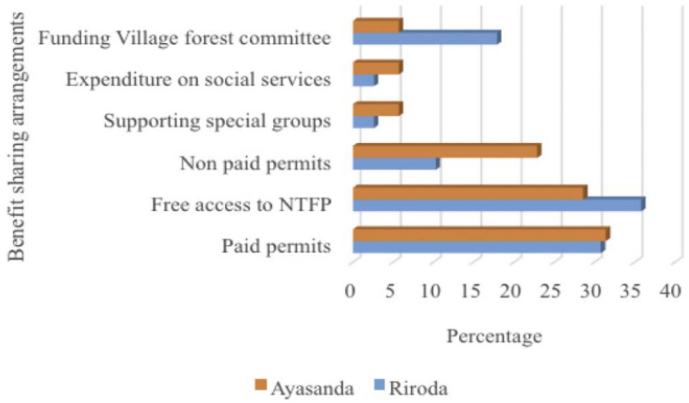


Figure 37. Figure 6. Benefit sharing arrangement in Riroda and Ayasanda (Tanzania) for community based forest management (Jacob and Brockington 2020)

- Khatun et al. (2015) investigated benefit sharing in VLFRs in the Kilwa District in Tanzania. The VLFRs management plans determined the proportions of VLFR revenues spent on forest management costs or village development activities, and the percentage (~ 5%) going to the district authority. Villagers were generally aware of and agreed with the distributions of revenue. On average, villages were spending approximately 50% of timber revenues on process activities and 50% on outcome-oriented activities. See the total income and expenditure for timber sales revenues and their distribution in Table 6.

Table 12. Total income and expenditure for timber sales revenues in TSH in VLFRs in Kilwa District (Khatun et al. 2015).

Village	Total income	Total expenditure	Process spend	Outcome spend	Process spend (%)	Outcome spend (%)	Outcomes widely beneficial	Outcomes widely beneficial (%)
Kikole	6 695 200	4 377 300	2 544 700	1 832 600	58.1	41.9	882 200	48.1
Kisangi	9 614 800	3 963 140	2 585 400	1 377 740	65.2	34.8	1 377 740	100.0
Liwiti	5 113 800	4 142 500	1 870 000	2 272 500	45.1	54.9	2 201 000	96.9
Nainokwe	14 232 000	11 459 488	4 414 600	7 044 888	38.5	61.5	7 044 888	100.0
Average (%)					51.7	48.2		86.2

- Enabling legislation: A supportive legislation and policy environment for community-based forest management in Tanzania exists. The communal tenure of village lands administered by village councils provides a legal environment for the development of community-based forest management and community benefit sharing.
- Flexibility and diversity of benefit sharing arrangements: Benefit sharing arrangements are flexible and can be tailor made (Jacob and Brockington 2017).
- Income funneled back into the community: With the short harvest rotations and the ability of the enterprise to generate income from marginal forest lands charcoal production is an attractive proposition for VLFRs where revenues generated from production is often funneled back into community infrastructure. Revenue derived from VLFRs and from sustainable charcoal harvesting licenses is allocated to local health, water, and education infrastructure developments benefiting village communities (Trupin et al. 2018).
- Benefits do not always remain with local communities: Research undertaken by Baumert et al. (2016), although in Mozambique, found that most revenues do not remain with local communities but with outside operators instead. The informality of charcoal trade is considered a key constraint yet current formal approaches to govern the charcoal sector in Sub Saharan Africa, do not appear to benefit rural producers, instead rural producers are exploited by urban elites (Smith et al. 2019).
- Elite capture: in some cases, benefits from charcoal production are often open to elite capture. Jacob and Brockington (2020) found that benefits are derived by the elite due to weak governance mechanisms when examining benefits from REDD+ implementation in the Duru-Haitemba VLFR in northern Tanzania. Inequitable distributions of costs and benefits, and unjust procedures for determining them emerge at a village level. Oppression is locally driven and organized, reinforcing existing power hierarchies and inequalities rather than equitable sharing of benefits from forest resources (Jacob and Brockington 2017). Leaders are more likely than community households to increase wealth from VLFRs although the community does not always object seeing it as a perk of leadership (Cross Camp 2017).
- Unequal distribution of benefits: As the forest resources surrounding urban centers recedes, and becomes harder to access, the distribution of benefits and profit margins amongst actors leads to unequal benefit distributions, favoring urban stakeholders (Smith et al. 2019).

- Lack of transparency and corruption: Financial reports are less than often shared with the villagers and village leaders and officials are known to embezzle forest income (Jacob and Brockington 2017).
- Limited income derived: Benefits from VLFR are predominantly derived from fines and harvesting fees but villagers in Duru Haitemba claim that the benefits were not well distributed and that most income was used to support financial and administrative needs of the village government (Jacob and Brockington 2017).

2.11 Ecological viability

- Wood supply and demand analysis based on 2015 NAFORMA data shows that forest harvesting exceeds the annual allowable cut by 19.5 million m^3, which will lead to widespread degradation of the forests due to illegal overharvesting and logging. The FOA (2015) showed the projected wood deficit in Tanzania by 2030 in Figure 7.

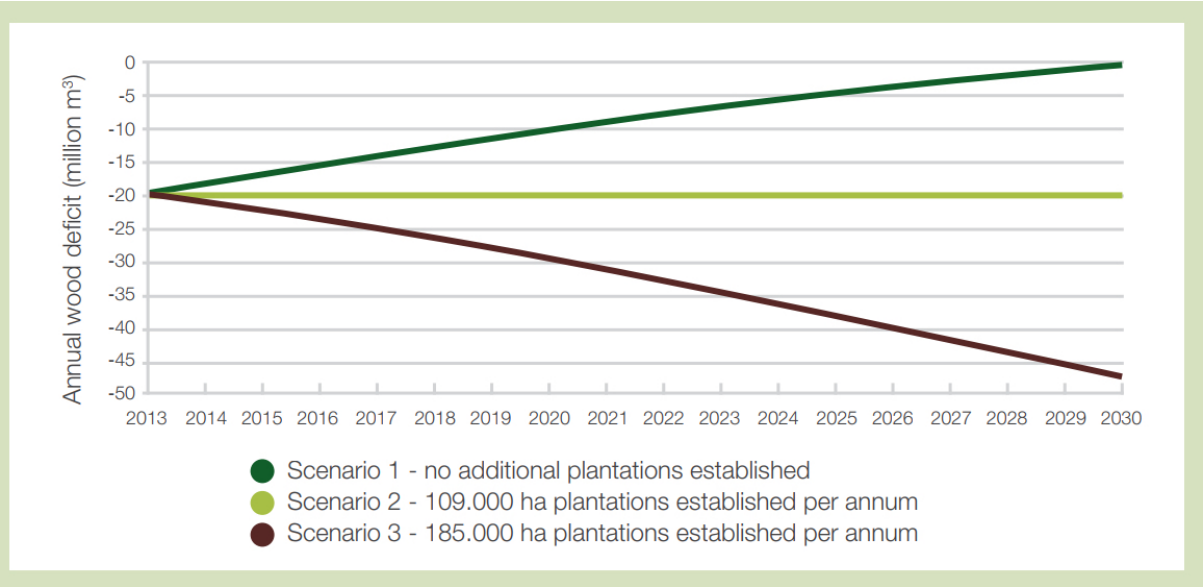


Figure 38. Projected wood deficit (2014 - 2030) in mainland Tanzania (FOA 2015)

- Current rates of harvesting are unsustainable, causing widespread forest degradation near urban areas and major highways especially (Trupin et al. 2018).
- Charcoal species rapidly regenerate: The dominant species in Miombo woodlands are light-dependent species that can grow rapidly from coppices, root suckers, and previously suppressed saplings in open sunlight during the early stages of regeneration. In phase one of the TTCS project, 67 percent of stumps reproduced vegetatively after harvesting, with the oldest stumps being most likely to die (Trupin et al. 2018).
- Short harvesting rotation compared to extractive timber: The current model for harvesting works on a 24-year cycle which is not long enough to regenerate 100 percent of the biomass in mature Miombo forests. It does however maximize biomass production in charcoal forest management units over successive harvests. To produce Miombo trees large enough to harvest for timber (dbh greater than 45 cm) requires an 80 to 120 year rotation, producing

trees large enough for charcoal harvesting 15cm dbh or larger) can be achieved in 15 years (Trupin et al. 2018). Charcoal production therefore offers a short term and interim benefit opportunity, especially when forests are marginal, and the benefits of extractive timber will only be derived in the long term.

- Charcoal harvesting is easy to monitor: Charcoal harvesting is relatively easy to monitor (Trupin et al. 2018).
- Harvesting in the absence of forest management and harvesting plans: Charcoal value chains are largely informal with production proceeding in the absence of sustainable harvesting plans. The informality of production, particularly in the absence of formalized and sustainable harvesting, has contributed to widespread forest degradation and to a lesser extent, deforestation particularly in the vicinity of concentrated markets and urban areas (Doggart and Meshack 2017)

2.11.1 Data availability

- More research is needed on tree regeneration (time and volumes) in miombo woodlands and how various forms of land ownerships influence miombo woodlands management. Greater consideration should also be given to the possibilities and preferability of establishing forest plantations for producing charcoal (Nyamoga and Solberg 2019).

2.12 Socioeconomic values

- Although there is a lack of explicit evidence of well-being benefits from community forest management, forests are known to provide energy for both rural and urban living Tanzanians. Forest also contributes significantly to domestic subsistence and consumption requirements, increasing disposable income for households and serving as a safety net against climate change, as well as directly contributing monetary benefits to households through trade.
- Most non timber forest products are collected, consumed and traded informally and often outside the cash economy meaning they are not adequately captured in national economy statistics resulting in insufficient recognition in national planning.
- Charcoal production and trade provides a livelihood to a great number of informal, family-based enterprises reducing poverty.
- VLFRs if managed purely for extractive timber enterprises or conservation they can prevent communities from accessing and utilizing the forestry resources in the reserves unless multiple land use units are allocated.
- Limiting access to forest resources increases village community vulnerability as climate change intensifies their reliance on non-timber forest products.
- VLFRs provide intangible benefits including interest, support and investment from outside organizations and provides villagers with a means by which to assert legal control over forest resources, providing strategic benefits. It provides a means to stop outsiders from harvesting their timber and are important to their claim for territorial autonomy and achieving greater control over forest access and exclusion which is highly valued. Community forest management holds self-correction potential for addressing social inequities that appear far better than those of top-down centralized systems.

2.13 Consumptive use of forest and non-forest products, hunting, fishing

- Forests provide 92% of Tanzania's energy and provide a livelihood from many rural people while also providing a dependable energy source for urban households (FOA 2015). Mutta et al. (2021) highlight that 90% of the annual wood harvest in Africa is used for energy, 20% of which is being made into charcoal.
- Non-timber forest products contribute toward the economic assets of rural households by providing domestic subsistence and consumption requirements, increasing disposable income for households and serving as a safety net against climate change, as well as directly contributing monetary benefits to households through trade (Balama 2016). Balama (2016) identified 12 non timber forest products households obtained from the Iyondo Forest Reserve in the Kilombero District in Tanzania, provided in Table 7.

Table 13. Non timber forest products obtained from the Iyondo Forest Reserve in Kilombero District in Tanzania (Balama 2016).

Products	Units	Mean annual quantity per household		Mean annual quantity per household	Unit value (TZS)	Mean annual value (TZS) per household
		Subsistence	Trade			
Firewood	Head load	115 (83)	328.3 (12)	443.3	2 000	886 600
Bush meat	Kgs	45.3 (36)	110 (38)	155.3	3 000	465 900
Wild mushroom	Kgs	68 (36)	224 (21)	292	1 000	292 000
Medicinal plants	Kgs	2.6 (36)	26.3 (2)	28.9	8 000	231 200
Honey	Litres	4.6 (10)	21.1 (22)	25.7	6 000	154 200
Poles	Pieces	27.3 (30)	52 (5)	79.3	1 000	79 300
Thatch grass	Head load	26 (45)	25 (28)	51	1 000	51 000
Ropes	Bundles	2 (23)	0	2	8 000	16 000
Wild vegetables	Kgs	28.65 (70)	0	28.65	500	14 325
Withies	Bundles	2.5 (25)	0	2.5	5 000	12 500
Wild fruits	Kgs	19.7 (51)	0	19.7	400	7 880
Tool handles	Pieces	3.7 (51)	10 (11)	4.7	1 000	4 700

Number in parenthesis is a proportion of respondents (%) of the households.
A unit of head load for firewood and thatch grass was equivalent to 16.55 ± 3.33 and 14.12 ± 3.19 Kg, respectively.

- Non extractive timber products from forests: Apart from providing charcoal wood and wood fuel woods forests are also a source of palm nuts, tannin extracts, bark, gums, resins, medicinal plants, aromatics, fruits, edible mushrooms, wild animals and fodder as forage for livestock (FOA 2015). Forests in Tanzania contribute 20% towards the subsistence economy (FOA 2015). Beekeeping in the forest is also an important subsector generating about US$ 19 million in 2015 (FOA 2015).
- Charcoal production provides a livelihood to a great number of informal, family-based enterprises having a positive effect on reducing poverty and supporting basic livelihoods. Although using Kenya as a case study Mutta et al. (2021) found that charcoal production reduces poverty with income being used for basic needs and to buy food, pay for children's education and the associated costs such as uniforms and books.
- There is evidence that community-based forestry management provides food security benefits in Tanzania. Charcoal plays an important role is food security, food production, processing, utilization and access to food through income generation, and by providing a reliable cooking energy providing well cooked, easily digestible food and thereby enhancing nutrient uptake (FAO 2020). The number of meals consumer per day increased in community-based forestry management areas between 2003 and 2012 (Pailler et al. 2015).

- Climate change bringing with its recurrent droughts, devastating floods, threatening biodiversity and impacting on the conventional livelihoods of households in Tanzania. It therefore also increases reliance on non-timber forest products for both subsistence and income (Balama 2016).
- Limited access to forest resources: VLFRs provides a livelihood to many, but if managed purely for extractive timber enterprises or conservation have been known to prevent communities from accessing and utilizing the forestry resources in the reserves. Planning for multiple forest use management units is advisable where some units are set aside for conservation, extractive timber and other consumptive and non-consumptive uses, including harvesting for charcoal.
- Lack of explicit well-being benefits from community-based forest management: In a study considering the impacts of community-based forest management in Tanzania Gross Camp (2017) found a lack of explicit well-being benefits with majority of households remaining in the same wealth rank category assigned them in 2005 to 2015, regardless of community-based forest management practices. Gross Camp (2017) however did find that despite the lack of explicit well-being benefits from community-based forest management water access was the one item reported as having improved in areas with community-based forest management.
- Informal trade: Most non timber forest products are collected, consumed and traded informally and often outside the cash economy meaning they are not adequately captured in national economy statistics resulting in insufficient recognition in national planning (Balama 2016).
- Agricultural land use demand is a threat to charcoal production as the opportunity costs of agriculture are high. Charcoal production can be seen to compete with agriculture for land, labor and net primary production (Doggart and Meshack 2017) and could lead to food shortages in the country. Furthermore, clearing forests for charcoal production exposes the soils to wind and water erosion degrading the soil structure and rendering the land infertile for arable crop farming (Eniola 2021).

2.14 Intangible values

- The formation of community forests in Kilwa brought substantial outside attention from both government and non-government organisations as well as funding. These interventions were perceived by village members to bring new value to the forest, as well as contribute to a village's ability to assert legal control over its resources, providing strategic benefits. It provides a means to stop outsiders from harvesting their timber and are important to their claim for territorial autonomy and achieving greater control over forest access and exclusion which was highly valued (Gross Camp et al. 2019; Gross Camp 2017). Community forest management holds self-correction potential for addressing social inequities that appear far better than those of top down centralised systems (Gross Camp et al. 2019).
- The involvement and investment from external institutions such as NGOs and government aid agencies such as Finland, Denmark and Norway in VLFRs could be viewed as an intangible benefit (Gross Camp 2017).

- Village leaders were seen to indirectly benefit from VLFR management and charcoal production by having access to meetings and training, receiving knowledge and enabling them to improve their income and quality of life (Cross Camp 2017).

2.15 Biodiversity and ecosystem services

- Experiences have indicated that community-based forestry can improve forest condition and wildlife populations through the sustainable management of forest resources. Through proper planning and allocation of forest management units in VLFRs forest systems can be conserved with minimal loss of resources to other land uses.
- Community forestry enterprises provide a promising model for unlocking economic benefits while supporting efforts to protect forest ecosystems and reduce carbon emissions in Tanzania.
- Forests are cleared and or degraded for charcoal production, leading to a loss of biodiversity, habitats and wildlife.
- There is evidence of declining deforestation rates under VLFR management even when charcoal production is one of the activities taking place in the reserve. The same cannot be said for VLFRs operating charcoal related enterprises close to urban centers and highways where the risks of overexploitation due to the close proximity of large markets remains.
- Unfortunately, charcoal production does result in the emission of greenhouse gases through deforestation and also carbon emission during the production process. However charcoal production is compatible with REDD+ where although the REDD+ payments for preventing deforestation would be reduced by 70 percent, earnings from sustainable charcoal production are competitive for villages at current REDD+ prices of less than $5/ton of CO2.
- When revenues are derived, and the value of forests acknowledge, greater stewardship of the ecosystems becomes a result. In some cases, revenues were put towards forest patrols and equipping village members for patrol activities as an example.
- Poor compliance and payments of fees and royalties means majority of producers do not contribute to the costs of forest management.

2.16 Species conservation

- Forests are being cleared and or degraded for charcoal production leading to a loss of biodiversity, habitats and wildlife. Experiences from Tanzania, Ghana, Kenya, Namibia and Guinea suggest that wildlife populations can increase with improved forest condition under community forest management, generating an important biodiversity benefit (Blomley 2013).
- If done unsustainably, charcoal production may cause degradation of forests (Mutta et al. 2021; Fitwangile (2017). Charcoal production is said to be responsible for 25% of closed woodland degradation and deforestation of 20% of closed woodlands and 51% of open woodlands to the west and north of Dar es Salaam, but systematic and sound data has not been able to clearly attribute forest degradation and or deforestation to concentrated charcoal production for urban markets many studies have however linked the two (FAO 2020). Doggard and Meschack (2017) indicating that deforestation occurring due to charcoal

in Tanzania is 33.16 percent undermining the delivery of other eco system services derived from forest such as erosion control, air quality and weather modification.

2.17 Conservation stewardship

- VLFRs in Tanzania have resulted in around 600 000 hectares of land being protected through the establishment of VLFRs and deforestation rates have dropped in a number of sites providing strong evidence for the link between community forest enterprises and conservation outcomes (Trupin et al. 2018). Rosa, Rentsch and Hopcraft (2018) found that there were fewer relative incidences of forest lost in areas with some form of protection or management status was in place, including VLFRs.
- Revenue sources derived from VLFRs contribute to sustainability of VLFRs as villages are encouraged to protect the community forests if benefits for doing so are gained. As of December 2017, 22 villages across the Kilosa, Mvormero and Morogoro rural districts who have adopted a TTCS sustainable charcoal model have put 109,540 hectares of forests into VLFRs of which 10 percent (10 895 hectares) has been put into forest management units that will be managed for charcoal productions (Turpin et al. 2018). A decline in deforestation has been observed since the introduction of the model. The TTCS model provides an example of how communities can, when provided with legal opportunities to sustainably manage and regulate harvesting for charcoal production, use this important source of energy as a means to improve local forest management (Trupin et al. 2018). Through proper planning and allocation of forest management units forest systems can be conserved with minimal loss of resources to other land uses.
- When revenues are derived, and the value of forests acknowledge greater stewardship of the ecosystems become a result. For example, villages under TTCS projects have set aside charcoal revenues to pay for forest patrols and equipping village members for patrol activities. A motorcycle was purchased so that rapid patrols can be undertaken (Trupin et al. 2018) resulting in reduced deforestation. However, these decreases in deforestation rates are not as significant near urban centers and highways within the TTCS projects.
- Community forestry enterprises provide a promising model for unlocking economic benefits while supporting efforts to protect forest ecosystems and reduce carbon emissions in Tanzania (Trupin et al. 2018).

2.18 Climate Change

- Charcoal production results in the emissions of greenhouse gases from the resultant deforestation and forest degradation (Doggart and Meshack 2017; Eniola 2021), especially near urban areas and major highways (Trupin et al. 2018).
- Charcoal production using kilns emit carbon dioxide contributing to climate change and indications are that production and use of fuelwood and charcoal contribute 2-7% of greenhouse gases (FAO 2020).
- Government action: The Tanzanian government prepared an Agricultural Climate Resilience Plan for 2014 – 2019, but its practical outcomes where not disclosed (Talvela & Mikkolainen 2019).

- REDD+ compatible: Establishing sustainable charcoal enterprises in VLFRs can stop forests from being converted to agriculture, and thus contributes to REDD+. However, any kind of harvesting reduces the long-term average carbon stock of a forest because while the trees may regrow, on average, there will be less biomass present during the re-growing period. Miombo forests are managed on a 24-year rotation, the biomass stock may never return to the original biomass, which means that the long-term average is reduced even further. Assuming linear growth, and that roughly 60 percent of the harvested biomass will regenerate over 24 years, the long-term average biomass will be 30 percent of the starting biomass. Thus, the potential REDD+ payments for preventing deforestation would be reduced by 70 percent. However, earnings from sustainable charcoal production are competitive for villages at current REDD+ prices of less than $5/ton of CO2 (Trupin et al. 2018).
- Changes in biodiversity distribution: Climate change affects crop and livestock production which will lead to both changes in distribution of the biodiversity components and in village demands on forest resources in VLFRs (MNRT 2019).
- Poor compliance and payment of fees and royalties: Most wood for charcoal production were harvested as a free good from forests, which means majority of producers do not contribute to the costs of protecting and managing the forests where wood for charcoal production is harvested (Ishengoma and Abdallah 2016).

Timber extraction [15]

October 2021

[15] One of 6 reports on the viability of community-based natural resource enterprises (baobab products; beekeeping; Carbon markets; charcoal production; wildlife credits) in Africa. Produced for WWF's Nature Pays program by CARMa-Afrika, Nelson Mandela University, South Africa. The authors are Christo Fabricius, Bianca Currie, Monicah Mbiba and Herbert Ntuli. Contact us at christo.fabricius@mandela.ac.za

1 Introduction to the initiative

WWF Tanzania has supported the establishment of over 25 Village Land Forest Reserves (VLFRs) in the Ruvuma Trans boundary Landscape which are at different stages of development as well as levels of benefits derived. Four villages in Tunduru and Kilwa Districts have harvested 160 m^3 of standing trees and 2,396 pieces of sawn timber generating US$ 80,806.4 in 2019, and seven other villages generated US$ 218,000 between July-December 2017. This shows potential for income generation with proper marketing strategies for certified timber.

Table 14. National context of Tanzania (http://hdr.undp.org/en/countries

Country:	Tanzania
HDI:	0.52
Rank: 163	163
Trend since 1990 (Positive / Neutral / Negative):	Positive
Total population (millions):	72.2
Per capita Gross National Income:	$2600
Multidimensional poverty %:	55.4
Inequality (Gini Coefficient):	40.5 (2017) World bank estimate
Employment %:	81.8
Internet users %:	25
Skilled labour force %:	5

- *Problem being addressed* – Deforestation
- *Locality* - Tanzania
- *Activities* – Establishment of VLFRs for the harvesting and processing of forest timber resources for domestic and export trade.
- *Intermediate outcomes* – Community land autonomy and forestry land use and management planning.
- *Ultimate impacts* –Community livelihoods, decentralized sustainable forest management and utilization of forest resources.
- *Value chain* – Harvesters - transport operators – sawmillers and manufacturers - wood traders and exporters.

Table 15. Value chain analysis of extractive timber enterprises in Village Land Forest Reserves in Tanzania

Value chain	Activities	Direct beneficiaries	Indirect beneficiaries	Supporters*	Outcome
Management / cultivation / conservation of the resource	Establishment of VLPRs and preparation of forest management plans	Village councils (land autonomy and protection) & Tanzanian government through the preparation of management plans and the protection of forest resources	Service providers (lawyers, accountants, consultants)	WWF MCDI Finland Govt MNRT	Decentralised management of forests. VLPR plans
Use / harvesting / extraction	Extracting timber from VLPRs	Govt. (Facilitation fees & transportation permit fees) Village councils (harvesting fees and royalties) Harvesting contractors	Transportation and service providers	District Forest Officers FSC	Harvested raw timber stock
Value added industries	Hand and mechanised sawmilling, wood treatment and product manufacturing	Manufacturers and processors (e.g. sawmills, furniture manufacturers)	Service providers (lawyers, mechanical services)	Finland Govt MNRT FORVAC MFP UNDP ESRF	Value added wood products Sawn timber, construction products, packaging products, electrical poles, furniture plywood, pulp & paper.
Sales	Domestic, regional (Kenya) and export (China, India) sales	Raw timber - Village councils (raw timber trade), Wood traders, exporters, Processed timber - furniture manufacturers, processors	Service providers	MNRT MFP UNDP ESRF	Trade and economic development
Benefits to households / individuals	Jobs with forest management (e.g. rangers) / timber extraction / value adding industries.	Jobs in forest management / harvesting & extraction (transportation) / value added industries	Management plans / protection natural resources / village council investments.	WWF MCDI Finland Govt.	Direct socio economic benefits (income, economic stimulation, community development
1. Benefits to the natural environment	Conservation outcomes / reduction in deforestation and carbon emissions / sustainable utilization	Sustainable utilization, increased biodiversity		WWF MCDI Finland Government MNRT	Sustainable development / utilization and conservation of natural resources.
Supporting organizations	NGOs & Govt agencies	Civil organisations NGOs Govt agencies	Govt sectors and agencies	Nat. Tanzanian Govt. District Govt	Sustainable forest management and utilization in Tanzania

* World Wide Fund for Nature (WWF); Mpingo Conservation and Development Initiative (MCDI), Ministry of Natural Resources and Tourism (MNRT); Forest Stewardship Council (FSC); Forestry Value Chains Development Programme (FORVAC); Ministry of Finance and Planning (MFP); United Nations Development Programme (UNDP); Economic and Social Research Foundation (ESRF).

Extractive Timber enterprises in Village Land Forest Reserves in Ruvuma, Tanzania

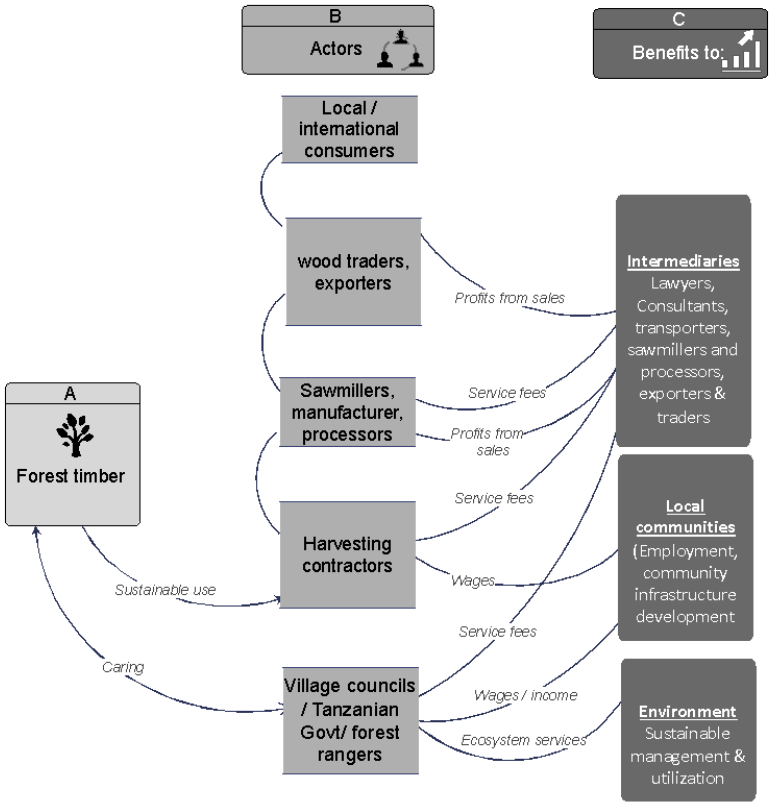


Figure 39. Diagram of the extractive timber value chain in Village Land Forest Reserves in Tanzania

2 Viability of timber extraction in Tanzania

2.1 Enabling Context

- There is a supportive legislation, policy and trade environment for community-based forest management in Tanzania. The communal tenure of village lands administered by village councils provides a legal environment for the development of community-based forest and woodland management. Village Land Forest Reserves (VLFRs) offers a mechanism which is easy to establish and which provides for flexible arrangements for benefit sharing.
- Although there is the legal framework for the rights to resources there is no secure land title and marginal land allocations, weak delivery of land rights and limited power transfers. The country ranks low on the worldwide rankings for governance and there are overlapping mandates, a weak regulatory framework and regulatory barriers resulting in a sector that is plagued by corruption and illegal utilization of forest resources.
- A broad lack of capacity and resources at all levels has resulted in weak community support from district governments and the bureaucratic and technical demands of sustainable forestry inhibit implementation and results in a lack of village surveys, mapping and land use plans for VLFRs. The lack of local capacity and government support has also resulted in elite capture of benefits and an overreliance on donor funding for complicated and expensive processes and external technical expertise required to produce the necessary documentation and plans for VLFR establishment.
- Although there is regular reporting to CITES there is an absence of information and monitoring, and no national assessment of forests. There is also little data on the status of village land tenure and documented sales of land by village councils resulting in poor land use planning and land disputes.

2.2 Enabling policy environment

- There is a supportive legislation and policy environment for community-based forest management in Tanzania. The communal tenure of village lands which are administered by village councils provides a legal environment for the development of community-based forest and woodland management (URT 2008).
- International obligations: On an international level the government of Tanzania has legally, and non-legally binding forest related international agreements and processes, including the Convention on Biological Diversity (CBD) the Ramsar Convention, the Convention on International Trade in Endangered Species of Fauna and Flora (CITES), the United Nations Convention to Combat Desertification (UNCCD), the United Nations Framework Convention on Climate Change (UNFCCC).
- Important national legislation: Relevant legislation, governing land tenure and use, environmental management and the community forest landscape include:
- **The Forest Act No. 14 of 2002** provides the legal framework for conservation and management of forest resources as well as regulations for trade in timber products. Under this Act, traders in wood products and harvesters are required to have a license and any transporter must possess a valid transit pass.

- **The Village Land Act, number 5 of 1999**, refers to governance and administration of village land.
- **The Local Government (District Authorities) Act, 1982** under section 118(2)(n) empowers the local government subject to the provisions of this Act or any other written law, to establish, preserve, maintain, improve and regulate the use of forests and forest produce. Section 142 of the same Act empowers the village council to plan and co-ordinate the activities of and render assistance and advice to the residents of the village engaged in agricultural, horticultural, forestry or other activity or industry.
- **The Land Act of 1999** provides for land tenure and the administration of land other than village land in Tanzania.
- **Land Use Planning Act No. 6 of 2007** makes provision with respect to the procedures and processes in accordance with which land use in a planning area or zone are prescribed, managed, monitored and evaluated.
- **Environmental Management Act of 2004** provides the legal and institutional framework for sustainable management of the environment and requires that timber logging and processing should be subject to conducting an environmental impact assessment.
- **International Promotion Act 1988** guides investment activities in Tanzania, to provide for more favorable conditions for investors.
- Policies and programs: On a national level forestry conservation and management is the responsibility of the **Ministry of Natural Resources and Tourism (MNRT)**. The MNRT established the **Tanzania Forest Service (TFS)** to oversee management and administration of the forestry sector. Furthermore, the **National Forestry Program Facility** was created in 2002 and is governed by a steering committee. The National Forest Program Facility is an instrument meant to implement the **National Forest Policy** which was approved by the Government in 1998 and which is under review, a **new 2008 draft** now exists. The notion of participatory forest management in Tanzania is provided for in the policy which takes cognizance of macroeconomic and other sectoral policies ranging from environmental conservation to sustainable development of the land based natural resources. The National Forest Policy promotes and provides for the establishment of **Village Land Forest Reserves** (VLFRs) and the management thereof.
- The Ruvuma Landscape is supported by several sectorial policies for forestry, land wildlife, agriculture, tourism, mineral, water and rural development, together with national and transboundary policies, actions and plans such as the **National Environmental Policy of 1997** which defines the environmental framework for the forest policy since forestry is a component of environment. The Ruvuma Region also benefits from and depends on the country's conducive investment and trade policies, political stability and well-prepared development frameworks based on the **National Development Vision 2025** (URT 2019).
- Enabling legislation: A supportive legislation and policy environment for community-based forest management in Tanzania exists. The communal tenure of village lands administered by village councils provides a legal environment for the development of community-based forest management and community benefit sharing.
- Regular reporting to CITES: Tanzania ratified CITES in 1979 and has been reporting regularly since 1892 (Lukumbuzya and Sianga, (2017)

- Flexible arrangements: VLFRs offer flexible arrangements that are quick to set up compared to wildlife management areas which are formally protected conservation areas and are widely used to protect corridors (Debonnet and Nindi 2017).
- Conducive liberalization polices: The economic liberalization policies in Tanzania provide a conducive environment for markets and trade in timber.
- Low worldwide governance rankings: Tanzania ranks 163 on the worldwide rankings for governance (http://hdr.undp.org/en/countries).
- Non-harmonized legal and policy framework: Logging on non-reserved village lands will continue without proper forest resources assessments and harvesting plans because the Land Act and Village Land Act are not harmonized. This is unsustainable and leads to further deforestation and degradation. Controversies and inconsistencies between the Land and Village Land Acts are cited to be among the challenges causing forest degradation, and therefore require harmonization. According to the Village Land Act, 'general land' includes all land that is not reserved land or village land, whilst the Land Act says 'general land' means all public land which is not reserved land or village land and includes unoccupied or unused village land (MNRT 2019).
- Overlapping mandates: The Tanzanian Forest Service (TFS) district forest officer and the villages on VLFR jurisdictions have overlapping mandates. The TFS is reported to be collecting forest royalties or issuing licenses to harvest trees from VLFRs (which is against the Forest Act of 2002). There are also conflicting intra-sector policies favoring forest conversion (Mwangi et al. 2018).
- Weak regulatory framework and regulatory barriers: The regulatory framework is generally weak in the east and southern African regions, which when combined with low accountability and capacity has led to poor law enforcement (Lukumbuzya and Sianga, (2017). Talvela and Mikkolainen (2019) also mentions slow bureaucratic procedures to process harvesting licenses. Effective law implementation is inhibited by a lack of financial support, technical and human capacity, stakeholder coordination, conflict resolution and grievance mechanisms (Mwangi et al. 2018). Regulatory barriers such as licensing requirements for communities to transport timber have been a major risk and constraint for community-based forestry enterprises, and without any positive incentives to reward good practice (Penderson 2017).
- Corruption and illegal utilization: Corruption and illegal logging are common. The contributing factors include weak law enforcement, high political interference and poor resource governance at all levels (MNRT 2019, Mwangi et al. 2018). Talvela and Mikkolainen (2019) also mention government's unwillingness and or inability to control illegal logging.
- Lack of government support: Community based forest management has not been widely promoted or seen as a national development priority by the Tanzanian government (Trupin et al. 2018). Despite being part of the forest policy, the concept of community-based forest management has not been fully embraced by national forest authorities. Local TFS managers see community-based forest management as a threat, reducing the royalties they can collect.
- Bureaucratic and technical demands of sustainable forest management inhibit progress, as it makes implementation costly for government officials and villages (Sungusia et al. 2020).
- Lack of budget: There is no allocated budget at a national or district level to support community-based forest management (Trupin et al. 2018).

2.2.1 Data availability

- Lack of a national assessment of forests: As per SADC protocols forestry state parties are required to undertake and regularly update a national assessment of forests, to establish and maintain a regional database on the status and trends, management and use of forest resources, to develop a market information system for the collection, organization and exchange of forest market and industrial information in conformity with the SADC Protocol on Trade. There is no evidence that Tanzania has yet done a national assessment (Lukumbuzya and Sianga 2017).

2.3 Rights to land or resources

- Since the colonial period until now all land in Tanzania is considered public land. The Village Land Act 1999 provides the legal framework for land rights recognizing customary tenure and empowers local village governments to manage village land. The Village Land Act provides for equal rights to access, use and control the land.
- Little data is provided on the status of village land tenure in the Ruvuma Province however the last published figures from 2003 to 2011 are provided in Figure 2.

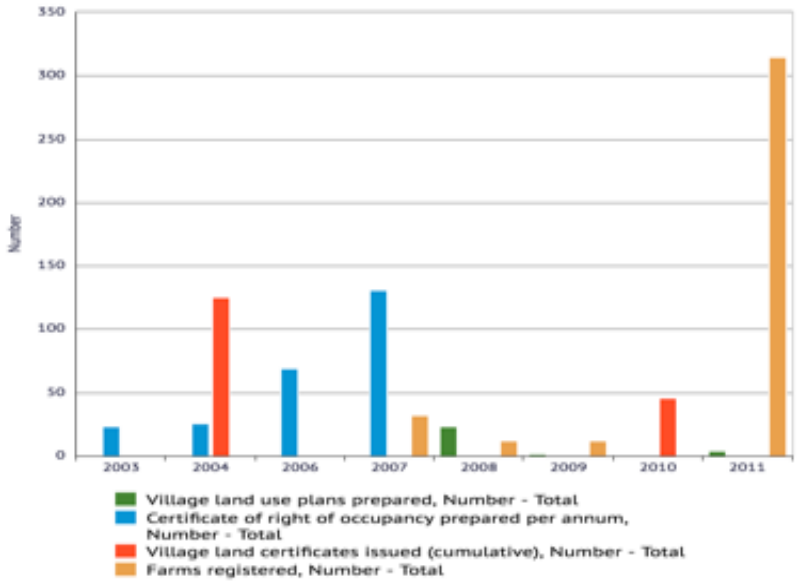


Figure 40. The status of village land tenure in the Ruvuma Province of Tanzania between 2003 and 2011(https://tanzania.opendataforafrica.org/TZSOCECD2016/social-economics-of-tanzania-2016?region=1000110-ruvuma-region&indicator=1001300-population-size-nu

Village Forest Reserves

- The Village Land Act of 1999 provides two mechanisms through which a village can establish areas for forest management. They can declare a woodland inside the village area as common land or provide for the ownership of all rights to be titled to a group in the community, or the community as a whole.
- VLFRs may also be established on general lands.

- VLFRs are forests owned by villages and managed by committees established under the village councils. Defined in the Tanzanian Forest Policy of 1998 a VLFR is "*a forest which is owned and managed by the village government. The village institutions will be granted appropriate user rights as incentives for sustainable forest management including rights to indigenous trees*". Three years after a VLFR is registered villagers may request the reserve be formally gazetted.
- Community forest reserves are found on village land and are similar to village land forest reserves, except that the village council delegates the management of the forest to a group of people within the community (e.g., timber operators). In such a case the "owner"/manager is not the whole village but a subgroup or sub village.
- In 2015, the Ruvuma region had a total of 1,283,870 ha of natural forest reserves, which is equivalent to 20 percent of the region's total land area of 6,476,400 ha (URT 2019). See a summary of the VLFR status in the FORVAC programme area in Table 3 and growth of the VLFRs supported by the MCDI during 2009-2017 in the Ruvuma region in Figure 3.

Table 16. Summary of the status of establishment and mobilization of Village Land Forest Reserves in the FORVAC programme area in Tanzania (MNRT 2019).

1	2	3	4	5	6	7	8	9
Cluster	District	No. of existing VLFRs	Total area of existing VLFRs (ha)	No. of new VLFRs to be established (villages)	Total number of villages with VLFRs + VLFRs to be established (No. 3 + 5)	Total area of selected villages for the FORVAC intervention, ha (VLFRs + additional VLFRs to be established)	LUP needed/new VLUPs to be developed	No. of VLFRs with timber harvesting commenced
Tanga	Handeni	2	14,169	3	5	19,462	3	
	Kilindi	2	1,072	3	5	4,410	4	
Lindi	Liwale	24	139,420	3	27	216,995	9	17
	Nachingwea	2	9,789	6	8	33,498	0	6
	Ruangwa	2	9,075	8	10	25,725	8	5
Ruvuma	Namtumbo	6	29,900	1	7	32,900	7	
	Songea	5	14,177	2	7	24,177	5	
	Mbinga	4	7,140	2	6	15,723	6	
	Nyasa	10	23,046	0	10	26,046	10	
Total		**57**	**247,789**	**28**	**85**	**398,938**	**52**	**28**
Anticipated increase in area of VLFRs during the life time of the programme (ha)						**151,149**		
Anticipated increase in area of VLFRs during the life time of the programme (%)						**61**		

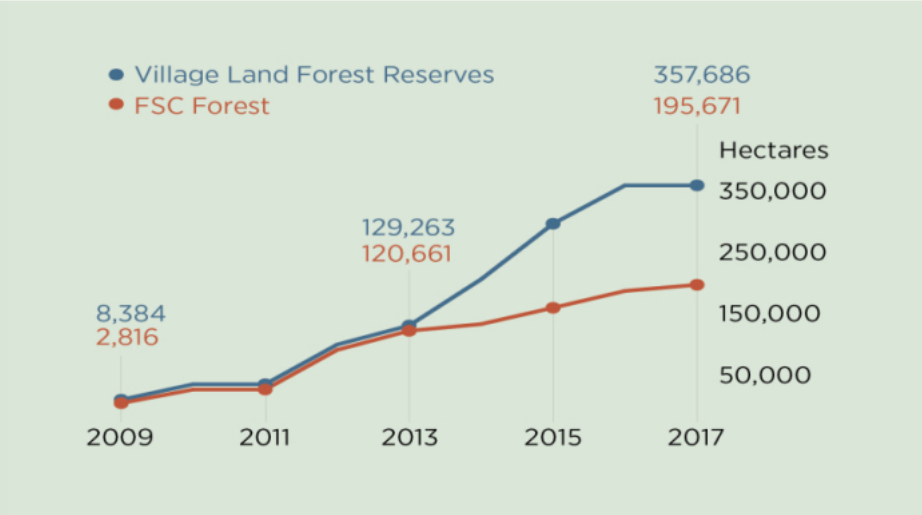


Figure 41. Growth of Village Land Forest Reserves supported by the MCDI between 2009 and 2017 in the Ruvuma region (Trupin et al. 2018)

- By law the VLFRs are managed for both production and protection purposes. Once the process of declaring is done villagers gain the right to harvest timber and forest products, collect and retain forest royalties. They may monitor resource use, make and enforce rules about harvesting and management as well as exclude others from having access. They may undertake patrols, arrest and sanction violators. They are exempt from regulations regarding the harvesting of reserved trees species and are not obliged to share their royalties with central or local government.
- Tenurial status: The tenurial status of the village is strengthened by the Land Act which allows the village membership to hold land as a cooperative; and by the Investment Promotion Act to put such land to work as part of a joint enterprise.
- *No secure title:* Although the Village Land Act and policy enables community-based forestry it does however remove the right of a village council to own the land, rather providing the council with a "manager" role as apposed an ownership role.
- Land disputes: Forest village land was primarily communally owned as communities only claimed customary right of occupancy over areas where they had historically established farms. However, villages are now selling land to private individuals and corporations from outside the villages. Many of these land purchases are of a speculative nature and therefore much of the land remains unused and still covered in forest. These sales have not been clearly documented making it difficult to know about them without visiting the specific area to determine if areas are claimed by multiple adjacent villages or outsiders and if any village boundary conflicts exist (Trupin et al. 2018).
- *Ease by which reserves can be established:* Given the current global demand for land, the ease by which village land can be appropriated is a concern.
- *Weak delivery of land rights*: Overlapping roles of the ministry of land and the prime minister's office, regional administration and local government, and weak governance in land administration pose major concerns in terms of delivering land rights in an efficient and

equitable manner (Land Links USAID (n.d.) https://land-links.org/country-profile/tanzania/).

- Lack of significant power transfer and elite capture: The transfer of power to communities remains slow, especially where high value resources are at stake. An additional risk might be unequal access to resources harvested from the VLFRs - particularly for women and marginalized groups. Are there typically provisions for revenue sharing to all community members?
- Government and their officials as well as private enterprises and local elites often co-opt the decision-making processes on the basis of professionalization claiming communities are unable to meet the requirements, and that certain expert skills to properly manage the forest are needed (Gross-Camp 2019; Mwangi et al. 2018). Furthermore, technically demanding land use plans are costly and when paid for by governments, private enterprises or local elites the capture of the assets and benefits are facilitated and used to justify the lack of meaningful management rights transfer to the communities (Sungusia et al. 2020; Gross Camp et al. 2019).

2.3.1 Data availability

- Little data is provided on the status of village land tenure in the Ruvuma Province with the last published figures only covering the period from 2003 to 2011 (provided in Figure 2.) Furthermore, the sales of land to speculators by villages is not clearly documented leaving room for land disputes.

2.4 Participation

- The Village Land Act provides for the establishment of institutions responsible for village land governance, such as the village council, the village assembly and the land adjudication committee, as well as the village land council, which is responsible for mediating land disputes. The registered village members elect the village council, which is an independent legal entity holding executive powers, which can sue and or be sued, and which acts on behalf of the village members. The village council is responsible for gaining agreement from the village community on village matters and define village land areas for an interim period or in perpetuity, as land held in common (communal land) or issued as private deeds to groups, clans, households, spouses and individuals. The village council can hold property and enter into contractual arrangements.
- Village lands require a village land use plan to obtain a certificates of village land. Village land use planning is supposed to be an inclusive and integrated participatory process in assessment and planning which enables communities to develop their own community action plans, by-laws and local institutions to oversee rural management.
- Forest management planning in VLFRs involves dividing the forest into overlapping management units for different forest uses (Trupin et al. 2018), but the exercise is expensive and requires expertise that villagers are lacking. This vulnerability leaves villagers susceptible to the interests of the powerful and often external actors (Cross Camp 2017).
- Supportive legislation: Legislation provides for decentralization of power to communities.
- Cautious community approach to establishment and expansion of VLFRs: Small community forests are perceived by community members to provide greater control over the land and

potential financial benefit through timber sales. However, communities perceive larger community forests as less desirable due to the decrease in available land and ability to use it for other activities especially agriculture (Gross-Camp et al. 2019). Communities were most concerned about land outside of the community forest where there is less restriction placed on collecting resources and expanding agriculture practices.

2.5 Strength of community institutions and structures

- Although the democratization of forest management is commendable, community forestry is strongly dependent on the capacity of communities to manage and govern the access and use of forest resources. Elected village governments often lack capacity to manage forest resources (Lukumbuzya and Sianga, (2017). Nzali and Kaswamila (2019) found that there was inadequate capacity building, passive community participation and involvement in VLFRs management.
- The bureaucratic challenges involved in establishing a VLFR are significant leaving local village governments limited in their ability to navigate the legal process of establishing a VLFR. Nzali and Kaswamila (2019) mentioned that no village has navigated the process without the assistance of external organizations.
- Lack of community capacity; Elected village governments may give customary authorities control over forests which exceeds the community capacity to manage it. Other consequences include local elites gaining control and using the resources for political or economic gain, or control may be given with limits on the rights of the village communities.
- Lack of capacity for improved governance advocacy: Civil society organizations capacity to advocate for improved governance is uneven through the east and southern Africa region, with most lacking long-term strategies and funding, and lacking the ability to organize at national and regional levels (Lukumbuzya and Sianga, (2017).
- Lack of village boundary surveys and village land use plans: There are only about 1,000 villages of a total of 10,500-11,000 who have had their village land area surveyed and a village land use plan put in place. The number of the villages adjacent to forests or natural woodlands is not known but is estimated to be in the region of 6,000-8,000. Even if the villagers know the traditional village boundaries, they often have no legal documents stipulating the boundaries, they have no statutory power to control invading pastoralists. In addition, the villages with land use plans have no resources to put plans into action (MNRT 2019).

2.5.1 Data availability

- Absence of information and monitoring data: In the absence of up-to-date basic forest monitoring information and high-resolution data, forest management plans and harvesting plans are either non-existent or severely lacking. The Green Advocates International (2014) concluded that even in cases were resource off take is monitored it is not evident that resource usage rates are optimal or efficient, and in some cases the sustainable levels of forest resource use in unknown and harvesting quotas are not adequately determined or based on actual inventories (Green Advocates International 2014) all of which compromises the sustainable utilization of the resource.

2.6 Period of time the community has been involved in the enterprise

- It was only in the late 1990s that Tanzania shifted away from more centralized control towards greater participatory forest management which was ratified in the 1998 Tanzanian forest Policy and embedded in in the National Forest Act of 2002 and its regulation in 2004. The first community-based forest management example was the Dura Hai Temba forest reserve which was converted to community ownership and management in 1990 and 1991 as a pilot project (Bwagalilo, Mwamfupe and Olwig 2019).

2.7 Viable business model

- There is an increasing demand for timber in both well-functioning domestic and export markets, accessible through the country's transport systems. The markets do however fluctuate, supply is dispersed and there is a projected wood deficit for Tanzania.
- There is a lack of capacity across the value chain, including processing capacity and a lack of value addition within an industry focused on raw materials. There is government support (MNRT) for value addition which presents an opportunity for development, however competing land uses especially mining and agricultural enterprises are at the same time being promoted. The forest education system requires curriculum reform to develop the necessary capacity for community-based forest management and there are potential education partners to work with.
- More practical training through forest extension, targeted at community members.
- There are tax exemptions and preferential trade agreements for enterprises to take advantage of, but the high costs of VLFR establishment and forest management, market distortions and inefficient collection of forest revenue limit the financial benefits derived from extractive timber enterprises. Corruption, unsustainable logging and illegal trade also compromises the financial viability of the enterprises. Furthermore, there is a lack of institutional arrangements to encourage investment together with a lack of government investment in the sector. There is also a conflict of government interest as both VLFRs and government are competing in the same space.
- The technical demands and cost of forest management and achieving Forestry Stewardship Council certification is a barrier for both government and VLFRs, inhibiting sustainable management of forest resources, and the uptake of forest certification in Tanzania. Furthermore, with the limited or marginal forest resources available in VLFRs and production capacity issues, VLFRs tend to supply low quality products which do not meet local construction, export or FSC standards, leaving VLFRs unable to take advantage of preferential trade agreements.
- There is a lack of adequate financial recording keeping, access to trade data and information, as well discrepancies in reported volumes and values of timber trade. Furthermore, there are limited models of success that are independent of donor funding inhibiting the assessment of the potential financial viability of extractive timber enterprises on VLFRs without donor support. The FORVAC programme implemented by the MNRT does however aim to generate value chain information for the sector.
- Despite the clearly established ecological benefits including lower deforestation rates, direct community benefit sharing potential through a diversity of arrangements has yet to be

demonstrated, with limited projects showing commercial returns. Benefit sharing conflicts and elite capture have also been reported.

2.8 Financial viability

- There is an estimated 48 million hectares of forest providing a wood volume of 3.3 billion m^3, 97 percent from trees of natural origin and 3 percent from plantation trees in Tanzania. Half of Tanzania's total wood volume is found in protected areas (Lukumbuzya and Sianga, 2017). Natural forest hardwoods hold an estimated annual worth of US$ 42 million and the prices for wood from Tanzania has been increasing when compared with other African countries (MNRT 2019).
- Based on current prices and rates of fixed and variable costs, timber sales would have to increase almost tenfold for communities to be economically viable and to become independent of external donations; however, some combination of increased timber sales, increased training and capacity, capped community payments, and added timber value could be successful in achieving economic viability. Increased sales seem to be the most direct approach, but is constrained by lack of demand at present, so marketing is needed (Frey et al. 2021).
- The largest forest management costs were related to community forestry establishment and maintenance, which may be driven by the cost of relying on external professional services (Sungusia et al. 2020; Frey et al. 2021), although these costs decreased over time. Other costs mentioned by Hagen (2014) include road maintenance, controlled burning, firebreak maintenance and other fire prevention costs, patrolling, nursery operations or purchase of seedlings for planting, direct seeding, audits, and communications. Furthermore, the cost of certification and regulations requiring outside experts are high. There are 14 Forestry Stewardship Council (FSC) certified community forests selling timber and providing community payments, but these operations depend on external financial support (Frey et al. 2021).
- According to WWF four villages in Tunduru and Kilwa Districts have harvested 160 m^3 of standing trees and 2,396 pieces of sawn timber generating US$ 80,806.4 in 2019, and seven other villages generated US$ 218,000 between July-December 2017.
- Documenting the true costs of establishing the activity and measure against the returns would enable better financial planning and enable prediction of true financially sustainability.
- Increasing demand: There appears to be a general shortage of timber in Kenya and Uganda which bodes well for Tanzanian timber processors (Ledger 2017).
- Generation of value chain information: The FORVAC programme initiated by the MNRT is intent on conducting a Market System Analysis including a socio-economic study for existing participatory forest management in the FORVAC districts. The study will contain a review of existing VLFRs, VLFR timber pricing, demand and supply and prices of forest products in domestic and international markets as well as mapping potential value chains (MNRT 2019).
- Tax exemptions: Community revenue from timber sales is exempt from taxes and levies from central government or District Councils.
- Preferential trade agreements: Tanzania is eligible for preferential trade under the United States African Growth and Opportunity Act and the European Union EBA (Everything But

Arms) initiative. This means that significant export markets will be available if the country can improve the quality and quantity of outputs produced by the forestry sector (Ledger 2017).

- Standards for FSC certified timber have been approved in 2018 (Forestry Stewardship Council 2017).
- *High costs of forest management:* Frey et al. (2021) found that community forestry was not economically viable, with forest management costs being 2.6 times more than forest revenues over a five-year period. However, revenues appeared to be increasing and costs decreasing over the same time bring the costs down to 1.5 times the revenue generated. High transport costs can be a significant challenge (Talvela & Mikkolainen 2019) and the cost associated to the formulation of technically demanding forest management plans often comes with a hefty price tag for expertise (Sungusia et al. 2020; Gross Camp et al. 2019).
- Limited financial benefits: At the community level, the overall paucity of financial benefits generated from most externally initiated community forestry initiatives in Africa (and Asia) is a clear challenge to financial sustainability of community forestry and limits the type and scope of management activities that community managers can undertake (Hagen 2014). Akida and Bromley (n.d.) state that despite the positive incentives provided under the law, villagers who have embarked on community-based forest management have not yet capitalized on the significant economic values within their forest reserves.
- Market distortions: The financial feasibility of selling timber from VLFRs is not materializing because it is cheaper for traders to buy timber from general lands due to the current measurement system discrepancy. Royalty rates are administratively set and distort the market price level, revenue collection and distribution which is asymmetric. Royalties and taxes do not reflect market prices but are administratively set and are high, hampering sawmills profitability. This encourages traders to buy timber from general lands in which case measured volumes are much lower and illegal timber is available. A norm of using governmental royalty rates in wood sales is further making VLFR wood more expensive limiting its demand in the market (MNRT 2019).
- Inefficient collection of forest revenue: Irregular collection of royalties has been observed, and cash strapped local government authorities may also have been willing to accept some illegal logging to generate revenues (Pederson 2017). Only 5-10 percent of revenue due from forest reserves and general lands is collected. Fines and penalties appear ineffective and controlling the issuance and monitoring of logging licenses at district level. Adherence to existing forest harvesting guidelines is also problematic (MNRT 2019).
- Need for business models and institutional arrangements: Investments in VLFRs has been slow to non-existent in Tanzania due to the lack of business models or institutional arrangements which can link the village councils and investors despite the availability of enabling donor grants for sustainable and investable projects, businesses and asset investments requiring a return on capital (MNRT 2019).
- *Poor or limited forest resources*: Community based forest management sites tend to be too small to have significant revenue from forest products. Benefit sharing among multiple communities can also reduce income benefits (Pailler et al. 2015). Akida and Bromley (n.d.) also highlight the poor state of the forest resources as an issue which indicated that marginal forest lands were being allocated to village forest reserves.

- *Limited government investment*: Community based forest management currently receives limited government investment and incentives (Pederson 2017).
- *Lack of value addition*: Currently the industry is focused on raw material with little attention on processing and value adding, or employment creation. The consequences of this is an industry reliance on harvesting of raw materials that are decreasing in availability instead of shifting to an industry that improves harvesting efficiency and value addition through processing, which also creates diversity of employment opportunities in the sector. This said the recently published Ruvuma Investment Guide published by the URT in 2019 promotes investment in value added industries so this risk may likely decrease over time and value additions presents as an opportunity.

2.8.1 Data availability

- Lack of independent community projects to learn from: The long-term commitment of donors has generally been an advantage, but it makes analysis of community forestry's sustainability without donor support difficult. Nzali and Kaswamila (2019) mentioned that no village has navigated the process of establishing a VLFR and undertaking land use planning without the assistance of external organizations.
- Lack of financial record keeping and documentation: The lack of financial record keeping and documentation of transactions compromises production efficiency and inhibits the development of sufficient collateral to obtain a bank loan.
- Lack of access to trade data and information: Currently communities do not have access to information about fair prices of products as traders and middlemen control the market. The royalties and taxes are determined based on administrative decisions and on incomplete or outdated information about market prices (MNRT 2019).

2.9 Market viability

- According to Lukumuzya and Sianga (2017) Tanzania exported 12779 cubic metres of timber, consumed 150 000 cubic meters locally and important 5074 cubic meters.
- Demand: The market demand is expected to continue being primarily driven by the construction, furniture and paper sectors as well as transmission poles, and the transport sectors using wood for pallets and boxes. The demand is expected to double in round wood equivalent between 2013 and 2035 as illustrated in Figure 4 (Held et al. 2017).

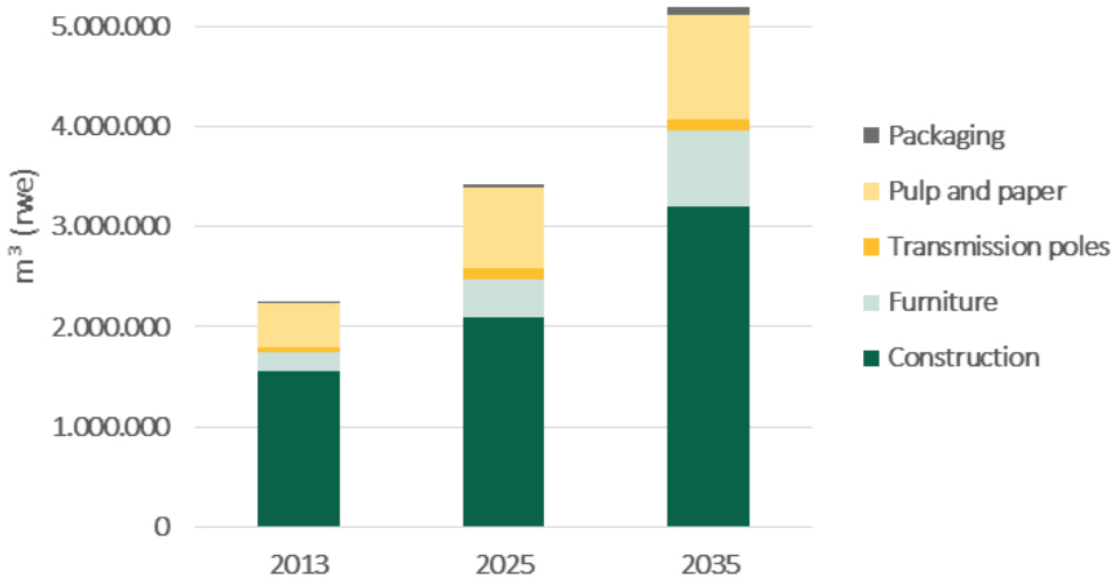


Figure 42. Projections of wood product demand in Tanzania by market segments (Held et al. 2017)

- Export: China is purported to be the main importer of timber from eastern and southern Africa (Lukumuzya and Sianga 2017). Kenya is also a significant importer of Tanzanian natural forest timber. Most of these imports are part of a transit trade that centers around the Port of Dar es Salaam (Lukumuzya and Sianga 2017).

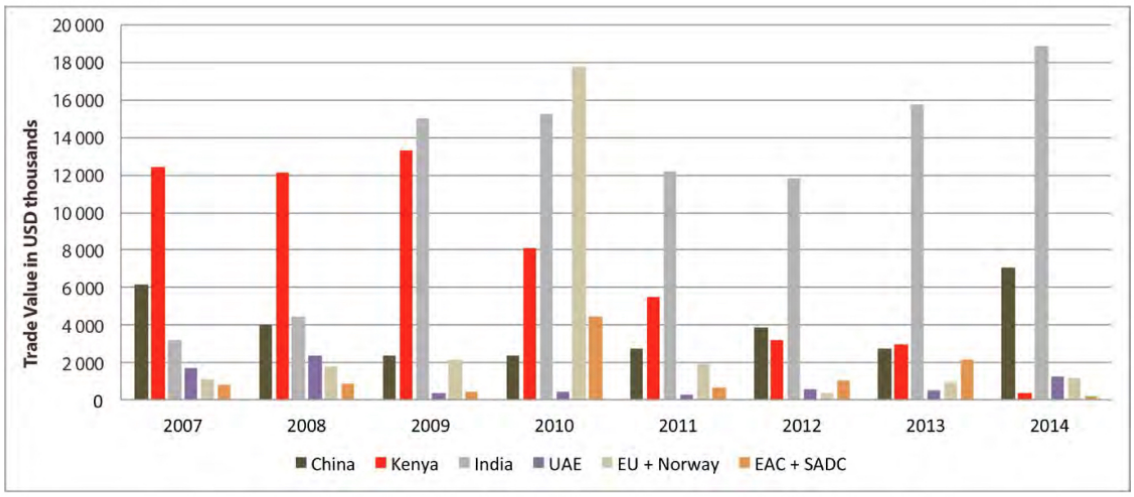


Figure 43. Destination and trade value of Tanzanian forestry product exports for the period of 2007 to 2014 (Lukumuzya and Sianga 2017)

- Domestic consumption: Lukumuzya and Sianga (2017) observed that there has been a shift from high quality timber to low quality hardwood and softwood species in the timber market since 2001, and that plank sizes of natural forest and woodland species, as well as softwood has decreased over time, indicating that the supply of softwood from plantations does not meet the demand. There is a high domestic market demand for planks and other wood products in Tanzania (Talvela & Mikkolainen 2019).

- Products: In an eastern and southern region assessment of the timber trade in Tanzania, Lukumuzya and Sianga (2017) found Tanzania to be a significant exporter of coniferous sawn timber and eucalyptus electricity poles in the region. The Tanzanian Government imposed a ban on the export of raw timber logs in order to promote value addition. This promoted saw wood exports which accounted for almost 80% of forest exports (US$ 33 million of US$ 42 million) between 2002 and 2014.

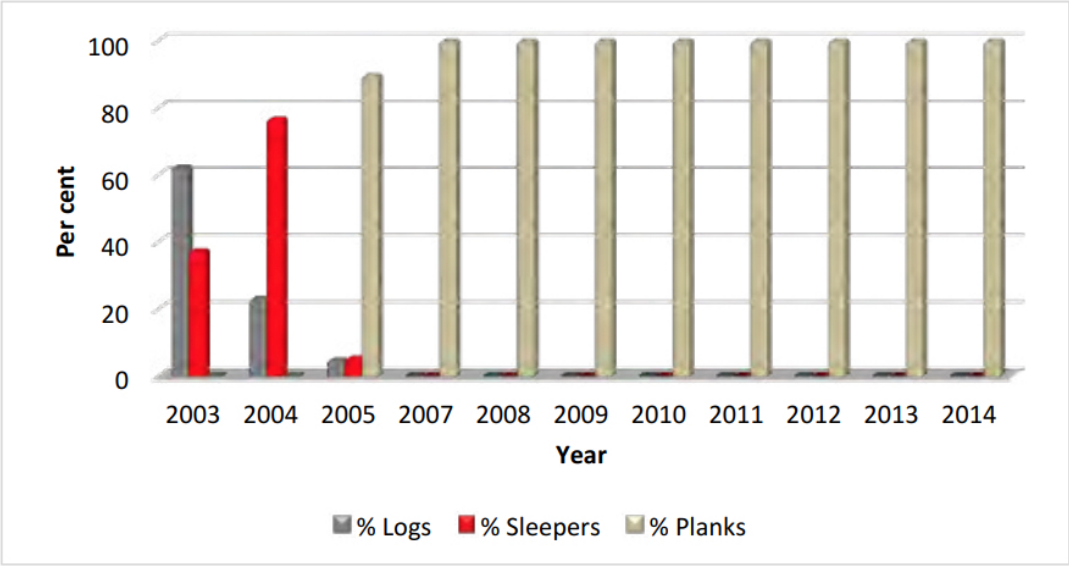


Figure 44. Relative share of different forest products by value exported by Tanzania during 2007 and 2014 (Lukumuzya and Sianga 2017)

- Main companies: Lukumuzya and Sianga (2017) found five main exporters of hardwood timber in Tanzania which account for 38% of export permits issued during 2012 and 2014.
- Tanzania signed an agreement in the XIV World Forest Congress to fight illegal trade in eastern and southern Africa. WWF, TRAFFIC and SADC are in support of the regional collaboration. Furthermore, Finland is supporting WWF, TFS and the Tanzanian Natural Resources Forum to promote sustainable forestry and action against illegal trade (MNRT 2019).
- Increasing demand: There is increasing global demand for timber emanating from western countries and China (Lukumbuzya and Sianga, 2017; Held et al. 2017).
- High potential for value added products: The Ruvuma Investment Guide (URT 2019) promotes the high potential for the Nyasa district council in Ruvuma to produce forest and timber products such as chipboards, plywood, fiberboards, furniture and poles. They also highlight forest plantations, sawmills and furniture making as an investment opportunity in the region. The URT promotion of timber related industries is backed by a government directive that none of the country's timber should be exported without processing to semi-finished goods, finished goods or secondary products from the raw materials (URT 2019).
- FORVAC programme: With funding from the Finland government (US$ 11.88 million / 9.95 Euro) the Ministry of Natural Resources of Tanzania (MNRT) initiated the "Forestry and Value Chains Development" (FORVAC) programme which is implemented by MNRT, the TFS and PO-RALG district authority. The project aims to increase economic, social and

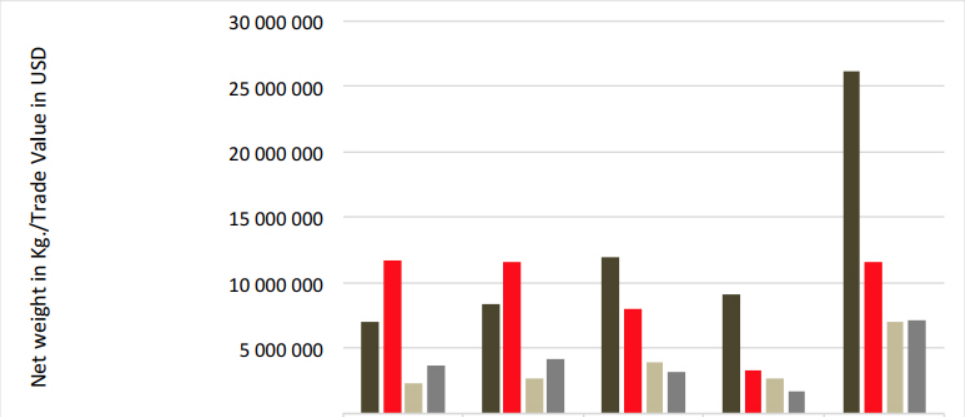
environmental benefits from forests and woodlands by improving value chains and increasing involvement of the private sector in forestry; improving stakeholder capacity to implement and promote forestry value chain development; supporting legal and policy frameworks for forest value chain and sustainable forest management development and functional extension, improve communication and monitoring and management information systems (MNRT 2019). The expected outcome of the programme is "improved forest sector value chains contributing to sustainable forestry and forest-based livelihoods" (MNRT 2019).

- Well-functioning wood trading markets: The wood trading markets function well and remain unimpacted by changes in the supply sources of wood in the region (van der Kolk 2017).
- *Promotion of competing land uses*: Although the URT (2019) Ruvuma Investment Guide promotes natural resource beneficiation including extractive timber, the government of Tanzania together with the various district councils in Ruvuma are promoting priority investment opportunities at a regional level which include large-scale commercial mining of coal, blue copper and gemstones and agricultural activities together with value adding industries such as cereals processing, grading and packaging; oilseed (sunflower, sesame, groundnuts) processing and packaging; soya bean, dairy, cashew and coffee farming and processing; livestock feeds processing and fruit and vegetable processing and packaging (URT 2019).
- Supply and demand gap: The increased scarcity being driven by unsustainable harvesting is observed in the decrease in the size of planks for sale at local markets in Tanzania. Schaffsma et al. (2013) observed a downward trend in plank size, especially for hardwood species, so that more planks could be harvested from a single tree, and immature trees could also be harvested from 2009 to 2011. During the same timeframe the price increased by 36%, significantly above the rate of inflation (Burgess et al. 2017). A forecast supply volume for planted timber was estimated at 3.2. million m^3 in 2035 and if compared to the demand forecast a deficit of 3 million m^3 is observed mainly by large diameter sawlogs, veneer production, wood fiber for pulp and fiber boards (Held et al. 2017).
- Corruption and Illegal trade: There are high levels of corruption at all levels of society (MNRT 2019) and Illegal timber trade results in millions of lost dollars. Some of the imports are shipped in dhows from informal ports on Tanzania's Indian Ocean coast to Zanzibar where trade is largely illegal and is difficult to investigate (Lukumuzya and Sianga 2017).
- Conflict of interest: There is no centrally stored data records on VLFRs or joint forest management agreements inclusive of forest management and harvesting plans. There is also a conflict of interest as TFS competes in the timber market and with the wood coming from VLFRs (MNRT 2019).
- Dispersed supply: Harvesting of timber is highly fragmented and dominated by small independent actors (Held et al. 2017). For example, the Kilwa District records show that the district forest officer received 179 applications from 125 traders to harvest 44 000 m^3 of natural forest wood primarily from individuals who applied under their own names and not through registered companies (Lukumbuzya and Sianga, 2017).
- Processing constraints: Majority of sawn timber processors are small entrepreneurs operating mobile sawmills with low recovery rates (20-35%) and producing low quality timber. However, these mobile sawmills are the only actors able to access dispersed woodlots of poor quality and limited volume (Held et al. 2017).

- Limited forest certification & low-quality products: Forest certification in Tanzania is not widespread and is confined mainly to the Mpingo Conservation and Development Initiative (MCDI) community managed natural forests (Lukumuzya and Sianga 2017). The market for FSC timber is small in Tanzania and customers are scarce. There is a good market for FSC timber in countries such as the USA, Europe and Japan, but these countries demand high quality product that is not available from VLFRs. Construction companies have tried to source FSC timber through VLFRs, but the quality of product was too inferior to accept (MNRT 2019). The quality of current supply often does not meet market expectations especially in the transmission pole market and construction sectors. This coupled with a lack of compliance with regulations and standards compromises community forest enterprises (Held et al. 2017).

2.9.1 Data availability

- Lack of data and information: Sound analysis of trends in forest trade depend on the availability of relevant data, which in the Eastern and Southern African region are often not in the public record and difficult to obtain, and some types of data may not even be recorded. Moreover, the usefulness and reliability of these data are limited by the unreliability of export data from the customs departments in the region (Lukumbuzya and Sianga, 2017). MNRT (2019) also report on the limited data available for forest markets, product prices, trade and industry.
- Discrepancies in volume and values of timber trade: There are discrepancies in volume and values which can include but are not limited to illegality, especially between Tanzania and China. Additional studies and analysis are required to understand the reasons for the discrepancies in volume and values.



	2 010	2 011	2 012	2 013	2 014
Reported By Tanzania Netweight Kg	6 964 476	8 400 166	11 897 244	9 069 940	26 178 511
Reported by China Netweight Kg	11 713 702	11 633 578	8 044 726	3 262 430	11 568 833
Reported by Tanzania Trade Value USD	2 336 597	2 705 071	3 861 968	2 719 373	7 026 709
Reported by China Trade Vaue USD	3 682 190	4 127 887	3 126 743	1 651 109	7 150 625

Figure 45. Trade value and net weight of forest products exported by Tanzania to China, as reported by the two countries for the period 2010 to 2014 Lukumbuzya and Sianga, 2017)

- Attempts have been made to establish a national monitoring system but so far, they have not been completed (MNRT 2019).

- Fluctuating market demand: Market demand can fluctuate drastically (e.g., failure in India to produce pulses) (Talvela & Mikkolainen 2019).

2.10 Operational viability

- Production: The wood-based forest industry in Tanzania is dominated by sawmilling, furniture and other processed wood products. A high efficiency sawmill in Sautimoja is being used to produce FSC certified sawn timber for the Grumeti Reserves Eco-lodge valued at approximately. US$ 33,000), of which 80% has been paid to the village already and 20% will be paid upon delivery. Furthermore, the mobile sawmill has created employment for 76 village members (24 women and 52 men) (WWF 2020).
- Infrastructure: The transport systems in Ruvuma include surface, water and air transportation. The Ruvuma region is strategically located within the Mtwara Economic Growth Corridor that links the Indian Ocean port of Mtwara with the Southern Highland regions, as well as with the neighboring countries of Mozambique and Malawi (URT 2019). The corridor project aims to provide road, rail and waterway access from the surrounding region to the Port of Mtwara. A road and rail link are to be built from the port of Mtwara to Mbamba Bay on Lake Nyasa to link Malawi to the corridor and further road links into Mozambique will facilitate access to northern Mozambique (Development corridors Partnership 2019).
- The Tanzanian government has invested in water-borne transportation systems by rehabilitating ports and buying new and larger vessels for transporting passengers and cargo. There are several roads linking to important ports in the region. A northern timber route links Tanzania by road through the border crossing at Mutukula on the Ugandan border, and at Kigoma Port, and a southern trade route centers around the Port of Dar es Salaam (Lukumuzya and Sianga 2017). A number of major road infrastructures are currently being upgraded including secondary and tertiary roads. Some of these road networks are linked to the planned Mtwara, Nacala and Pemba-Lichinga Development Corridors, which are planned to service mining explorations and will result in better accessibility and connectivity between major towns and villages. The Tanzanian government also has plans to build stable bridges to link the Ruvuma Region with the neighboring country of Mozambique.
- Skills: Capacity development and skills training are needed at a national, regional and local level for all activities across the value chain. This need includes community members, professional capacity for the FBD, TFS, district participatory Forest management teams and extension services, village natural resource committees and even service providers (MNRT 2019). Skills such as forest management, wood selling and pricing, measurements, forest harvesting, logistics, processing (saw milling, carpentry), marketing and selling of products is required (MNRT 20019). Family level companies suffer from a lack of access to technical advice.
- High staff turnover is also a constraint (Talvera & Mikkolainen 2019).
- Currently harvesting and processing technologies are poor resulting in low quality products, and large parts of the trees remain unused (Talvera & Mikkolainen 2019).
- Human resource capacity development: The FORVAC programme will be developing a capacity development program focusing on capacities of communities to implement

community-based forest management (MNRT 2019). Recently, the Sokoine University of Agriculture (SUA) has established a tourism related training program in Nyasa, Wildlife Management training program in Tunduru and Forestry/Bee-Keeping program in Madaba.

- Potential training partnerships: There are several training institutions that can partner in delivering forestry training. These institutions include the Forestry Training institute, the Forest Industry Training Institute, the Forestry and Wood Industries Training Centre and the Vocational Education Training Authority and the UONGOZI institute. The Private Forestry Program has commenced development of a VETA level training program for the Tree Growers Associations, TGAs, small and medium enterprises for forestry, forest harvesting, and small scale saw milling in collaboration with the Forestry Training Institute and the Vocational Education Training Authority. The training program will provide training for forest users and managers in VLFRs and other reserves (MNRT 2019).
- Limitations of forestry education: Although there are numerous entities providing forestry education in Tanzania the sector emphasizes scientific forestry as the approach to managing all types of forests and does not include insights from social sciences and humanities in order to understand participatory and community-based forest management and complex socio-ecologies (Sungusia et al. 2020).
- Lack of capacity: There is a lack of capacity across the board. For example, forest management plans require technical skills to carry them out and district officers to provide services and support to the communities on a sustainable basis (Talvela & Mikkolainen 2019). The heavy reliance on technical forestry and expertise which emphasize modelling, technical planning and rotational forestry are challenging for local managers to provide and seem out of sync with local realities on the ground. It makes community-based forestry too costly to implement for most communities (Sungusia et al. 2020). Buyers prefer sawn timber instead of logs and the market is able to absorb them, but villages lack the capacity to respond to the demand (Talvela & Mikkolainen 2019). There is also a lack of business service providers like insurance companies, lawyers and transportation services, and an insufficient focus on customer satisfaction (Talvela & Mikkolainen 2019).

2.10.1 Data availability

- Harvesting and processing in the regions is largely unregulated and fragmented, which greatly challenges sustainability. Despite existing policies, laws, and international protocols, most forestry departments in the east and southern region do not routinely monitor the industry. Records of the number and types of enterprises, the levels of employment, species used, the volume of raw materials consumed and converted, exported or imported, and the revenue turnover and taxes paid by forestry companies are largely unavailable (Lukumuzya and Sianga 2017).

2.11 Benefit sharing potential

- The community benefits from Participatory Forest Management value chains are low. So far, financial benefits from Joint Forest Management have been minimal and successes few. As a result, communities are not necessarily eager to participate in community forestry unless they get their fair share of the value addition from forests to market (MNRT 2019). Benefits delivery can also be delayed if the VLFR is small and degraded (MNRT 2019).

- There have been a few community based forest management arrangements that have successfully managed to generate financial benefits to communities, however, majority of them have not yet been able to deliver due to poor commercialization of forest products available in their forest (MNRT 2019). In 2017 the 18 village forest reserves (350 000 hectares) supported by the MCDI in Ruvuma generated US$ 626 000 through timber sales. The village assemblies (made up of the adults in each village), for each MCDI supported village in Ruvuma are empowered to decide on how the benefits are distributed (International Institute for Environment and Development (IIED) 2019 and Pederson 2017).
- Khatun et al. (2015) investigated benefit sharing in VLFRs in the Kilwa District in Tanzania. The VLFRs management plans determined the proportions of VLFR revenues spent on forest management costs or village development activities, and the percentage (~ 5%) going to the district authority. Villagers were generally aware of and agreed with the distributions of revenue. On average, villages were spending approximately 50% of timber revenues on process activities and 50% on outcome-oriented activities. See the total income and expenditure for timber sales revenues and their distribution in Table 4.

Table 17. Total income and expenditure for timber sales revenues in TSH in VLFRs in Kilwa District (Khatun et al. 2015)

Village	Total income	Total expenditure	Process spend	Outcome spend	Process spend (%)	Outcome spend (%)	Outcomes widely beneficial	Outcomes widely beneficial (%)
Kikole	6 695 200	4 377 300	2 544 700	1 832 600	58.1	41.9	882 200	48.1
Kisangi	9 614 800	3 963 140	2 585 400	1 377 740	65.2	34.8	1 377 740	100.0
Liwiti	5 113 800	4 142 500	1 870 000	2 272 500	45.1	54.9	2 201 000	96.9
Nainokwe	14 232 000	11 459 488	4 414 600	7 044 888	38.5	61.5	7 044 888	100.0
Average (%)					51.7	48.2		86.2

- Diversity of benefit sharing arrangements: There are also a variety of benefit sharing arrangements which Jacob and Brockington (2017) identified in the Ayasanda and Riroda areas in Tanzania (provided in Figure 8). Access to non-timber forest products through free access, free permits and paid permits to the village government. Some arrangements involved providing financial benefits to special groups (e.g., orphans or disabled children) and or using the benefits for social services in the village (Jacob and Brockington 2017).

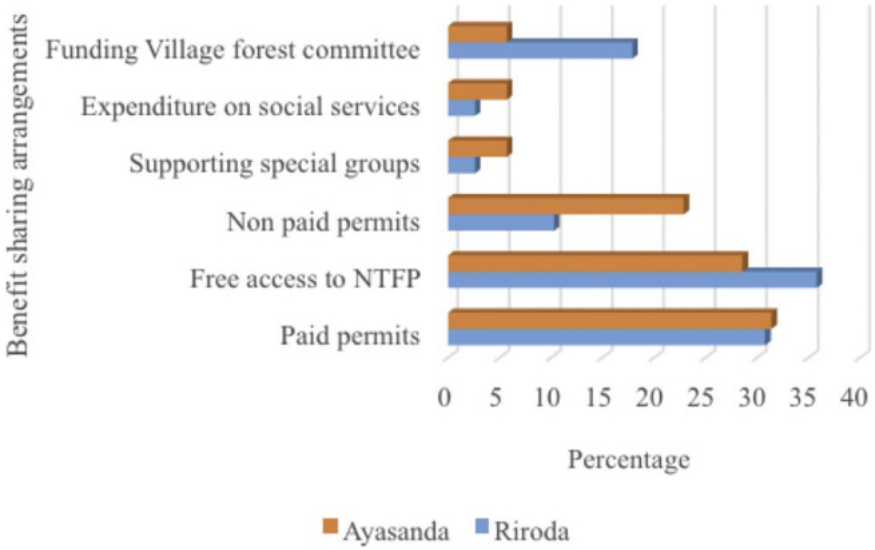


Figure 46. Benefit sharing arrangement in Riroda and Ayasanda (Tanzania) for community based forest management (Jacob and Brockington 2020)

- Benefit sharing conflicts. Community forests give rise to a series of intra and inter community conflicts, often pertaining to the financial benefits stemming from the forest (distribution issues), perceived unfairness and weakness in decision making processes (procedure/participation), and also tensions over cultural identity issues (recognition) Gross-Camp et al. 2019). Talvela and Mikkolainen (2019) also highlight border conflicts.
- *Elite capture of benefits:* If the benefits sharing from community forestry is not well managed elite groups can be found taking advantage and reaping the benefits, which can result in indifference towards the forest by the majority. Sungusia and Lund (2016) suggest that predominantly wealthy household village leaders are benefiting from community-based forest management initiatives (Gross-Camp 2017).

2.12 Ecological viability

- The total wood volume of Tanzania mainland is 3.3 billion m3, with 97 percent of the total volume from trees of natural origin, only 3 percent is from planted trees. About half the total volume is found in protected forests and wildlife-protected areas and therefore legally inaccessible for harvesting. The estimated annual consumption of wood is 62.3 million m^3, which exceeds the annual allowable cut of 42.8 million m^3. Therefore, the current supply of wood cannot meet current demands. The annual deficit is met by overharvesting and illegal harvesting in protected forests (FAO 2015). A wood supply and demand analysis based on 2015 NAFORMA data shows that forest harvesting exceeds the annual allowable cut by 19.5 million m^3, which will lead to widespread degradation of the forests due to illegal overharvesting and logging. The FOA (2015) showed the projected wood deficit in Tanzania by 2030 in Figure 9.

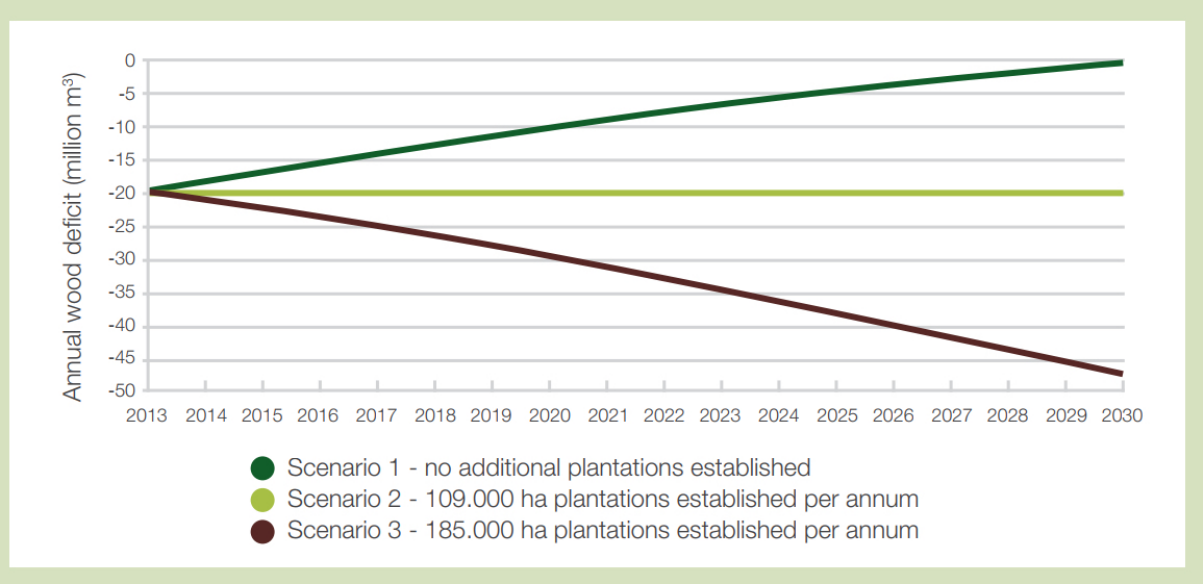


Figure 47. Project wood deficit (2014 - 2030) in mainland Tanzania (FOA 2015)

- The National Forest Resources Monitoring and Assessment (NAFORMA) estimated the deforestation rate at 370 000 ha/year for the last 10 years and more recently 469 420 hectares per annum by MNRT (2019). The report "Tanzania's Forest Reference Emission Level Submission UNFCC" estimated deforestation at 582 427 hectares a year between 2002 to 2013 (MNRT 2019)
- Forest area per capita has decreased from three ha/capita in the early 1980s to 1.1ha/capita (using the 2012 population census data), with a lower average growing stock in natural forests of 125 m^3/ha and in mangroves 48.8 m^3/ha compared to earlier estimates by the FAO of 185 m^3 /ha and 120 m^3/ha respectively. This results possibly reflects a combined effect of forest loss, human population increase, and previous overestimations of forest cover (Lukumuzya and Sianga 2017)
- Well established ecological benefits: The ecological contributions of community forestry are relatively well established and recognized as having similar or lower deforestation rates to that of state managed areas (Gross-Camp et al. 2019).
- Growing energy needs: The main drivers of forest degradation are the growing energy needs of an expanding population coupled with subsistence agricultural expansion. Demand for wood energy is rapidly increasing due to rapid population increases and continuing dependency of forest biomass as the national energy source (at almost 90%). Particularly unsustainable charcoal burning has left many government forest reserves deforested or badly degraded (MNRT 2019).
- The most sever threat to forests is agricultural land use.
- *Marginal land allocations:* The National Forestry Policy (1998) clearly indicates the government priority to bring unreserved forests, such as those found in village lands, under the jurisdiction of local communities, but some of these lands devolve rights to small low value, degraded forests to communities, which means that the delivery of benefits is delayed far into the future (MNRT 2019).

2.12.1 Data availability

- There is limited data available on forest resources apart from the forest resource assessment NAFORMA (MNRT 2019).

2.13 Socioeconomic values

- Conversion of community land to VLFRs can deprive communities of the consumption value of forests and limits access to non-timber forest products. This resulted in limited support for VLFR expansion.
- Non-timber forest products contribute significantly toward the economic assets of rural households by providing domestic subsistence and consumption requirements, increasing disposable income for households and serving as a safety net against climate change, as well as directly contributing monetary benefits to households through trade. Unfortunately, most non timber forest products are collected, consumed and traded informally and often outside of the cash economy, meaning the trade is not captured in national economy statistics and insufficiently recognized in national planning.
- There is evidence of food security benefits being derived from community forestry and communities do acknowledge the intangible strategic benefit of land autonomy and security VLFRs offer, as well as the self-correction potential for addressing social inequalities. The involvement and investment from external institutions are also considered a benefit.
- The social outcomes however seem less promising and are falling short of expectation where VLFRs are struggling to generate revenues and the benefit of local autonomy is rarely realized in practice.
- Reasons for the lack of social outcomes includes techno bureaucratic framing limiting autonomy and facilitating elite capture, forest officers holding the decision-making powers, marginalization of local forest knowledge, non-implementation (land use planning, inventories) and progress restricted to donor funded projects.
- Community reservation of VLFR establishment and expansion is due to a growing demand for energy, predominantly obtained from wood fuels and charcoal, as well as the agricultural opportunity costs were land for agricultural expansion is important. Communities are cautious of the benefits, costs and dimensions of environmental justice (distribution, future generations, procedural, recognition and identity), and are equally concerned about increased exposure to wildlife conflict the closer the forest reserve are to agricultural practices.

2.14 Consumptive use of forest and non-forest products, hunting, fishing

- Socio-economic sustainability of extractive timber enterprises depends on the balance of benefits and costs as perceived by communities. Gross-Camp et al. (2019) explored community experiences with community forestry and the benefits and costs VLFR formation may place on a community. Gross-Camp et al. (2019) found that communities are cautious of the establishment or expansion of community forests because of the benefits, costs and dimensions of environmental justice (distribution, future generations, procedural, recognition, identity) and decision making. The concerns were however superseded by the

benefits which included greater land autonomy and rights to the land on condition that some open forests for communities to access are made available (Gross-Camp et al. 2019).

- Community forest status can reduce access to forest resources depriving communities of the consumption value of forest and non-timber forest products (Gross-Camp et al. 2019). Community members were most concerned about the opportunity costs of agricultural and the increased exposure to crop raiding wild animals. Community individuals did however acknowledge that the proximity to a forest, managed or not, would increase exposure to crop raiding (Gross-Camp et al. 2019).
- Non-timber forest products contribute toward the economic assets of rural households by providing domestic subsistence and consumption requirements, increasing disposable income for households and serving as a safety net against climate change, as well as directly contributing monetary benefits to households through trade (Balama 2016). Balama (2016) identified 12 non timber forest products households obtained from the Iyondo Forest Reserve in the Kilombero District in Tanzania, provided in Table 5.

Table 18. Non timber forest products obtained from the Iyondo Forest Reserve in Kilombero District in Tanzania (Balama 2016).

Products	Units	Mean annual quantity per household		Mean annual quantity per household	Unit value (TZS)	Mean annual value (TZS) per household
		Subsistence	Trade			
Firewood	Head load	115 (83)	328.3 (12)	443.3	2 000	886 600
Bush meat	Kgs	45.3 (36)	110 (38)	155.3	3 000	465 900
Wild mushroom	Kgs	68 (36)	224 (21)	292	1 000	292 000
Medicinal plants	Kgs	2.6 (36)	26.3 (2)	28.9	8 000	231 200
Honey	Litres	4.6 (10)	21.1 (22)	25.7	6 000	154 200
Poles	Pieces	27.3 (30)	52 (5)	79.3	1 000	79 300
Thatch grass	Head load	26 (45)	25 (28)	51	1 000	51 000
Ropes	Bundles	2 (23)	0	2	8 000	16 000
Wild vegetables	Kgs	28.65 (70)	0	28.65	500	14 325
Withies	Bundles	2.5 (25)	0	2.5	5 000	12 500
Wild fruits	Kgs	19.7 (51)	0	19.7	400	7 880
Tool handles	Pieces	3.7 (51)	10 (11)	4.7	1 000	4 700

Number in parenthesis is a proportion of respondents (%) of the households.
A unit of head load for firewood and thatch grass was equivalent to 16.55 ± 3.33 and 14.12 ± 3.19 Kg, respectively.

- Forests are also a source of palm nuts, tannin extracts, bark, gums, resins, medicinal plants, aromatics, fruits, edible mushrooms, wild animals and fodder as forage for livestock (FOA 2015). Forests in Tanzania contribute 20% towards the subsistence economy (FOA 2015). Beekeeping in the forest is also an important subsector generating about US$ 19 million in 2015 (FOA 2015).
- There is evidence that community-based forestry management provides food security benefits in Tanzania. The number of meals consumer per day increased in community-based forest management areas between 2003 and 2012 (Pailler et al. 2015).
- Although community-based forest management outcomes support sustainable forest management, the social outcomes seem less promising and falling short of expectation. The VLFRs are struggling to generate revenues and the benefit of local autonomy is rarely realized in practice (Sungusia et al. 2020). A summary of reasons for the lack of social

outcomes includes techno bureaucratic framing limiting autonomy and facilitating elite capture, forest officers holding the decision-making powers, marginalization of local forest knowledge, non-implementation (land use planning, inventories), and where progress is restricted to donor funded project (Sungusia et al. 2020).

- Kalonga et al. (2015) found that FSC certified forests provided more economic benefits to communities compared to non FSC forest.
- Communities lack full incentives to support the management of forests. Key limitations to full incentivization include limited ownership, inadequate investments, weak governance at national and local levels and lack of business capacity to access reliable markets. The weak incentives trigger rural populations to opt for small scale agriculture, charcoal production and use of fire to clear lands for agriculture (Lukumbuzya and Sianga, 2017)
- Climate change bringing with its recurrent droughts, devastating floods, threatening biodiversity and impacting on the conventional livelihoods of households in Tanzania. It therefore also increases reliance on non-timber forest products for both subsistence and income (Balama 2016).
- Limited access to forest resources: VLFRs provide a livelihood to many, but if managed purely for extractive timber enterprises or conservation have been known to prevent communities from accessing and utilizing the forestry resources in the reserves. Planning for multiple forest use management units is advisable where some units are set aside for conservation, extractive timber and other consumptive and non-consumptive uses.
- Lack of explicit well-being benefits from community-based forest management: In a study considering the impacts of community-based forest management in Tanzania Gross Camp (2017) found a lack of explicit well-being benefits with majority of households remaining in the same wealth rank category assigned them in 2005 to 2015, regardless of community-based forest management practices. Gross Camp (2017) however did find that despite the lack of explicit well-being benefits from community-based forest management water access was the one item reported as having improved in areas with community-based forest management.
- Informal trade: Most non timber forest products are collected, consumed and traded informally and often outside the cash economy meaning they are not adequately captured in national economy statistics resulting in insufficient recognition in national planning (Balama 2016).
- Lack of scalability: Communities don't view the benefits of community forestry as scalable because of the associated costs. For example, whilst adoption of community forestry was used as evidence of resource management capacity during claims for autonomy, the expansion of community forestry does not really serve to strengthen that claim. Costs do escalate and can do so in non-linear ways as evidenced by concerns of a tipping point at which the scarcity of farmland would make shifting cultivation untenable (Gross-Camp et al. 2019).

2.15 Intangible values

- The formation of community forests in Kilwa brought substantial outside attention from both government and non-government organizations as well as funding. These interventions were perceived by village members to bring new value to the forest, as well as

contribute to a village's ability to assert legal control over its resources, providing strategic benefits. It provides a means to stop outsiders from harvesting their timber and are important to their claim for territorial autonomy and achieving greater control over forest access and exclusion which was highly valued (Gross Camp et al. 2019). Community forest management holds self-correction potential for addressing social inequities that appear far better than those of top-down centralized systems (Gross Camp et al. 2019).

- The involvement and investment from external institutions such as NGOs and government aid agencies such as Finland, Denmark and Norway in VLFRs could be viewed as an intangible benefit (Gross Camp 2017).
- Village leaders were seen to indirectly benefit from VLFR management by having access to meetings and training, receiving knowledge and enabling them to improve their income and quality of life (Cross Camp 2017).
- Involvement of outside organizations: The presence of non-profit organizations that advocate for community forests is attributed to the success of VLFRs in Kilwa. Their involvement reduced the knowledge gap of villagers in managing their forests, satisfying the professionalization demands of higher officials, yet remains challenged by intra and inter community tensions, as well as competing land us interests manifested in the formation of community forests (Gross-Camp et al. 2019).

2.16 Biodiversity and ecosystem services

- Environmentally speaking VLFRs have resulted in 600 000 hectares of land being protected, and deforestation rates decreased, where forest condition and wildlife populations are improved.
- The revenues generated through forest related enterprises are often spent on forest management showing the potential of community-based forestry for enhancing the management and conservation of forests and the ecosystems derived.
- Provisioning services and the income they provide, as well as cultural ecosystem services were the most recognized by communities. However, forests also provide wild pollinators important for the agriculture sector, carbon sequestration services, biomass production, habitat provisioning, seed dispersal, wind resistance, fire regulation and mitigation, pest regulation of native and invading insects, purification and regulation of water and climate regulation services.
- There is an increasing global demand for timber and continued forest loss and degradation driven by agricultural expansion, unsustainable harvesting of timber, firewood and charcoal, as well as wildfires. The continued forest loss, if left unchecked, will result in a loss of Tanzanian forests within eighty years.
- The harvesting of timber and deforestation provides a once off provisioning benefit whereas the costs of deforestation in the long term are far greater. VLFRs are aimed at combatting deforestation and therefore positively contribute towards reducing greenhouse gas emissions on condition harvesting is sustainable.

2.17 Species conservation

- Tanzanian deforestation rates are among the largest globally; if they continue or increase, all forest will be lost within 50-80 years (Mwangi et al. 2018).
- Experiences from Tanzania, Ghana, Kenya, Namibia and Guinea suggests that wildlife populations can increase with improved forest condition under community forestry, generating an important biodiversity benefit (Blomley 2013). Uisso et al. (2018) found that there were significant improvements in forest management and conservation indicators when VLFR land use plans were implemented and increases in the management and conservation activities carried out by the community in the Kilosa district after implementation. There was a decrease in use of the forest after the implementation of VLFR land use planning took place, providing evidence that the VLFRs have potential for enhancing the management and conservation of forests if land use plans are implemented in the context of the REDD+ strategy, and can be used as a forest management and conservation tool. Lund et al. (2015) found that community-based forest management resulted in more sustainable forest management practices and conservation of the reserved forest areas (Lund et al. 2015).
- Rosa, Rentsch and Hopcraft (2018) found that there were fewer relative incidences of forest lost in areas with some form of protection or management status including VLFRs. Community forestry enterprises provide a promising model for unlocking economic benefits while supporting efforts to protect forest ecosystems and reduce carbon emissions in Tanzania (Trupin et al. 2018).
- Kalonga et al. (2015) found that in particular FSC certified forests had better forest structure, regeneration and lower fire incidences than open access or state forests.

2.18 Conservation stewardship

- VLFRs in Tanzania have resulted in around 600 000 hectares of land being protected and deforestation rates have dropped in a number of VLFR sites providing strong evidence of the link between community forest enterprises and conservation outcomes (Trupin et al. 2018).
- Revenue sources derived from VLFRs contribute to the sustainability of VLFRs, as villages are encouraged to protect the community forests if benefits for doing so are gained. As of December 2017, 22 villages across the Kilosa, Mvormero and Morogoro rural districts have put 109,540 hectares of forests into VLFRs of which 10 percent (10 895 hectares) (Turpin et al. 2018). A decline in deforestation has been observed since the introduction of the model. Through proper planning and allocation of forest management units forest systems can be conserved with minimal loss of resources to other land uses.
- When revenues are derived and the value of forests acknowledged then ecosystem stewardship improves. For example, villages under TTCS projects set revenues to pay for forest patrols and equipping village members for patrol activities. A motorcycle was purchased so that rapid patrols can be undertaken (Trupin et al. 2018) resulting in reduced deforestation.

2.19 Ecosystem services

- Tanzanian deforestation rates are among the largest globally (Mwangi et al. 2018). VLFRs are established for production and protection purposes and therefore if well managed can contribute to conserving biodiversity and the ecosystem services provided. The link between community forestry and lower deforestation rates are relatively well established (Gross Camp et al. 2019) and it is known that biodiversity is important for the resilience of ecosystems and their services (Drakenberg et al. 2016).
- There have been several studies considering ecosystem services derived from the Tanzanian forest ecosystems. Maguzu et al. (2016) undertook a study on the potential of forest ecosystem services to the livelihoods of communities in the Shume-Magamba forest reserve in Lushoto, Tanzania, and found the provisioning services (generating subsistence income) were the most recognized eco system service provided by the forests followed by cultural services. Tibesigwa et al. (2019) found that wild pollinators from forests made a significant contribution to small holder crop farms in Tanzania. Other ecosystem services identified include carbon sequestration (Mauya et al. 2019) biomass production, habitat provisioning services, seed dispersal, resistance to windstorms, fire regulation and mitigation, pest regulation of native and invading insects (Brockerhoff et al. 2017), purification and regulation of water, climate regulation (Drakenberg et al. 20016). Jew et al. (2019) identified 19 provisioning ecosystem services used by households in rural miombo woodland landscapes in south west Tanzania.
- The harvesting of timber and deforestation provides a once off provisioning benefit whereas the costs of deforestation are far greater. UNEP (2015) considered the costs and benefits of deforestation for the Tanzanian economy and found that the once off provisioning benefit of harvesting timber, based on deforest levels of 372 816 hectares per year, provided discounted benefits over the period 2013-2033 of US$92 million whereas the discounted costs of deforestation for the same period amount to a total of US$263 million.
- Increasing global demand: There is an increasing global demand for timber partly coming from western countries and particularly China (Lukumbuzya and Sianga 2017) which if satisfied will drive deforestation, compromising the delivery of forest ecosystem services.
- Forest loss and degradation: Deforestation and degradation are driven directly and indirectly by agricultural expansion for subsistence and commercial farming; unsustainable and illegal harvesting of timber; firewood, charcoal and pole production; infrastructure development; and wildfires (Mwangi et al. 2018).
- Unsustainable logging: Non reserved village lands are subject to unsustainable logging without proper forest resource assessments and harvesting plans resulting in loss of water retention capacity of the forests, reduction of year-round surface water, reduced rural livelihoods, reduced food security and loss of biodiversity (MNRT 2019).

2.20 Climate Change

- Deforestation and forest degradation in Tanzania are high with the forest being used to meet the growing demand for biomass energy and unplanned expansion of agricultural and settlement areas due to increasing population and weak governance. Deforestation causes biodiversity loss and contributes to climate change, through emissions of greenhouse gases

(Drakenberg et al. 2016). Since forests are carbon sinks deforestation also affects atmospheric levels of greenhouse gasses negative.

- VLFRs are aimed at combating deforestation and therefore positively contribute toward reducing greenhouse gas emissions and maintaining the carbon store, on condition that harvesting is sustainable.
- Results from a WWF REDD+ Pilot project revealed that montane forest has higher average above ground live carbon (98.99) than other vegetation types due to favorable climate conditions meaning that REDD+ incentives in montane forest could be realized through management and conservation of existing carbon stock and other co-benefits related to biodiversity rather than carbon enhancement. The average above ground live carbon in Miombo woodland is low (25.55 tC/ha) compared to lowland forest (66.06) because most are found in dry areas with some of them lacking proper management (WWF 2015).
- The Tanzanian government has prepared an Agricultural Climate Resilience Plan for 2014 – 2019, but its practical outcomes are not disclosed (Talvela & Mikkolainen 2019).

Wildlife credits [16]

October 2021

[16] One of 6 reports on the viability of community-based natural resource enterprises (baobab products; beekeeping; Carbon markets; charcoal production; wildlife credits) in Africa. Produced for WWF's Nature Pays program by CARMa-Afrika, Nelson Mandela University, South Africa. The authors are Christo Fabricius, Bianca Currie, Monicah Mbiba and Herbert Ntuli. Contact us at christo.fabricius@mandela.ac.za

1 Introduction to the initiative

1.1 Problem being addressed

- If financial incentives are adequate to compensate communities for living with wildlife, then they will protect them. this value should be transferred to the people who are at the frontline of protecting these ecosystems
- There is environmental conditionality, i.e., that payments are only made if the agreed upon environmental outcome is delivered (Oberhauser 2019)

1.2 Activities

- Working with tourism lodges to create performance payments and establishing a national wildlife credits fund. Monitoring, recording and reporting on wildlife numbers and being rewarded for proven increases, or presence of wildlife in land set aside (e.g. corridors)
- E.g. in Namibia, Amarula is joining forces with Wildlife Credits, an innovative conservation initiative that rewards communities who are actively protecting and conserving wildlife and its habitat. Funding is paid directly to communities for measurable conservation results. Partnership is being launched between Amarula, Wildlife Credits and members of the Sobbe Conservancy in Namibia's Zambezi Region. Distell Namibia/ Amarula donated a one-time payment of N$130,000 to the Sobbe Conservancy for their eco-system service of protecting a critical wildlife corridor
- In anticipation that they will formally register the tenure of these corridors Wildlife Credits under the auspices of the Community Conservation Fund of Namibia, (who houses Wildlife Credits) is seeking to build up a Corridor Fund that can finance annual payments for communities are able to independently verify the protection and wildlife use of the corridors. The initial target of CCFN is to secure N$ 50,000 per year per corridor.
- All payments generated by Amarula for Wildlife Credits would be paid into to the national Wildlife Credit Fund. This fund has been established by the Namibian CBNRM Programme and is currently being managed by NACSO (http://www.nacso.org.na) and will be managed by CCFN (https://www.ccf-namibia.org/). Conservation Performance Payments shall then be made from the Wildlife Credit Fund to Conservancies that have entered into a Wildlife Credit contract. The contract states the expectations of both parties and provide the terms and conditions for the conservation performance payments. Within the next year, it is envisaged that the national Wildlife Credits Fund will be housed and managed by the Community Conservation Trust Fund, a Section 22 company. established to provide sustainable financing support to community conservation efforts that has as its Patron and founding member the Hon. Nandi-Ndaitwah. See attached a short brief on the CCFN and its background and bios for the Board of Directors and Founding Members.
- Rhino Bonds - Rhino Bonds have emerged as a form of ‘payment-for- results' impact investment, which transfers the risk of funding conservation from donors to impact investors by linking conservation performance to financial performance. The intermediary agency agrees a contract with the government or donor, based on specific outcomes (metrics), which allows the credits or bonds to be sold to impact investors and raise funds to implement conservation actions on the ground. If the outcomes are achieved, the

government or donor releases the funds to pay back the investors, totally or partially depending on the level of outcomes achieved. The advantage for governments is the transfer of risk to investors. The five-year, 670 million rand ($45 million) security will be the world's first wildlife conservation bond and the aim is to sell it in the middle of the year. The return-to-investment will therefore strongly depend on performance metrics, and the rate of return offered by project donors. There are also biodiversity data challenges ; cost variations; misunderstanding about impact bonds, e.g. whose outcomes would count as successes; complicated arrangements; and the stigma attached to 'deriving revenue from animals'. Read more at: https://www.bloombergquint.com/business/world-s-first-wildlife-bond-to-track-rhino-populations-in-africa.

1.3 Intermediate outcomes

- Fair and efficient payments to community organizations
- Investments in communal assets and infrastructure. Salaries and employment.
- Reduced illegal activity - e.g. Distell Amarula example in Namibia. In 2019 the conservancy contributed to the installation of electricity in six villages. N$30,000 from the Amarula's annual contribution of N$40,000 was donated to the electrification project. A total budgeted amount of N$270,000 was contributed by the conservancy to the project, which resulted in five villages receiving transformers and electric poles. Transformers and poles for the sixth village were purchased but not yet installed. • Conservation benefits were targeted to communities close to corridors and included: I. Management of the corridors, i.e., demarcation, awareness, patrolling. II. Assistance with Human-Wildlife Conflict to farmers, i.e., awareness and response. III. Contribution towards annual game counts and general wildlife protection patrolling. • Improved patrolling of the corridor included: o GPS for capturing location o Use of SMART technology o Increased patrols from twice a month to once a week. Camera traps • Georeferenced camera traps were placed at strategic places along the wildlife corridor. Wildlife Monitoring App Satellite Verification • In order to establish that the land use within the corridor remained unchanged, satellite imagery was taken and compared in 2018 - 2020 (a short period of time). • Satellite imagery confirmed that the corridor remained unchanged (i.e., no new fields, settlements or kraals within the corridor), maintaining its integrity for the movement of elephant and other wildlife in the area.

1.4 Ultimate impacts

- Reduced human wildlife conflict
- Ecosystem conservation. E.g. proactively protecting a wildlife corridor that is critical to elephant movements between Botswana, Namibia, Angola and Zambia.

1.5 Value chain

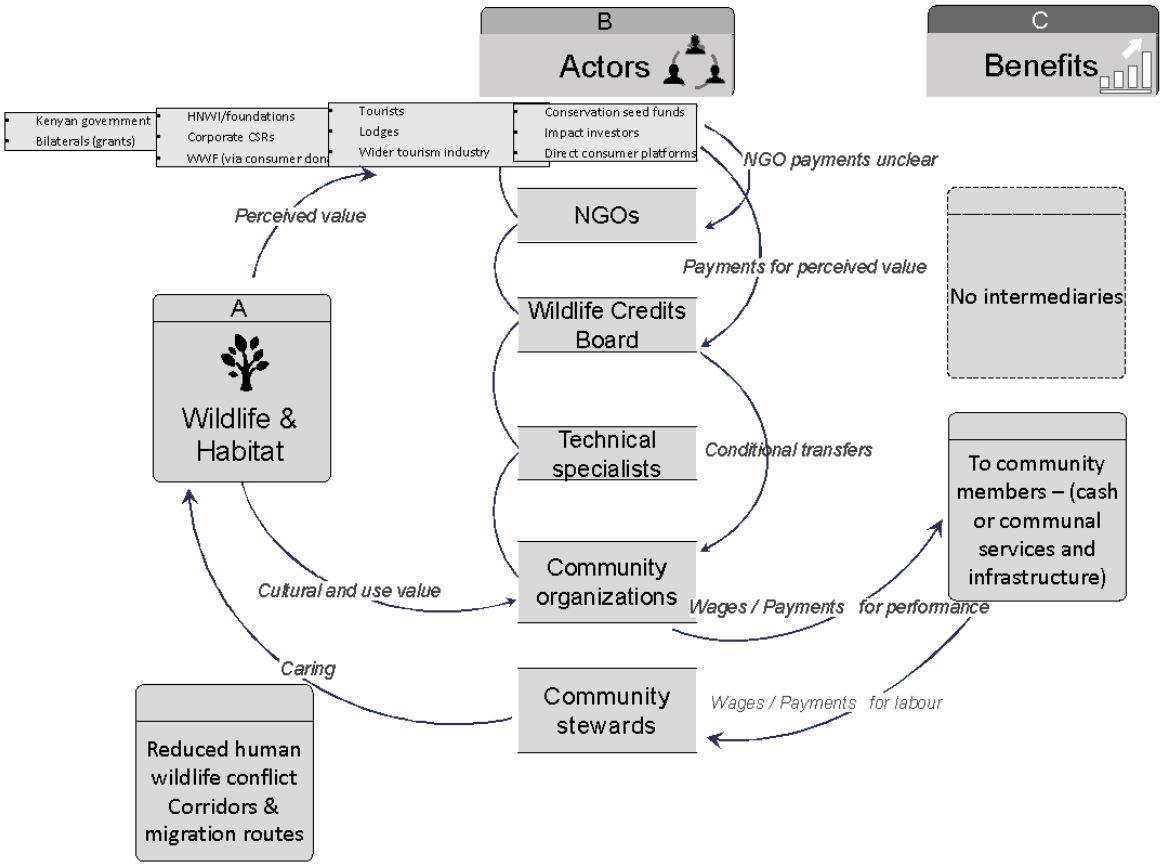


Figure 3. Wildlife Credits Value Chain

2 Enabling Context

2.1 Enabling policy environment

- Enabling legislation

Table 1. Table S1. Kenya's governmental legal and policy instruments on wildlife conservation that encourage local community participation in co-management (Oduor 2020)

Instrument	Provision
Constitution of Kenya (2010)	Communities and private landowners are key stakeholders in wildlife management. Therefore, every Kenyan has a duty to cooperate with state organs and other persons to protect and conserve wildlife and ensure ecologically sustainable development and use of the wildlife resources.
Draft Wildlife Policy (2017) of the Kenya Government	Wildlife conservation and management shall be encouraged and recognized as a form of land use on public, community and private land. Where benefit accrues from wildlife conservation and management, the people of Kenya will share these equitably.
Wildlife Conservation and Management Act of 2013 (No. 47)	Recognizes wildlife conservancies, sanctuaries and community wildlife associations. Also promotes effective participation of the public in wildlife management and encourages equitable sharing of benefits from wildlife to offset costs and devolution of wildlife conservation to those owners and managers of land where wildlife occurs.
Community Land Act, No. 27 of 2016 of the Kenya Government	Promotes wildlife conservation and natural resource management on communal land.
The National Wildlife Conservation and Management Policy, 2012	There is a need to identify and implement compatible land uses and fair distribution of benefits derived from wildlife including from both non-consumptive and consumptive uses of wildlife.
National Land Use Policy 2016	There is a need to sensitize the population on the economic benefits of integrating wildlife conservation with other land use activities.
Forest Conservation and Management Bill 2015	A local community can apply for and be licensed to participate in monitoring and protecting wildlife.
The National Wildlife Strategy 2030 of Kenya's Vision 2030 Development Policy	All Kenyans should recognize the value of wildlife and be involved in its conservation through appropriate collaborative initiatives.

- Legitimacy, transparency, accountability, inclusiveness, fairness, integration, capability, and adaptability.
- Enhanced income from gainful employment and new business opportunities, membership to cooperative societies and participation in community work (e.g. school bursary and feeding programmes), enhanced social relations, improved access to credit and health facilities, enhanced physical infrastructure (schools, roads and bridges), improved physical security and coordinated sharing of provisioning ecosystem services like pasture and water.
- Principles of legitimacy, inclusiveness, and integration had reportedly been well implemented in wildlife co-management
- Kenya has been a sanctuary for wildlife and a model for community based conservation for decades. However, conservation initiatives are now diminishing in the face of rapid and volatile socio-economic change and growing ethnic and clan conflicts (https://www.cfr.org/blog/african-wildlife-conservation-and-kenyas-wildlife-policy-act)
- Under the new law, community conservation committees are set up to ensure communities benefit from wildlife. However, lifestyles are changing rapidly; where once nomadic pastoralists had enough land to follow rain and grasslands and co-exist peacefully with wildlife, now intense population pressures impact traditional wildlife habitats. Without compensatory benefits, landowners can resent and destroy wildlife.

- Institutional mechanisms for sharing resources within the conservancies lacked transparency, accountability, and fairness, and tended to favour those who were politically connected to the leadership of the conservancies.
- Weak systems and few resources to facilitate delivery on responsibilities (i.e. had low capability), and had some costs associated with human-wildlife conflicts.
- The devolution of power from national to county governments in Kenya may affect natural resource governance, especially in cases of unclear allocation of roles and power between officers employed by national and county government. Even more so, the manner in which participatory forest management is implemented limits effective participation. Revenue from timber extraction licences is kept by the government rather than shared with Community Forest Associations (Mogoi et al., 2012), reflecting the reluctance of the government to share power and resources (Kairu et al., 2018). The policy being implemented reflects a trade-off between the need to involve resource users and the reluctance to share too much power or resources, or to cede control. As such, how well participatory forest management is supported and is perceived to perform remains unclear (Schaafsma et al. 2021)

2.2 Rights to land or resources

- The scale and level at which the rights are allocated determines the capacity of land rights to promote wildlife management as does the elimination of contradictory rules being applied which could fan unsustainable harvesting or decimation of wildlife resources. (Kameri-Mbote 2019). Lack of adequate legal protection of community rights plays a significant role in sustaining rural poverty.
- Forest and other resource commons are generally not subject to sale or purchase; hence the land and resources cannot be used as collateral for loans, and outside investors often cannot hold shares in CFEs (Antinori, 2000). As a result, banks and other lenders may be reluctant to lend to CFIs, particularly in the early stages of their development (Boscolo et al., 2010). In situations where CFEs opt not to issue shares to outside investors, they are unable to take ad- vantage of potential opportunities for private equity financing (Gnytch 2020)
- A critique of rights devolution processes is that governments often seek to retain former levels of control through imposing excessive regulations on the emerging CFI (Larson and Dahlal, 2012)
- Persistent drought (also enhance conflict with elephants) Too many livestock Uncontrolled development of tourism lodges Members unwilling to lease land to the conservancy Communities' fences that may block corridors and harm wild animals Low level of community literacy, despite having relatively high tourism income Managing community expectation

2.3 Participation

- When commercial investments are made in community-owned re- sources, tensions may emerge internally over trade-offs between equitable benefits and profit, democracy and hierarchy, managerial efficiency and traditional customs, and management for conservation versus production (Antinori and Bray, 2005; Cronkleton et al., 2011; Gnytch 2020).

2.4 Strength of community institutions and structures

- Rural community institutions and traditional authorities often lack the technical skills, knowledge, and social and political networks needed to successfully negotiate and manage investment and com- mercial partnerships (Bunge-Viver and Martínez-Ballesté, 2017; Vega and Keenan, 2014; Gnytch 2020)
- Important that some effort is made to, in parallel, strengthen management and institutional capacity in local communities and all other actors without significant leakage of revenues. Preferably funds should be raised from elsewhere for this purpose and not drawn from wildlife credits

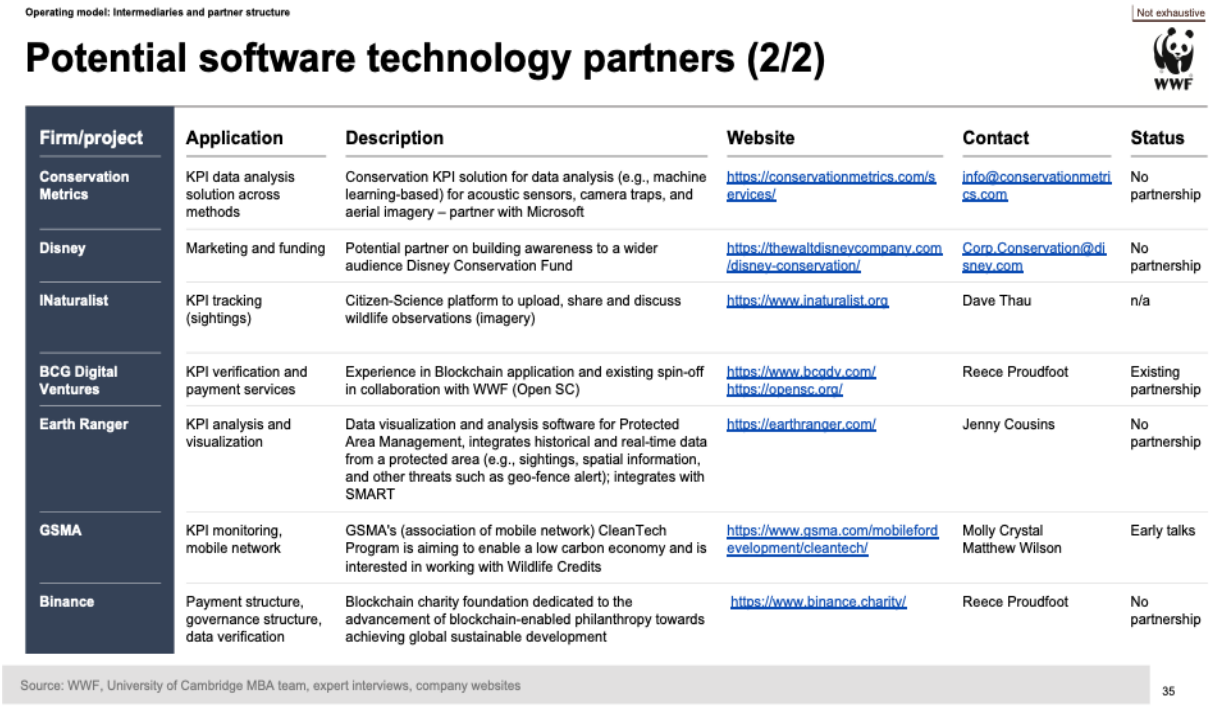
2.5 Period of time the community has been involved in the enterprise

- Communities have no or little experience of biocredits. The Northern Rangelands Project has experimented with performance-based rewards but little data are available on benefit sharing, monitoring and rules of engagement.

2.6 Technology and infrastructure

- Blockchain technology may help address some of the challenges by reinforcing PES programs with tamper-proof blockchain smart contracts (Oberhauser 2019), although questions have been raised about the necessity for this. There are also concerns about the top-down nature of high-tech solutions
- Namibia: the habitat integrity of an elephant corridor is assessed by remote sensing algorithms, which in turn trigger fictitious blockchain smart contract payments to surrounding communities.
- Blockchain technology is unlikely to provide transformative solutions in geographies with complex environmental governance.
- The blockchain-based PES POC is available on GitHub3. It consists of three components as depicted in Figure 2. First, an Ethereum backbone, consisting of an Ethereum smart contract and two Ethereum accounts. Second a land cover classification algorithm executed on Google Earth Engine (GEE) and accessed through the GEE Python API. Third, a link based on the Oraclize webservice connecting the above components. In the following, we describe the individual components in detail. (https://github.com/blockchain- ecosystem-payments/proof- of- concept)
- A PES transaction through the POC comprises five steps: (i) the deployment of the smart contract, (i) the initial payment from the PES buyer that calls the initialize function and starts the PES mechanism, (ii) the query to and callback from Oraclize, (iii) the payment to the EOA of the PES seller, and (iv) the transfer of remaining funds back to the PES buyer. For all these transactions the usual Ethereum transaction fees (gas fees) associated with mining the new blocks on the blockchain occur (Oberhauser 2019).
- Google Earth Engine is used for land cover classification. GEE is an openly accessible, cloud-based remote sensing service provided by Google.
- Smart contracts can technically make benefit distribution tamper proof.

- Camera traps installed to keep track of how many animals make use of the corridor (Oberhauser 2019). Machine learning software is used to classify images.
- Animals could be fitted with GPS-collars. GPS-collars are available with integrated geofencing technology which registers if an animal roams within a predefined area
- Spread of mobile phones in rural geographies of sub-Saharan Africa suggests that new technologies have a supportive rather than a transformative impact.
- Potential for democratization and empowerment of underrepresented rural populations in digital technologies, but environmental monitoring using open-access remote sensing algorithms can be linked to smart contracts on the Ethereum blockchain - where land is privately owned.



Operating model: Intermediaries and partner structure

Not exhaustive

Potential software technology partners (2/2)

WWF

Firm/project	Application	Description	Website	Contact	Status
Conservation Metrics	KPI data analysis solution across methods	Conservation KPI solution for data analysis (e.g., machine learning-based) for acoustic sensors, camera traps, and aerial imagery – partner with Microsoft	https://conservationmetrics.com/services/	info@conservationmetrics.com	No partnership
Disney	Marketing and funding	Potential partner on building awareness to a wider audience Disney Conservation Fund	https://thewaltdisneycompany.com/disney-conservation/	Corp.Conservation@disney.com	No partnership
INaturalist	KPI tracking (sightings)	Citizen-Science platform to upload, share and discuss wildlife observations (imagery)	https://www.inaturalist.org	Dave Thau	n/a
BCG Digital Ventures	KPI verification and payment services	Experience in Blockchain application and existing spin-off in collaboration with WWF (Open SC)	https://www.bcgdv.com/ https://opensc.org/	Reece Proudfoot	Existing partnership
Earth Ranger	KPI analysis and visualization	Data visualization and analysis software for Protected Area Management, integrates historical and real-time data from a protected area (e.g., sightings, spatial information, and other threats such as geo-fence alert); integrates with SMART	https://earthranger.com/	Jenny Cousins	No partnership
GSMA	KPI monitoring, mobile network	GSMA's (association of mobile network) CleanTech Program is aiming to enable a low carbon economy and is interested in working with Wildlife Credits	https://www.gsma.com/mobilefordevelopment/cleantech/	Molly Crystal Matthew Wilson	Early talks
Binance	Payment structure, governance structure, data verification	Blockchain charity foundation dedicated to the advancement of blockchain-enabled philanthropy towards achieving global sustainable development	https://www.binance.charity/	Reece Proudfoot	No partnership

Source: WWF, University of Cambridge MBA team, expert interviews, company websites

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- Expectations might be inflated, and sober assessment are necessary. Technical challenges as well as organizational, cultural, and behavioral concerns must be addressed by transdisciplinary research. ..blockchain is still at a "conceptual state" and that advocates have therefore "been able to largely gloss over detailed discussion" ...blockchain being "complementary rather than substitutive," i.. tracing funds and enforcing the conditions under which they are released.
- Smart contracts requires technological literacy. In order to benefit from benefits related to immutability and transparency, stakeholders need to be able to understand the technology. If they do not, a trusted intermediary is required which undermines the core concept of blockchain.
- Governance of benefit distribution will not change just because new technology is available
- Recipients of the payments would have to convert the received ETH back to a real currency because cryptocurrencies are not a practical medium of payment in the rural settings where PES schemes occur.
- Nature events e.g. fires, floods, droughts can severely influence outcomes and payments
- Costs of collars for tracking.

- Increased automation detaches environmental monitoring from PES sellers on the ground. Anonymous high tech monitoring could lead to the exclusion and alienation of community members (Oberhauser 2019).
- Implementing interventions that heavily rely on a technology like blockchain is likely to require centralized technocratic donor support which opposes such devolution
- Transformative quick fixes to externally identified problems of natural resource management cannot be reasonably expected.
- Unlikely that blockchain smart contracts can be harnessed to address issues of equity and benefit distribution in complex constellations of communal natural resource management as found in many PES settings. This is mainly due to the inaccessibility of blockchain technology for the relevant stakeholders, which results in heavy reliance on trusted intermediaries. Genuinely participatory approach are ruled out.
- Caution: suggested interventions may influence the participatory process- particularly if they advocate technologies that originated in the global North for natural resource governance in the global South.

2.6.1 Data availability

- Only prototypes exist and all wildlife credits initiatives are in early development stages.
- Success depends on all 5 pillars present: Incentives; benefit sharing; funding structure; governance (local and national).

2.7 Financial viability

- Potential investors exist.
- Participation in wildlife co-management has a great potential to improve livelihoods locally
- New practices, notably around finance mechanisms, being experimented with and then institutionalized. In Namibia, where the number of CFIs is rapidly outstripping the capacity of NGOs and the state to support them, NACSO has created the Community Conservation Fund of Namibia (CCFN) to source funds from a variety of sources and channel them to conservancies (NACSO, 2019). Access to such funds will be particularly important for newly established conservancies and those located in areas that are inaccessible or unattractive to tourists or sports hunters (Gnytch 2020).
- Novelty factor.
- Protection of wildlife corridors could have added benefits of climate change mitigation and Carbon offsets via REDD+.
- Oduor 2020: "Because the conservancy entry fees alone [tourism revenues] is not enough to fund community projects, the community relies heavily on donor funding" (Key informant 6, male, Olderkesi).

2.8 Market viability

- Size of conservation land great fit for pilot (e.g., easy to measure, high integrity of data, important proxy for wildlife) •# of sightings and HWC instances reported relevant but ensuring data integrity crucial Which animal to use in sightings depends on conservancy – lions could be interesting Proxy for entire wildlife in conservancy Iconic/endangered (less in

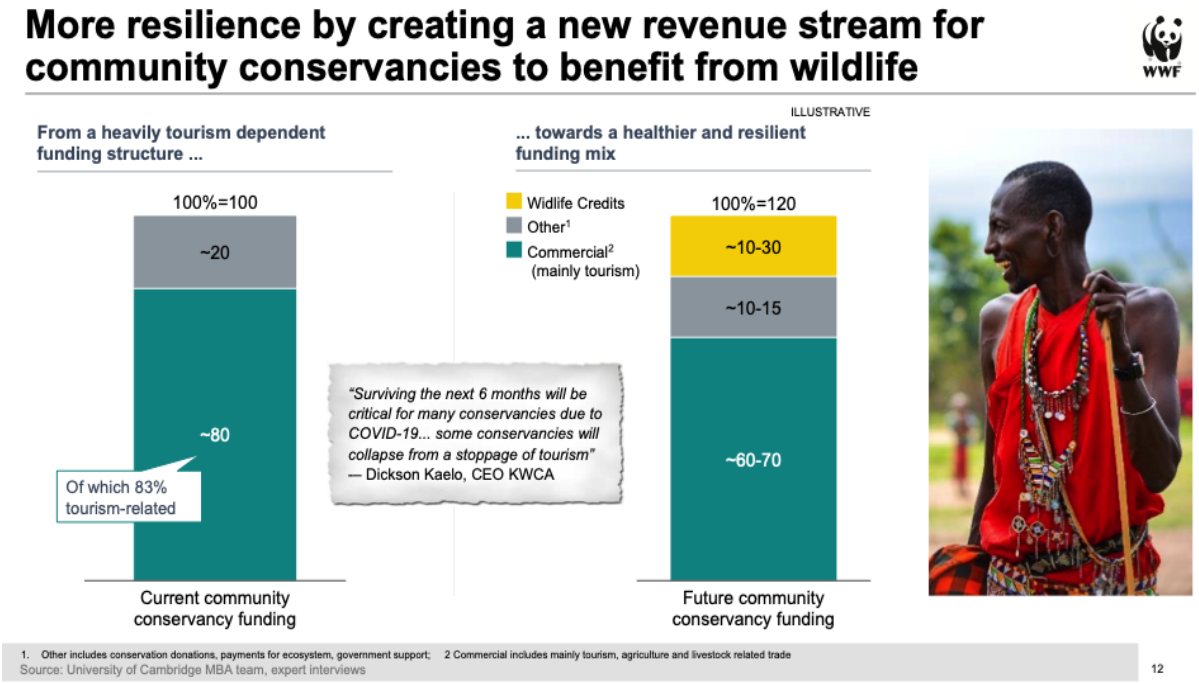
focus than rhino) Territorial – attribute to conservancy Driver of HWC Cultural role within Maasai communities Possible to calculate opportunity cost Pricing of KPI could be driven by opportunity cost (e.g., Land-use: Mara conservancies lease land for ~USD 50-90 per hectare)

2.9 Risk viability

- Barriers to investment in CFI are not insurmountable and investment in CFI is taking place. External investment has come primarily from donors and governments, but private sector investment is increasing (Gnytch 2021)

Types		Considerations on pilot funding
Govern-ment	• Kenyan government • Bilaterals (grants)	• Potential access via WWF SOKNOT application (DFID and BMZ) – SOKNOT may be too late to fund pilot (early 2021)
Traditional	• HNWI/foundations • Corporate CSRs • WWF (via consumer donations)	• WC attractive as allows donors to "buy impact" • Approach a strategic & close partner for pilot funding • e.g., TCC Global (Cris Close) Unilever (Hina West) • Kenyan players (M-PESA, Safaricom) could be partners • WWF funded pilot allows focus on KPIs (vs. on results accountability)
Tourism	• Tourists • Lodges • Wider tourism industry	• Tourists/lodges have a 'working' model with conservancies (fee based and/or per night payments) • Wider Kenyan tourism industry (Kenya Airways,..) may be interested – however, difficult time to approach (COVID-19)
New	• Conservation seed funds • Impact investors • Direct consumer platforms	• Seed funds may be willing to take risks to provide seed funding, e.g., Acumen Kenya (Hina West) • NGOs with markets-led expertise (TechnoServe, Conservation Capital) • Impact investors require financial return – too early for pilot • Direct consumer platform needs effort to be build – too early for pilot

- Reduced dependence on tourism as a revenue stream means increased resilience



- Rural community members and indigenous rights leaders and activists may be skeptical of commercial investors due to a long history of exploitation, inequities in the distribution of costs and benefits, and lack of formal recognition of ancestral/customary rights (Mayers and Vermeulen, 2002; Vermeulen and Cotula, 2010).

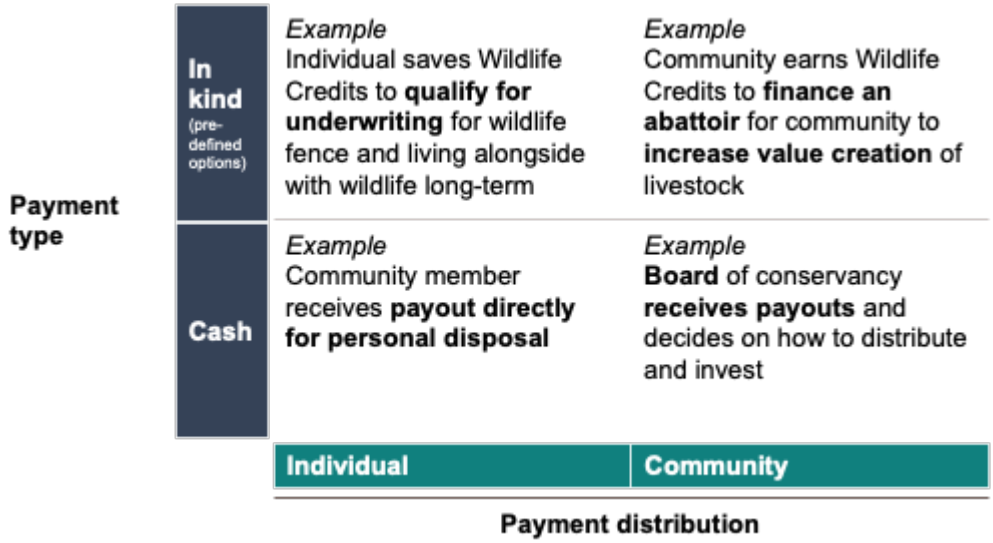
- Elite capture of funds and corruption are not uncommon (cf. Bollig, 2016; NACSO, 2016).
- Conservancy members that have never received any benefits are unlikely to actively participate in the democratic management procedures of the conservancy.

2.10 Operational viability

- Partnerships with capacity exist.
- Opportunities to learn from pilots in Namibia, and innovation fund experiments (provided that a learning network is formed).
- Willing communities – in select places.
- Lack of capacity in financial management is a significant challenge in the institutional setup of the CBNRM program, as stated by several interviewees in Namibia (Oberhauser 2019).
- Getting Wildlife KPIs right is crucial. Most are directly linked to conservation performance. Rewards released based on these KPIs Wildlife KPIs should be decided on jointly with conservancies (e.g., based on threat analysis). Balance between right mix of KPIs (avoid unintended consequences) and simplicity (buy-in/lower monitoring costs). Social-well being KPIs ultimate goal of Wildlife Credits – making life better from taking care of wildlife.
- Separating natural fluctuations due to weather, fires, floods, from community performance, will be a major challenge.

2.11 Benefit sharing potential

- Great potential to bypass intermediaries and transfer benefits directly to communities and even individuals.
- Payments to community structures for investment in communal benefits can result in equitable benefit sharing and avoid intra-community conflict and disruption of community dynamics.
- Payment type and distribution highly depended on community governance structure in place – inclusiveness critical for development goals (e.g., women economic empowerment) •Cash pay-out easiest to administrate but can possibly lead to wrong incentives systems and disregard cultural aspect of living alongside wildlife •Cash to individuals most direct and reduces intermediaries •In kind can be used to predefine options to enhance sustainable living alongside wildlife (tackle cause not symptom). Community approach builds on existing structures.



2.12 Ecological viability

- Payments for performance means beneficiaries are incentivized to be actively involved.
- Non-extractive, i.e. no risk of over-utilization.
- Focus on charismatic species at the expense of vulnerable yet obscure species, e.g. plants, reptiles (easy to reliably record yet low willingness to pay).
- Measurements and indicators of landscape / corridor conservation, e.g. woodland cover, can be misleading due to encroachment of woody species at the expense of grassland cover
- Possible risk of greenwashing, where developers use contributions to wildlife credits to quell community protests or complaints against over-development and other environmental impacts of tourism.

2.12.1 Data availability

- Due to the short time span there is little data about the positive impacts of wildlife credits.

2.13 Intangible values

- Investments in building institutional and management capacity can strengthen community institutions.
- Pride and sense of purpose are important co-benefits.
- Conservation of local and indigenous knowledge, if used for monitoring and data collection
- Community members may not support investment in commercial enterprises because they fear that exposure to markets may increase demand for resources and change community consumption patterns, eroding natural resources, traditional values, and cultural practices (Hernández-Aguilar et al., 2017; Gnytch 2020).

2.14 Species conservation

- Potential positive impact on populations of target species and habitat due to performance incentives.

- Neglect of obscure species, e.g. endemic plants and reptiles, at the expense of charismatic species.
- Compensation for human-wildlife conflict is fraught with ethical dilemmas when it comes to human lives and safety.
- Matching the opportunity cost of high value products e.g. rhino horn and pangolin, could be a challenge.

2.15 Conservation stewardship

- Strong financial incentives for stewardship that complement traditional stewardship values
- Compensate for opportunity cost.
- Rewarding people for upholding the law could have unintended consequences when funds run low.
- Very little long term data or evidence from pilot studies.

2.16 Ecosystem services

- Wildlife Credits is a PES scheme with a similar Theory of Change .
- Crucial that some of the investments are used to build management, institutional and governance capacity

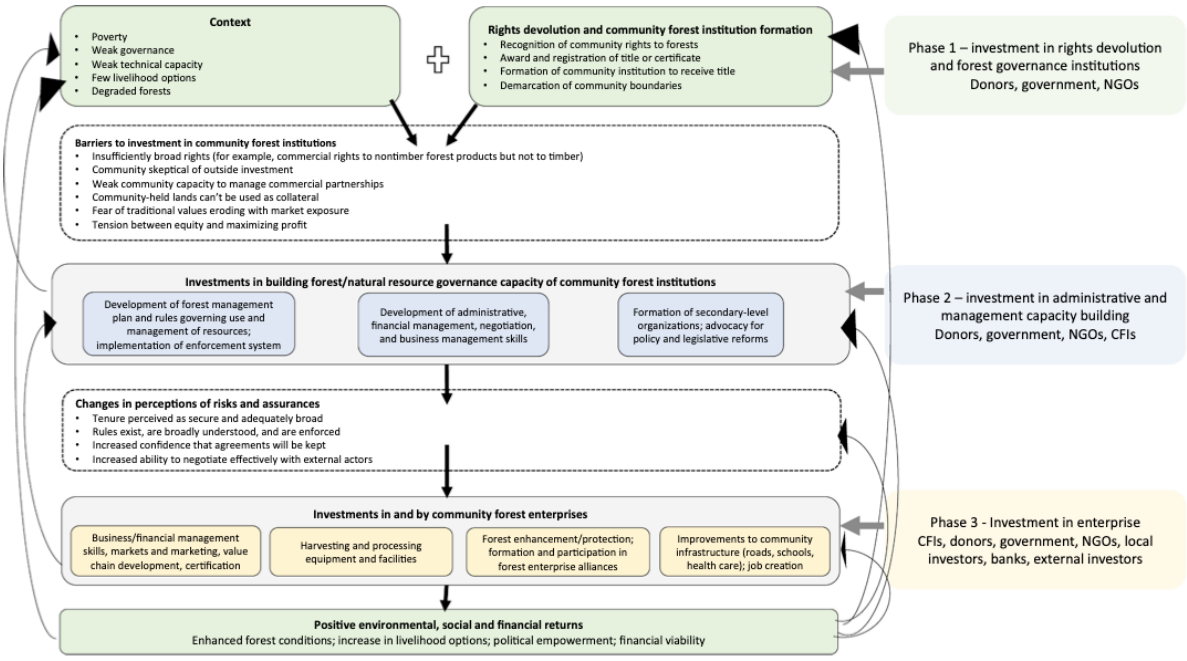


Fig. 2. Adapted theory of change linking rights devolution to financial investments and environmental and social outcomes.

Figure 4. Adapted Theory of Change for PES in forest conservation, from Gnytch et al. (2020). In this instance the term "Forest" can be replaced with "wildlife habitat"

2.17 Climate Change

- Protection of wildlife corridors could have added benefits of climate change mitigation and Carbon offsets via REDD+

- Blockchain is now a significant contributor to global greenhouse gas emission (Truby, 2018). A single bitcoin transaction has temporarily consumed as much energy as an average American household per week, the energy consumption of the entire Ethereum network has at times exceeded those of small countries (Malmo, 2017). It would be ironic if a PES scheme for carbon sequestration nullified its achievements because it uses blockchain technology (Oberhauser 2019).

2.18 Keys to success (*adapted from Porras & Steele 2020*)

1 Enabling policy from government for implementation
- 1.1 Granting legitimacy to actions through recognised management plans
- 1.2 Rules for monitoring and reporting biodiversity
- 1.3 Registration and trading rules
- 1.4 Strategies to allow for voluntary initiatives to avoid double-counting or leakage
- 1.5 Strong legislative system and meaningful institutions to ensure 'no net loss'

2 Market engagement to attract buyers and generate sales
- 2.1 Market survey of potential buyers to ensure sufficient demand
- 2.2 Long-term commitment from industry and buyers
- 2.3 Clear units of measurement
- 2.4 Setting clear and understandable prices
  - 2.4.1 Negotiations between buyers and sellers
  - 2.4.2 Opportunity cost estimates
  - 2.4.3 Prices are dynamic, vary over time
  - 2.4.4 Low prices can make projects non-viable – store credits until prices recover
- 2.5 Targeted buyers
  - 2.5.1 Tourism industry and tourists
  - 2.5.2 Public and private economic developers causing biodiversity loss
  - 2.5.3 Private biocredit resellers and intermediaries: these are some of the main buyers within voluntary carbon markets.
  - 2.5.4 Companies involved in corporate social responsibility
  - 2.5.5 Philanthropists and impact investors
  - 2.5.6 The public: public interest is growing. The general public may be willing to pay for biocredits.

3 Simple, transparent cost-effective design
- 3.1 Consistent monitoring and measurement
  - 3.1.1 Place-based monitoring
  - 3.1.2 Valid for a specific time period – which can be used to assess net changes.
  - 3.1.3 Measurable against an established baseline
  - 3.1.4 Suitable for collective aggregation to provide an overall indicator of the condition of biodiversity.
  - 3.1.5 Comparable over space and time
- 3.2 Transparent standards and registration
  - 3.2.1 Biocredit inventory: records physical units of biodiversity, e.g. species and/or ecosystems
  - 3.2.2 Register: database that records serialised biocredit units as required by policy
  - 3.2.3 Transaction registry: capability to transfer biocredit units between multiple account holders
  - 3.2.4 Data management system: archival records information about biocredits (eg the type of biocredit for transparency purposes
  - 3.2.5 See www.earthmind.org/vca/registry

3.3 Legal and regulatory clarity property rights

3.3.1 Combine expert judgements, monitoring-based estimates, satellite imagery, and/or model-based estimates.

3.4 Effective use of technologies

3.4.1 Reduce the administrative costs of making market trades (‘transaction' costs)

4 Inclusive and fair benefits for local people

4.1 Standard setting to initiate and maintain pro-poor benefits – e.g.Plan Vivo

4.2 Deferred benefits for the poor who need immediate income

4.3 Costs of lost access and tenure

4.4 Prior and informed consent FPIC

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