

# Sustainable woodfuel (charcoal & firewood) systems in coastal regions in Tanzania

Stakeholder engagement in context analysis and  
planning using the SHARED methodology

November 2018





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This document presents results of a situation analysis of woodfuel (charcoal and firewood) in Mtwara, Lindi and Pwani regions in Tanzania all together referred to as the Coastal region. The situation analysis also involved planning aimed at making woodfuel sustainable from a systems perspective that considers production of wood, wood processing into charcoal, transport and trade/marketing and utilizations and cross cutting issues such as regulations and gender. The process applied the Stakeholder Approach to Risk-informed and Evidence based Decision-making (SHARED) methodology. The priority interventions identified for sustainable woodfuel systems include; (i) awareness raising and capacity development, (ii) implementation of sound innovations, (iii) effective impacts monitoring systems and (iv) a sound coordinated policy framework. Strategies for awareness raising, communication and capacity building are also presented. Stakeholders participation in context analysis and planning brings a desired common vision for sustainable woodfuel that connects the different components of the system.

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# Acronyms

CBO	Community based organizations
COSTECH	Tanzania Commission for Science and Technology
CTCN	The Climate Technology Centre Network
DFM	District forest manager
DFO	District forest officer
DTO	District Trade Office
FAO	Food and Agriculture Organization of the United Nations
FBD	Forest and Bee Keeping Division, Tanzania Forest Services
GHG	greenhouse gas
ICRAF	World Agroforestry Centre
LGA	Local government authority
MoE	Ministry of Energy, Government of Kenya
NGO	Non-government organisations
NLUC	National Land Use Planning Commission
NTFP	non-tree forest products
SHARED	Stakeholder Approach to Risk-informed and Evidence-based Decision-making
SIDO	Small Industries Development Organization
SSA	sub-Saharan Africa
TaFF	Tanzania Forest Fund
TAREA	Tanzania Renewable Energy Association
TARURA	Tanzania Rural and Urban Road Agency
TFS	Tanzania Forest Services
TRA	Tanzania Revenue Authority
VEO	Village executive officer
VETA	Vocational Education Training Authority
VNRC	Village natural resource committees
WEO	Ward executive officer

# Introduction

**Wood is an important source of energy that has been used for millennia for cooking, boiling water, lighting and heating (WHO, 2006). More than 2.7 billion people – 38% of the world’s population – rely on the traditional use of solid biomass for cooking, typically using inefficient stoves in poorly ventilated spaces (IEA, 2016).**

## 1.1 Woodfuel

Woodfuel (charcoal and firewood) is the most common form of energy used for cooking and heating in sub-Saharan Africa (SSA). It is also used in small-scale businesses such as restaurants, bakeries, street food kiosks, brick making, and to in the drying process in tea and tobacco production. In SSA, more than 90% of the population relies on either firewood or charcoal (IEA, 2006). Africa produce 62% of the global wood charcoal, estimated at 52 million tonnes (Mt) (FAO, 2016a). Tanzania ranked 7<sup>th</sup> in the world for overall charcoal production, accounting for roughly 3% of global charcoal production at over 1.6 million tonnes. Woodfuels provide 85–90% of Tanzania’s energy supply (World Bank, 2009; URT, 2015b). Charcoal is mainly consumed in urban areas while firewood is used in rural areas. In urban areas in Tanzania, 71% of households depend on charcoal (Doggart and Meshack, 2017). Charcoal contributed over USD 650 million annually to the Tanzanian economy and is a major source of employment and income in both urban and rural areas. The situation is the same in other countries in Eastern Africa, where for instance in Kenya, 82% of urban households rely on charcoal for cooking and, in Ethiopia, 70% of all charcoal produced is consumed by urban households (MoE, 2002; GCF, 2014; Yigard, 2002). In Zambia, charcoal use increased by 4% between 1990 and 2000, with 85% of urban households relying on charcoal for cooking and heating (Chidumayo *et al.*, 2002). Charcoal production has risen in recent decades as demand has grown among urban households and enterprises (FAO, 2017). Charcoal consumption is expected to grow in SSA in coming decades, especially given that the percentage of population living in urban areas is projected to grow from 36% to 50% by 2030 (World Bank, 2014).

The woodfuel (both firewood and charcoal) value chain has considerable value as it provides income, employment, livelihoods and energy security. For instance, in Tanzania and Kenya, it has an economic value estimated at USD 650 million and USD 1.6 billion respectively (FAO, 2017) with a current estimate of over USD 2.7million and hence the need for its development as a productive sector.

On the other hand, unsustainable woodfuel processes results into 1-2.4Gt of carbon dioxide equivalent (CO<sub>2</sub>e) per year, which is 2.7% of total anthropogenic GHG emissions (FAO, 2017). The emissions are generated in various stages of the value chain and wood production,





carbonization of wood into charcoal and utilisations are the greatest contributors (FAO, 2017). In very inefficient operations, charcoal production can result into 9kg of CO<sub>2</sub>e per kilogram of charcoal produced and 29-62%, 28-61% and 9-18% of emissions are from wood sourcing, carbonization of wood into charcoal and end use (FAO, 2017). Inefficient use of woodfuel, such as use of poorly dried wood that is burned in inefficient cook stoves and in poorly ventilated areas, results in smoke-linked respiratory illnesses. Globally, over 4 million deaths occur annually from illnesses related to the smoke generated by indoor combustion, which mainly affects women and young children (Lim and Vos, 2012). Coughing, sneezing and headaches are common among women who work in smokey kitchens, while bronchitis, lung cancer, asthma and tuberculosis have also been linked to smoke inhalation from indoor combustion (WHO, 2006).

Interventions exist with the potential to make woodfuel sustainable and efficient. For an optimal impact in the reduction of deforestation, GHG emissions, and negative effects on public health, inefficiencies at all the stages of the value chain must be addressed and enabling policy framework developed. For instance, sustainable wood production for woodfuel could be achieved through sustainable forest, woodlands, shrublands management, sustainable community-managed woodfuel plantations, integrated food and energy systems, agroforestry and urban forestry, and recovery and reuse of biomass residues and waste streams (FAO, 2017). A shift from traditional to more efficient kilns and stoves can result in the reduction

of GHG by 80% and 63% respectively (FAO, 2017). A greater impact would be yielded if different hotspots in the woodfuel value chain are addressed at the same time. For example combining sustainable harvesting of trees on-farm for woodfuel with more efficient stoves (Njenga *et al.*, 2017). Recovery of organic waste including wood waste for briquette production has benefits in reducing loss of trees and emissions, provision of additional fuel, and generation of income and employment (Njenga *et al.*, 2014).

The woodfuel value chain operates under a variety of sectors where, for instance, wood production is under forest or agriculture, marketing/trade and transport is under transport while uses is under energy. In most cases, these sectors operate in silos. For effective development of enabling woodfuel policy that benefits for instance national government through tax, and promotes income generation and employment while conserving the environment, there is need for a coordinated regulatory framework aligned to the sustainable development goals. For informed decision-making in the policy development and effective implementation, there is need for data and participation of actors with a stake in the sector. Clear understanding of gender roles, needs, aspirations and potential of different categories of people is crucial for greater impact. There must be policy direction to support the adoption of sustainable woodfuel production and use technologies and practices which are suitable for the local context (Iiyama *et al.*, 2017).

## 1.2 Scaling-up sustainable woodfuel (charcoal and firewood) systems in the coastal region of Tanzania

Households, enterprises and institutions in the regions of Mtwara, Lindi and Pwani in Tanzania all use charcoal and fuel wood for cooking, leading to a rate of biomass harvested from the forest and other sources to produce domestic energy higher than the natural regeneration. In addition, the technology that is most used for cooking in households and institutions is the three-stone open fire which is low in energy efficiency and results in greenhouse gases and particles emission with negative effects on health and the environment. Charcoal production is considered an important potential source of economic activity for these communities.

Mtwara region has a population of 1,270,854 (male 599,648 and female 671,206), Lindi has 864,652 (male 414,507 and female 450,145) whereas Pwani has 1,098,668 (male 537,826 and female 560,842) (URT, 2013). According to some regional forest officers (RFOs, personal communication) in the three regions, the consumption of charcoal in urban centres is 90%, 85% and 80% for Mtwara, Lindi and Pwani, respectively, while in rural areas it is 10, 15 and 20 for Mtwara, Lindi and Pwani respectively. Pwani region is among the top three producers of charcoal in Tanzania, after Morogoro and Tanga. Considering the demand in urban areas such as the



city of Dar es Salaam the rate of deforestation is unlikely to decrease if woodfuel systems are not transformed into sustainable systems.

With the goal of making woodfuel sustainable, The Climate Technology Centre and Network (CTCN) provided assistance to The World Agroforestry Centre (ICRAF) to implement the request made by Tanzania Renewable Energy Association (TAREA) through Tanzania Commission of Science and Technology (COSTECH). This assistance aims at providing solutions to reduce unsustainable production and inefficient use of biomass energy practices that contributes to climate change in Tanzania. Specifically, the CTCN technical assistance seeks to understand the potential for scaling-up biomass energy and more specifically climate-friendly and environmentally-sound woodfuel (charcoal and firewood) technology and policy frameworks that include sustainable production, efficient marketing and utilization throughout the

country. The assistance will greatly contribute to improving rural communities' health status and livelihoods. Specific activities of the technical assistance include:

- i. Synthesis of secondary data on the situation of woodfuel systems in Mtwara, Lindi and Pwani regions including urban areas as points of demand
- ii. Participatory context analysis and planning for sustainable woodfuel systems
- iii. Developing capacity and awareness for sustainable woodfuel systems
- iv. Developing a proposal on scaling up sustainable woodfuel systems in Tanzania

### 1.3 The SHARED decision hub applied in the participatory design of sustainable woodfuel systems in Tanzania

This report presents a synthesis of results of activity two on participatory context analysis and planning for sustainable woodfuel systems. The results were achieved through application of Stakeholder Approach to Risk-informed and Evidence-based Decision-making process (SHARED)

a methodology developed by World Agroforestry Centre (ICRAF). The SHARED methodology is a tailored process that builds interaction between people and accessible evidence for improved decisions towards sustainable impact (Figure 1).

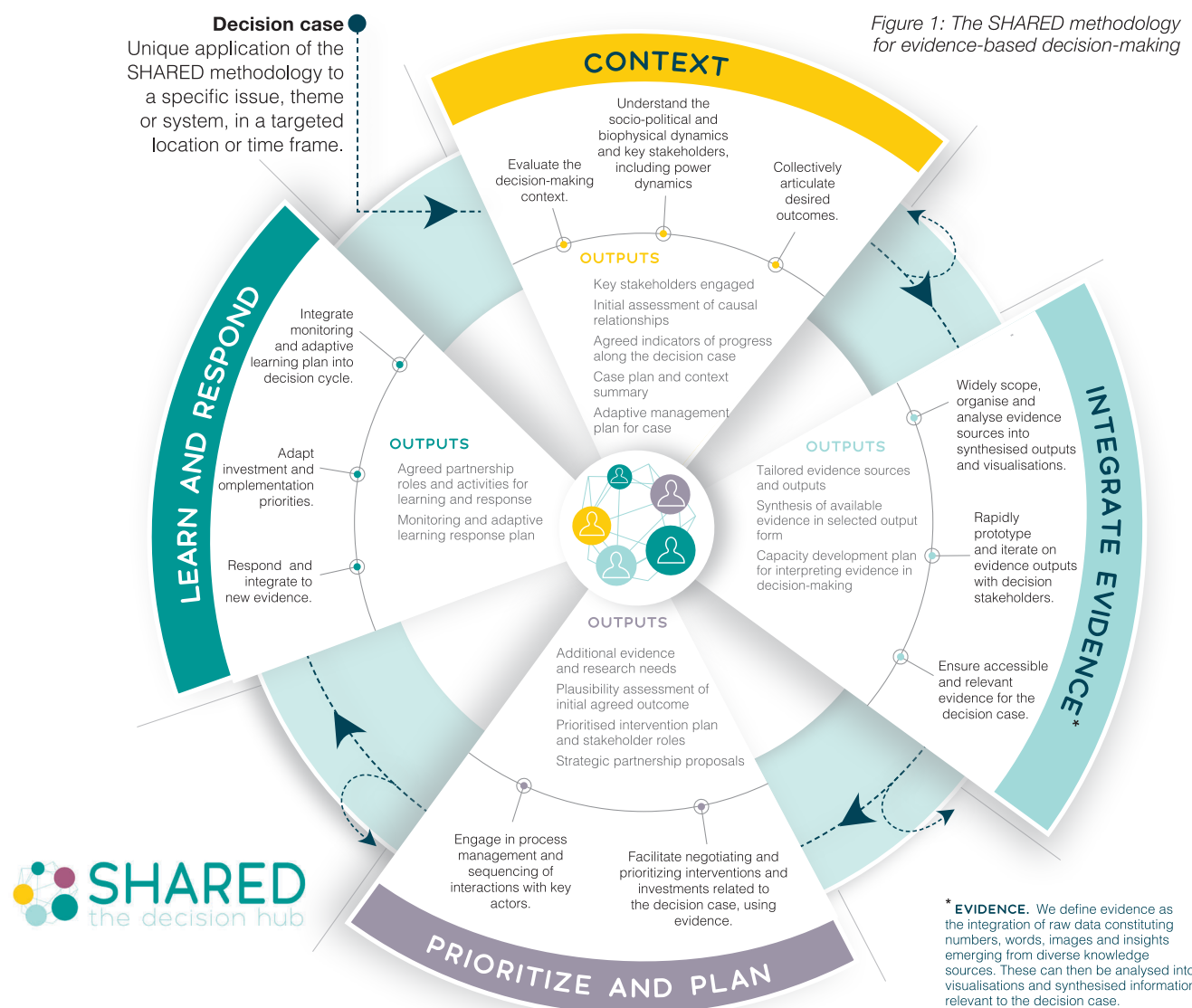


Figure 1: The SHARED methodology for evidence-based decision-making

## 1.4 Process applied in Tanzania to the theme of woodfuel

 The SHARED methodology:

- Ensures a people-centred process and a demand-driven and tailored engagement structure and space for co-learning and negotiation amongst key stakeholders to achieve mutually agreed upon development outcomes
- Integrates across themes, scales, institutions and knowledge domains
- Takes a systems approach that appreciates the complexity of issues being faced and the inter-relationship among social, environmental and economic dimensions
- Brings evidence, in the form of knowledge, data and information, recognising and honouring different knowledge sources and presents these in an appropriately accessible form
- Develops capacity for decision-making that is inclusive, embraces complexity, addresses root causes and identifies investment priorities through evidence and iterative tracking of progress

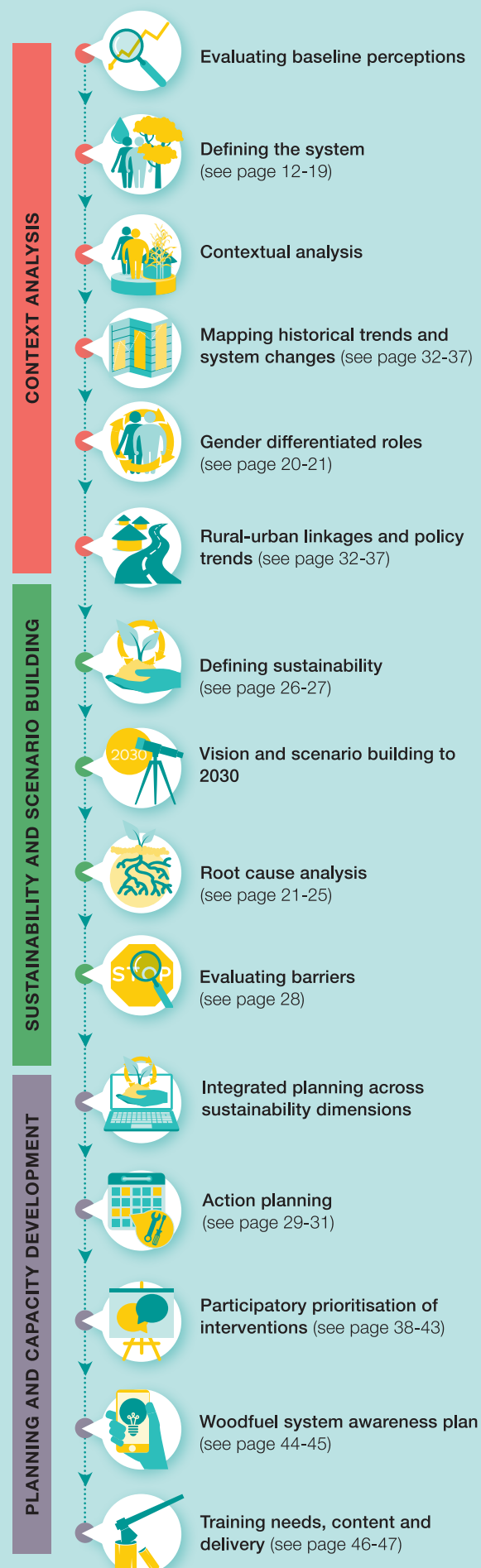
A participatory context analysis, negotiation and planning approach which the SHARED methodology undertakes is necessary in supporting stakeholders in prioritizing technology needs and actions to implement climate-friendly and environmentally-sound woodfuel systems in the three target regions, which are replicable in the whole country. This knowledge informs the planned capacity development work under activity 2 and development of the proposal in activity 4 for a larger scale implementation of sustainable woodfuel systems approach in the country. The technical assistance aims at setting goals for 2030 through an interactive engagement process for collaborative learning and co-generation of decisions to achieve mutually agreed development outcomes.

The SHARED methodology was tailored to the local context for context analysis, planning and decision-making among stakeholders, while approaching woodfuel from a systems perspective in the coastal region of Tanzania. The key background objectives for the SHARED component of the work were to:

- Gather and analyse information to understand the context of the woodfuel system in the three regions coastal regions in Tanzania
- Understand causal relationships and key challenges to achieving sustainability
- Use facilitated exercises to create an understanding of woodfuel flow patterns and develop stakeholders drawn and annotated natural resource maps depicting current and future (2030) scenarios.
- Interactive prioritization of feasible interventions/options including technological actions, capacity building and trainings and policy to make woodfuel cooking systems sustainable.
- Interactive prioritization of communication strategies for effective adoption of sustainable woodfuel systems
- Identifying contents of the training, target groups and methods for effective delivery.

In order to achieve these objectives, a tailored workshop design covering 15 core interactive workshop sessions was produced. The report summarises the findings from the sessions in relation to the objectives.

(Right) Figure 2: The tailored SHARED stakeholder engagement process for the woodfuel system in Tanzania





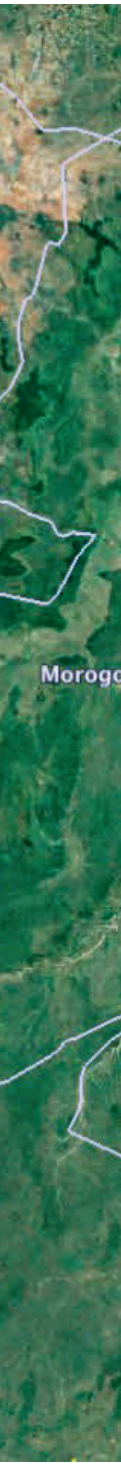
## 1.5 Description of stakeholders in the coastal regions of Tanzania

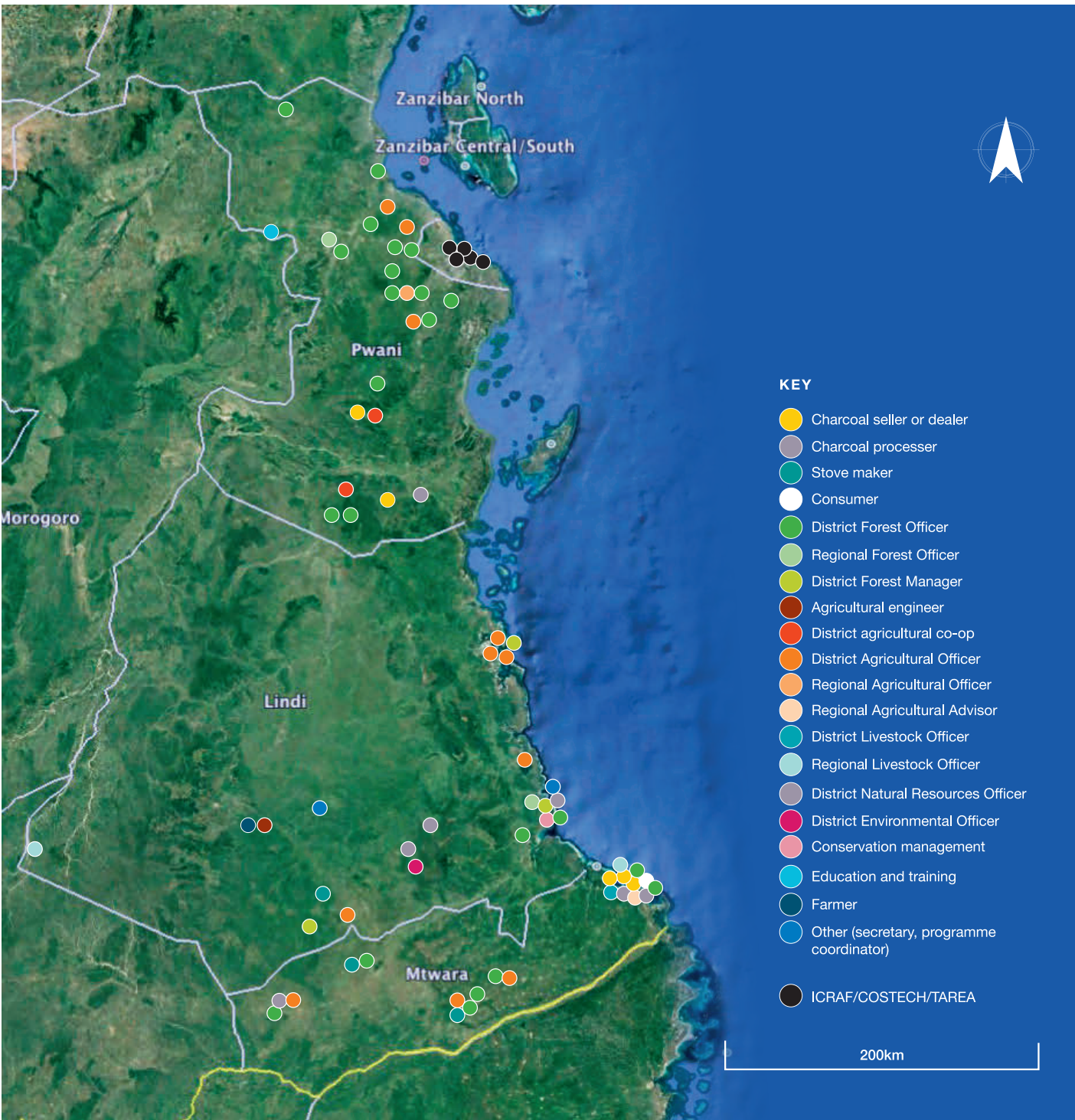
The workshops were attended by 80 stakeholders from the three regions, and covered a wide diversity of geographic expertise and roles in the woodfuel system. The different geographic locality and stage of involvement in the woodfuel system and roles of the workshop attendees are illustrated in Figure 3 and Figure 4 respectively.

(Below) Figure 3: Map of participants by focal area of involvement in the woodfuel system

(Right) Figure 4: Map of participants based on role

(Above, from left to right) Figure 5: Participants in the Mtwara workshop; Figure 6: Participants in the Lindi workshop; Figure 7: Participants in the Pwani workshop





# Synthesis of the local context

including rural-urban linkages and implications in coastal woodfuel systems in Tanzania

## 2.1 Definition of a woodfuel system

The woodfuel system for the stakeholder engagement processes was defined according to four key stages from sourcing of wood through to consumption (Figure 8). This framework was presented to stakeholders at the

outset of each of the workshops as a guiding framework for discussion and analysis and used throughout the workshops. ICRAF is applying the system approach in its initiatives aimed at sustainable woodfuel.

Figure 8: Definition of a woodfuel system



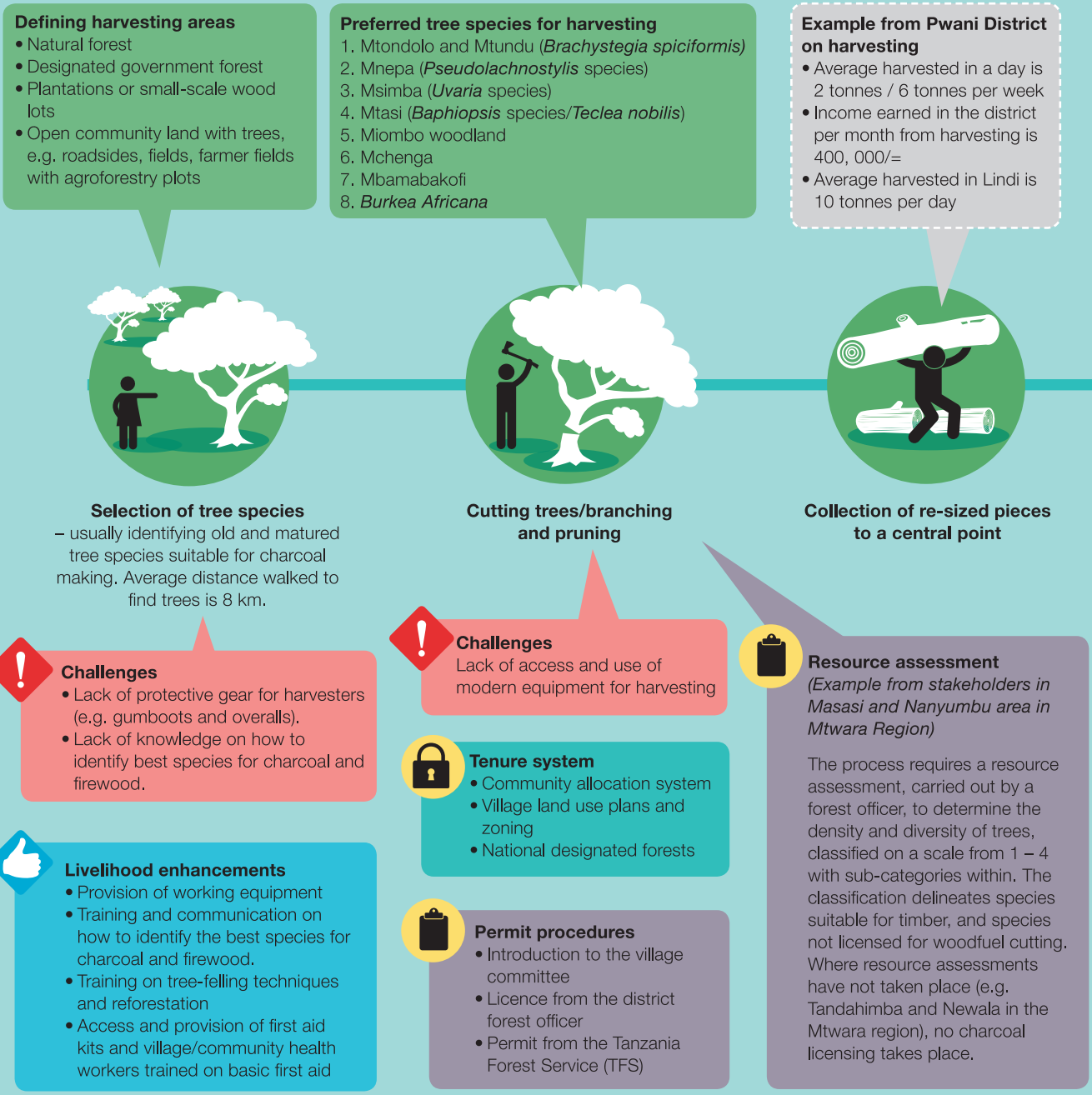
Figure 9: Visual description of the current charcoal system from sourcing and harvesting of wood to consumption.



Figure 10a: Description of the current context of sourcing, harvesting and processing woodfuel



## Sourcing and harvesting of woodfuel



**Case study of a harvester**

Amadala Lequava is from Lindi District and is based at Mtwara. He cycles for about 15km out of town on the main road and another approximately 10km inland from the main road to a firewood harvesting site. It takes approximately six hours to harvest a bicycle load, which involves sourcing the wood, cutting and sizing suitable to carry

on the bicycle. He does not carry any food or water with him during his daily cycle.

Then he sells the load (pictured) for TSH 10,000 and can make TSH 70,000 a week if he can secure a buyer every afternoon when he returns to town. As a polygamist, he has two wives and therefore supports two households, with 6 children.





## Processing of woodfuel

### Charcoal making options

- Open burning
- 'Local' earth kilns
- Modern kiln

### Location

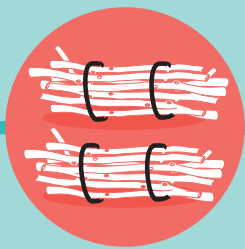
Usually within village forest areas

### Labour and income

- 20 charcoal sacks requires 1 week of labour for 1 person
- A kiln load of 20 bags will earn 50,000/=
- 25kg bags will get 4000/=
- Average income: 10, 000/= per bag and 30,000/= daily

### Capacity

One kiln produces a minimum of 80 bags



### FIREWOOD

Putting firewood in a bundle of 20 pieces of firewood



### CHARCOAL

- Collecting branch remains from trees harvested for burning bricks, limestone and kilns
- Sizing of logs



### Opening of kiln

- Preparation of earth kiln
- Arranging logs into earth kiln
- Covering the kiln



### Packing



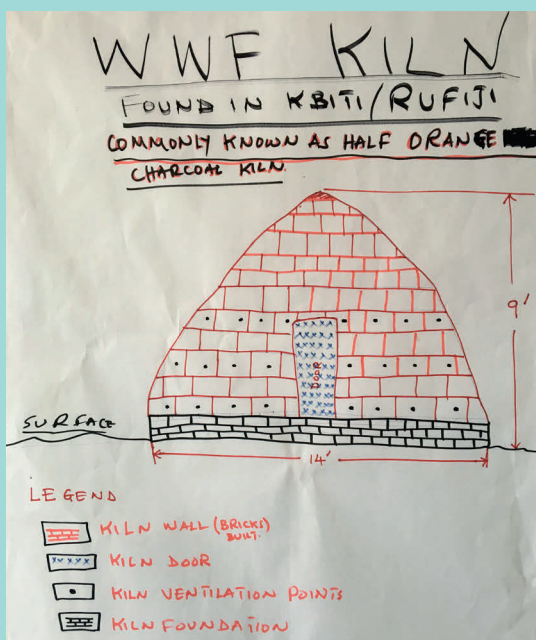
### Challenges

- Accessibility to improved kiln technology is poor
- Use of low quality instruments
- Earth kiln destroys natural ecosystem surrounding the kiln resulting in no regeneration of trees and grasses
- Low efficiency processes and low technology instruments
- Dangerous and labour-intensive work



### Livelihood needs

- Law enforcement and communication on by-laws
- Access to modern kilns and how to construct them
- Tree planting schemes and afforestation methods
- Awareness on tree species suitable for charcoal production and protected species
- Establishment of demonstration plots for agroforestry



(Left) Illustration of modern kiln from kiln maker in Pwani workshop; (Right) A charcoal processor in Mtwara preparing a traditional earth kiln (pic: Sharafi Makumbila)



### Regulations

Certificate of registration price 261, 000/= per year  
 License to fell 50 bags of 50 kg costs 656, 250/=

1 bag of 50 kg is equal to 12, 500/=

Transit pass Tshs. 7700/=

Figure 10b: Description of the current context regarding transportation and marketing, and trade, consumption and use



## Transportation and marketing

**Permits**  
Permits required for transporting firewood beyond district level



Transit pass required

**Rural-urban movement**  
Example estimates from Pwani stakeholders, showing movement into Dar-Es-Salaam  
6600 bags per day  
46,200 per week  
184,800 per month

**Modes of transport**  
On heads, bicycles, motorcycle, cars, boats and sailing boats (dependent on location and distance from market)



**Average sales**  
Rural 10 bags / week 50kg sold at 80,000/=  
Urban area - 300/500 bags of 50 kg per week at cost of TSH 35,000/= to 40,000/=



Transporting to marketing points

**Livelihood challenges**

- Limitations on transport volumes
- Limited negotiating power for increasing income
- Complicated process for accessing permits
- Long distance and time requirements of the work
- Exhaustion and health and fertility impacts on the bicycle transporters
- Poor road infrastructure
- High maintenance costs of motorized vehicles

Decide on means of transport to be used; load woodfuel



**Distances travelled**  
Shortest average distance is 25 km and the longest distance is 200 km. Distance travelled for each mode of transport:

- Carrying on head -5km
- Bicycles 20-25km
- Motorcycles 20-25km
- Vehicles 25+ kms



**Load sizes and earnings**

- Small bags - 15kg - a bicycle will carry four
- Medium - 35kg
- Large bags -50kg - truck will carry 110 bags

**Prices paid for a full load**

- Bicycle 80,000/= shillings charcoal load
- Motorcycle 90, 000 shillings charcoal
- Lorry 20m<sup>3</sup> 415, 00 shillings charcoal, Firewood 300, 000 shillings
- Cost per m<sup>3</sup> (stacked - market price) = 20, 000/=



**Livelihood needs**

- Awareness on permitting issues
- Entrepreneurship skills programs and savings schemes



**Case study of a transporter**

Hassan, from the Mtwara District, makes TSH 10,000 for a load, which takes 8 hours to collect and requires a 50km round trip.

**Income from firewood**

- Bicycle TZS 5,000/=
- Motorcycle TZS 10,000/=
- Vehicle up to TZS 25,000/=



## Trade, consumption and use

### Where charcoal/firewood is sold

- Roadside
- Charcoal yards/firewood storage areas
- Street markets
- Small shops

### Main consumers: domestic and institutional



Restaurants, hotels, households, prisons, schools



Households, prisons, schools



Budgeting for and buying charcoal/firewood



Portioning for efficient use and loading in the stove (using charcoal/firewood)



### Livelihood challenges

- Seasonal availability – demand is higher than supply
- Limited skills training to build and sell improved stoves



### Average weekly consumption

- Households – Family of 6 uses 30kg (charcoal)/week, family of 12 uses one 50kg bag/week
- Institutions – Schools use 1000kg (charcoal)/week



### Cost of improved stoves

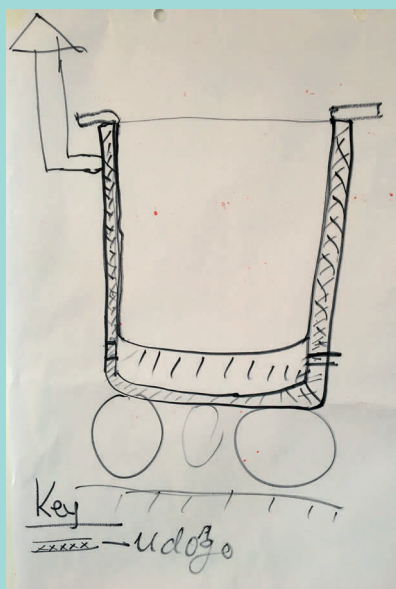
From 8,000/= to 15,000/=



Workshop participant Ntuki Sambo packing charcoal at her house (Picture - Jane Kajange)

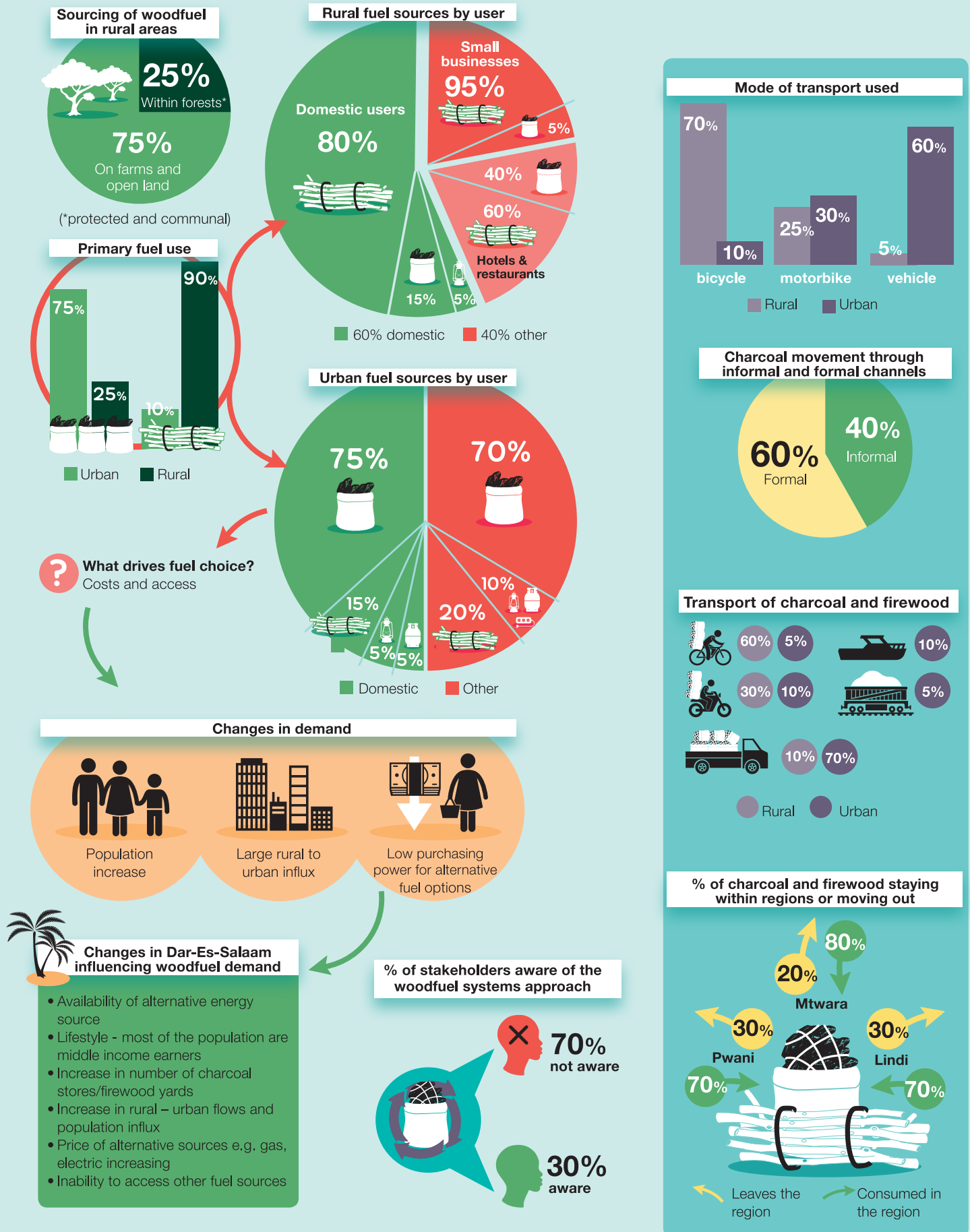


Jane Kajenge demonstrating her firewood store



Depiction of a modern stove

## 2.2 Visual description of the current charcoal system from sourcing and harvesting of wood to consumption





## 2.3 Case study of a producer

I, **Darus Bin Jumah**, was born on 15th January 1956 at Songosongo, Kirwa. I am a father of two children, a daughter born in 1974 and a son born in 1982. I have eight grandchildren, three boys and five girls, four of whom live with my wife (who is unable to speak or hear) and I.

I make charcoal at Jangwani village in Lindi municipality. I prefer to use mpingo (*Dalbergia melanocylon*) tree species but they are now not easily available. So I use other trees that are available. I make charcoal using traditional kilns which produce between 20-100 bags of 25kg. It takes me about 7 days to cut and size the logs and I hire one man to help me to arrange the logs. I pay him about Tsh 30,000 (USD13). It takes another 7 days for charcoal to be ready. I transport the charcoal from the production to the load using a bicycle or on my head, as the road is bad and difficult to ride a bicycle on, hence pack in small bags. There are three possible markets through which I sell charcoal. (a) Is selling at the production site and get about Tsh4000-5000 (USD 2) for a bag size 25kg (15kg weight of charcoal).

The other market outlets involve transporting to the road and I repack 2 bags of size 25kg (15kg weight) into a bag of size 50kgs (30kg weight of charcoal). The smaller bags from the production site to the road allow ease of carrying. The second market is Lindi town and, transporting from the roadside (loading site) to the town, I use a bicycle and carry 4 bags of 50kg. I make 3-4 trips per day and sell at Tsh6000 (USD 3). The only cost is for the person who assists in making charcoal at Tsh30,000. This market segment I sell about 20-30 bags per month with an income of Tsh120,000 to180,000 (USD 53-80)- Tsh30,000 (USD 13) profit of Tsh90,000-150,000 (USD90-67).

The other place I sell charcoal is Dar es Salaam. I make one to two trips a month with about 1000-2000 bags per trip. Transport costs Tsh 3000 (USD1), loading is Tsh500 (USD0.2) and off loading is Tsh500 (USD0.2) per bag at total of Tsh4-8 million (USD3563-1782) per trip. At the selling place at Kariokor in Dar es Salaam I pay Tsh6000 for security per trip. Transport back home is Tsh22,000 (USD10). I spend about 2-3 days there and am accommodated by relatives. For this market I pay tax to the village of Tsh 50,000 (USD22) per trip government. The other tax is to the government of Tsh50,000 (USD22) per year. The total cost involved in this market segment is Tsh4082167-8082167 (USD1818-3600) in one trip or Tsh8138167-16138167 (USD3625-7188) in two trips per month. The selling price at this market in Dar es Salaam is Tsh 30,000-40,000 (USD13-18) per bag and Tsh30-40m (USD13363-17817) to 60-80m (USD26726-35634) per trip on whole sale and Tsh50,000 (USD22) per bag, Tsh50m-100m (USD22,272-44545) per trip in retail.

For the charcoal to Zanzibar I transport by bicycle to my home and pack into bags of size 50kg (30kg weight of charcoal). I travel to Zanzibar once in every 3-4 months and I am accommodated by my daughter. Then hire a



lorry at Tsh30,000 (USD13) which carries 600-1000 bags to the ship loading area and another 1000 per bag for loading and offloading. The transport cost to Zanzibar is by ship and cost Tsh20,000-25,000, (USD9-11) per 20-30 tonnes. The selling price for the same bag of 50kgs at Lindi Tsh6000 (USD3) and in Zanzibar is Tsh 75,000 (USD33). The average monthly expenditure in my households is Tsh 50,000 (USD22).

The charcoal production has given me money to build a house, buy a motorbike and take care of my family. I also use some of the money on my farm in which I grow cashew nuts, maize and sorghum. I wish the government would appreciate charcoal as a livelihood strategy that empowers people and supports their livelihoods.

The main challenges include:

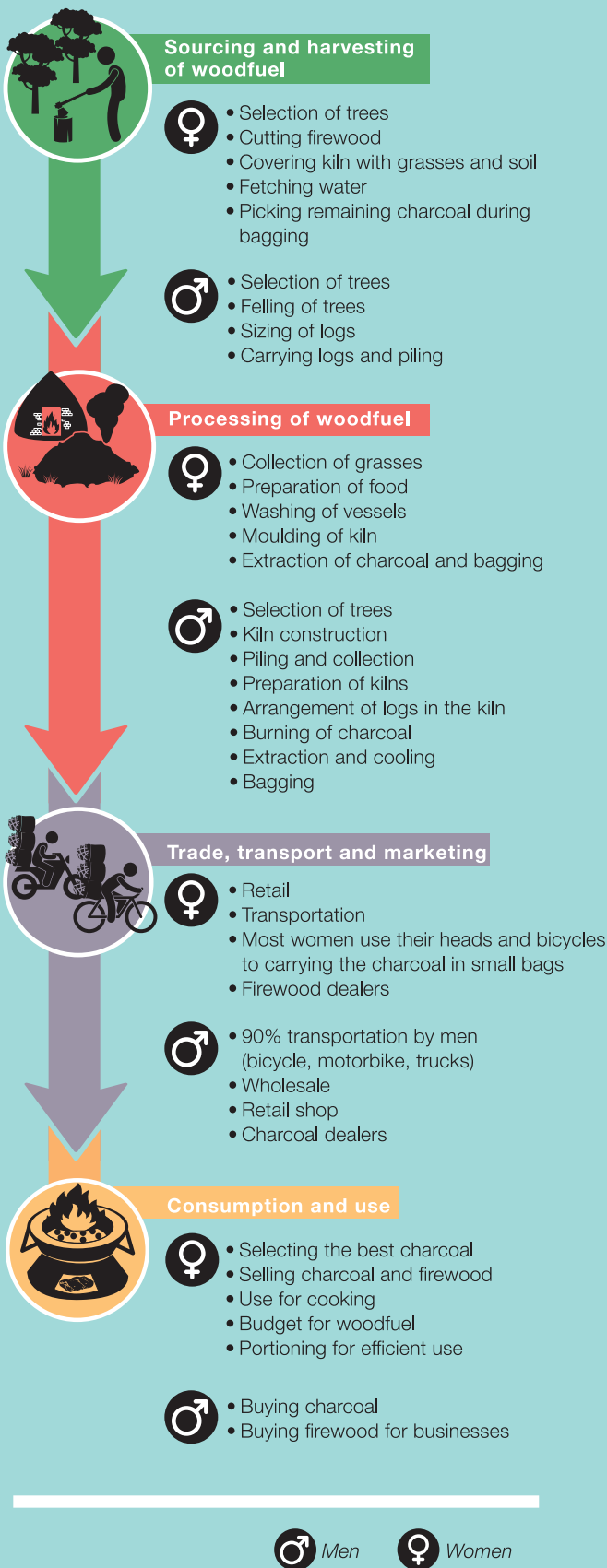
- Cutting the trees and sizing the logs with axes and machete, and carrying them to the kiln. It is difficult and hard work.
- The kiln I use takes many logs and produces a small amount of charcoal.
- It takes too long to produce charcoal; 7 days to prepare the kiln and 7 days to harvest the charcoal.
- Preferred species are becoming scarce.
- Sometime the charcoal burns into ashes.
- Difficult to transport from the production site to the road.
- Traffic police sometime bother me even if I have a license, especially during the rainy season when there are few vehicles on the road. I am forced to give about Tsh20,000 (USD10) per stop and total spend about TSh200000-300000 (USD89-133) per trip.

I am not carrying out sustainable charcoal production as I do not replant trees from the forests after I cut them down, in the same way that I replace the unproductive or pest-infested cashew trees on my farm once I cut them down.

I am so happy to have learned so much about the work I do and from now on I am going to be enlightening others involved in this work so that we can do it well, get good income and conserve the environment.

## 2.4 Gender differentiated roles in the woodfuel system

Figure 11: Gender differentiated roles in the woodfuel system



In order to plan interventions that equitably address the key stakeholders within the woodfuel system, a set of structured exercises sought to understand the gender differentiated roles, decision-making power and recommendations made accordingly to in the woodfuel system.

### Decision-making power over the roles

There has been significant change in the past 10 years with women being much more involved in harvesting, marketing and controlling many decisions regarding woodfuel usage. They also have better access to income. Typical gender differentiated roles in the woodfuel system are detailed in Figure 11.

Culturally and traditionally, men have more control across the system. In particular, men make more decisions regarding:

- Transportation
- Wholesale activities
- Land tenure and access - patrimonial land tenure system in place has a negative impact on women's ability to access, own and have decision-making power on the use of land and associated activities; men often own the main assets of a household, including land

Women play an active role in decisions regarding:

- Retail, purchasing quantities
- Choice of stove

### Recommendations for addressing gender aspects in scaling up sustainable woodfuel system

- Establish a fair trade procedure to allow women equal access in the marketing and trade aspects
- Women to be engaged directly in trainings
- Women to be empowered especially in technologies in cooling charcoal during processing and efficient use of woodfuel
- Labour regulations to ensure equality of pay and rights for women within the woodfuel system.



Figure 12: Participants in Mtwara carrying out the root cause analysis

## 2.5 Perceptions of changes and effects in the coastal woodfuel systems

In order to plan interventions to address sustainability within the woodfuel system, a reflection on what changes have taken place in the wider context in the last 20 years was undertaken with stakeholders. This historical trend gathering allows an understanding of what key changes have taken place and their impacts and effects. In addition to the historical analysis, stakeholders were asked to predict the impact of trends by 2030.

Categories for assessing change looked to understand wider patterns within the coastal ecosystems, for example perceptions on aspects such as population movements, poverty levels and food security in order for stakeholders to appreciate the woodfuel system within a broader economic, social and environmental system and set of activities and impacts that inter-link (Table 1).

### Root cause analysis

Causal mapping is critical to the SHARED approach so that decisions are made to address root causes versus effects contributing to better understanding of the inter-relationships across sectors and issues and implications of actions.

Participants were taken through a facilitated training on Root Cause Analysis where key objectives of the training were to understand the root cause of a given issue, and more importantly, barriers that would prevent sustainability being achieved in the woodfuel system. There was a lot of discussion among the participants who noted that many of the current approaches to planning deal only with the symptoms of problems rather than the root cause of an issue. The results of the root cause analysis are illustrated in Figure 13.

Root causes that were outlined as key in achieving sustainable woodfuel system include:

- Ineffective marketing systems
- Climate change impacts
- Insecure land tenure system
- Low level of government prioritization to woodfuel
- Lack of adequate finances for management
- Low level of awareness and knowledge on sustainability and the 'system' of woodfuel
- Communities not ready to apply by-laws and new policy

Table 1: Historical trends in the woodfuel system

	CHANGE/TREND	EFFECTS	EFFECTS BY 2030	
<b>SOCIAL, ENVIRONMENTAL AND ECONOMIC SYSTEM</b>	<b>Population and rural-urban trends</b>	⊕ Rapid increase in rural to urban migration and large increase in overall population numbers	Informal and illegal movement of woodfuel to meet the demand	
	<b>Food security status</b>	⊖ Reduce food production due to shifting cultivation	Land degradation Food insecurity at household level	
		⊖ Dependence on imported food from outside the regions, rather than local production. For example, Mtwara importation of food from Ruvuma, Mbeya and Morogoro region		
	<b>Poverty levels</b>	⊕ Decrease of poverty levels due to additional income and livelihood options.	Diminishing natural resource base	Increased natural resource degradation, with negative impact on livelihoods dependent on natural resource extraction
		⊖ Livelihood options heavily dependent on natural resource extraction		
	<b>Gender roles</b>	⊕ Increased women engagement in the woodfuel system and have roles across all stages		Women fully integrated and equal participation within the woodfuel system
	<b>Governance</b>	⊕ Decentralisation of power to local government and community	<ul style="list-style-type: none"> <li>• More administrative areas created e.g. Mtwara from 3 councils to 9 councils in 2017</li> <li>• Increased control within local administrative areas</li> <li>• Engagement of community on the use of resources e.g. village owned forests</li> </ul>	<ul style="list-style-type: none"> <li>• If by-laws adequately implemented and monitored, it will ensure effective supervision of resources e.g. cut trees, plant trees</li> <li>• Increased supervision on the planning and the use of woodfuel resources</li> </ul>
		⊖ By-laws not implemented or adequate controls in place		
		⊖ Weak enforcement due to corruption and inadequate staff which leads to contradiction of laws and regulations		
	<b>Landscape and agriculture</b>	⊖ Rivers change from permanent to seasonal, decreased level of water flow	<ul style="list-style-type: none"> <li>• Decrease of soil nutrients due to the decrease /degradation of forest cover</li> <li>• Land degradation and erosion due to unsustainable harvesting practices</li> <li>• Destruction of water catchment areas</li> <li>• Wind and soil erosion leading to reduced land quality</li> <li>• Increase of production costs due to the need for manure and industrial fertilizers</li> </ul>	<ul style="list-style-type: none"> <li>• Continued erosion and severely depleted land quality</li> <li>• Low land productivity and food insecurity</li> <li>• Severely degraded and deforested landscape</li> <li>• Drought occurrence increased and inter-annual issues with sufficient rainfall and access to water resources</li> <li>• Water conflicts between farmers &amp; livestock keepers</li> </ul>
⊖ Scarcity of water, resulting in a decrease in fishing activities				
⊖ Reduced soil fertility - e.g. Mtwara - Makonde plateau				
⊖ Shifting cultivation has increased				
⊖ Tree cover and density have significantly declined eg. Mtwara - along Makonde escarpment. Decrease in number of different species eg. mninga, mpingo				
⊕ Increased commercial farming activities, with positive impacts on employment, but negative impacts on the landscape from increased pressure on the land and reduced fallow periods				
⊖ Minimal uptake and practice of agroforestry activities on farms				
⊕ Arable land changed to non-agriculture activities due to urban expansion				

⊕ positive change   ⊖ negative change   ⊕ neutral change

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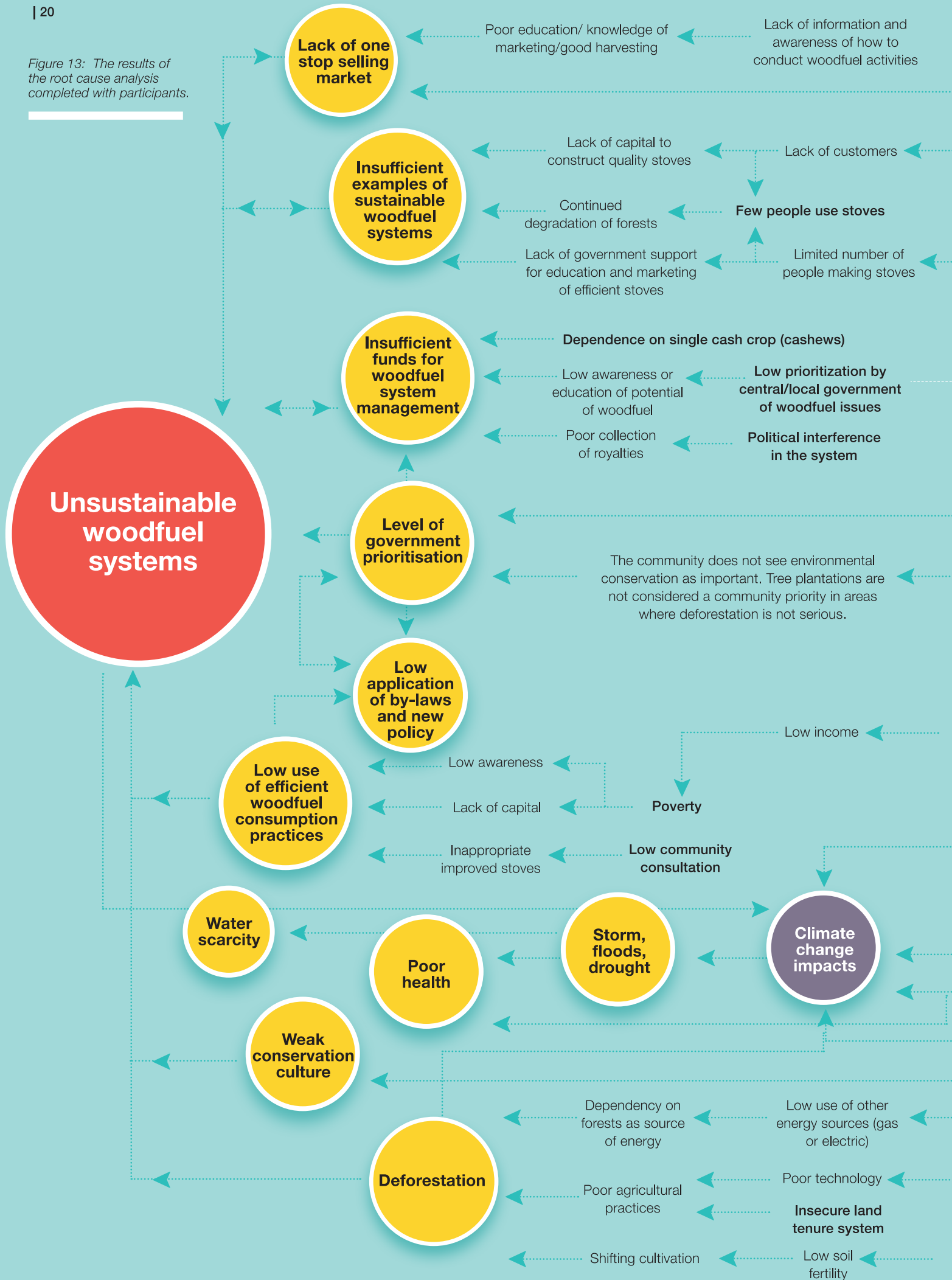


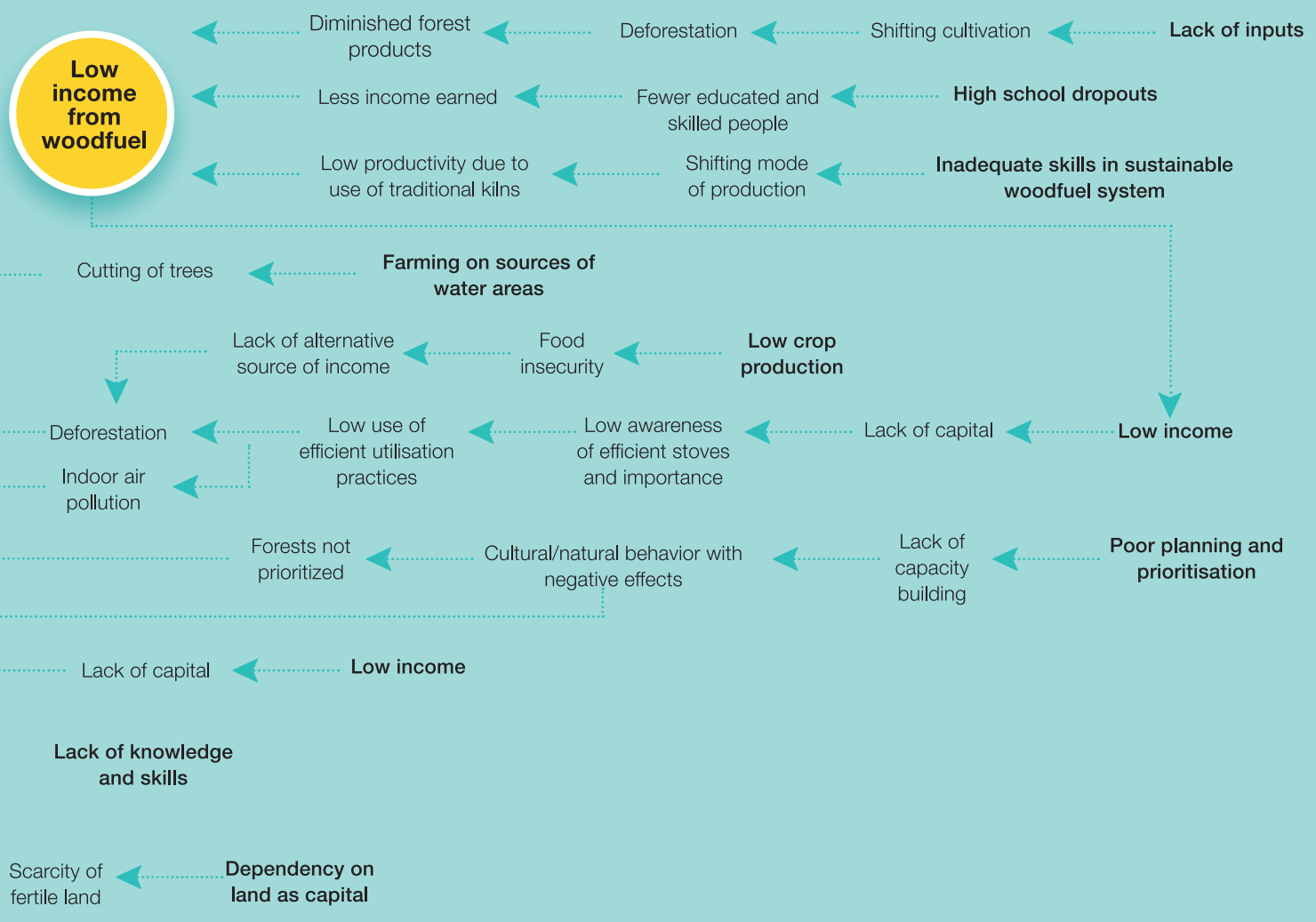
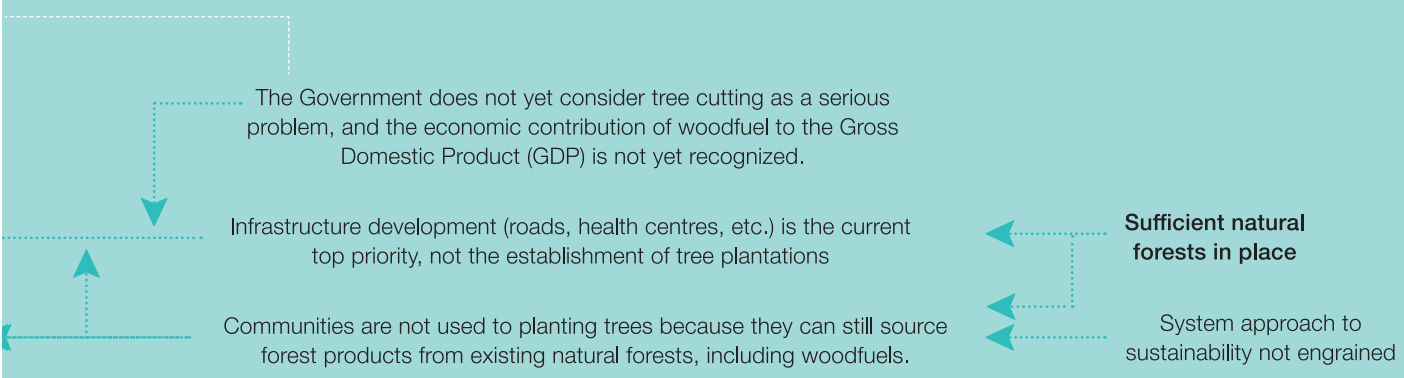
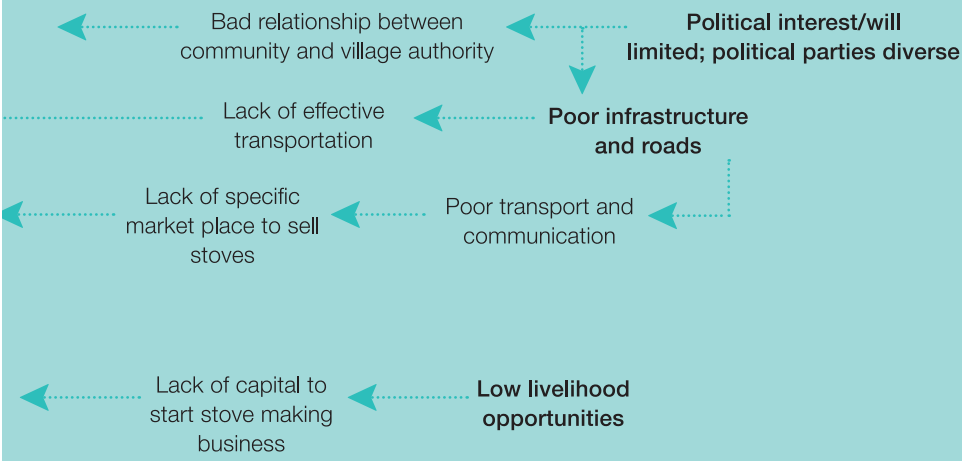
		CHANGE/TREND	EFFECTS	EFFECTS BY 2030
<b>WOODFUEL SYSTEM</b>	<b>Harvesting methods</b>	⊕ Introduction of new technology in harvesting (chain saw) and improved accessibility	Due to harvesting of many trees in a short period of time	<ul style="list-style-type: none"> <li>• Drought</li> <li>• Desertification</li> <li>• Disappearance of water sources</li> <li>• Water use conflicts</li> </ul>
	<b>Processing technologies</b>	⊕ Low uptake but slowly growing to share knowledge on modern kilns		<ul style="list-style-type: none"> <li>• Reduced local ecosystem degradation</li> <li>• Efficient production processes with the progression to modern kiln technology</li> </ul>
	<b>Transportation of woodfuel</b>	⊕ Transportation changes (motorbike and trucks in urban areas and motorbike and bicycle in rural areas)	<ul style="list-style-type: none"> <li>• Huge increases in urban demand and use of motorbikes for transport.</li> <li>• Large volumes of charcoal and woodfuel transported to urban areas.</li> <li>• Increased access to forest and demand of urban consumers being met has led to rapid increase in rates of deforestation.</li> </ul>	
		⊖ Large quantities of woodfuel can be transported by motorbike and bicycle, and more areas of forest (including protected forest areas) are accessible illegally by motorbike leading.		
⊕ Increase in job creation for motorbike drivers and bicycle transporters				
<b>Home energy use and cooking technology</b>	⊕ Transition from using more wood for three base stone cooling stoves to use of brick built stoves, and modern charcoal and gas stoves, up to 60% in urban areas.	<ul style="list-style-type: none"> <li>• Health impacts from air pollution within households, and burden of labour for carrying and fetching firewood for women.</li> </ul>	<ul style="list-style-type: none"> <li>• Reduction in over dependence of fuel wood and use of alternative energy forms electricity, gas and improved cooking technologies.</li> <li>• Women's empowerment with increased time (less time spent sourcing wood and cooking) for other income earning and child care activities.</li> </ul>	
	⊖ Use of improved cook-stoves not widespread. Many households still use three stone stoves and depend entirely on woodfuel			
	⊖ Lack of adequate access to alternative sources of energy to woodfuel			

⊕ positive change    ⊖ negative change    ⊕ neutral change



Figure 13: The results of the root cause analysis completed with participants.





# Action plan

based on the results of the stakeholder-driven participatory context analysis and planning approach for the three coastal regions

The rapid rate of deforestation, primarily caused by demand and reliance on woodfuel for energy needs, both in rural and urban areas in Tanzania, means addressing sustainability from a system perspective is a priority.

## 3.1 Sustainable action planning

At the opening of the workshops, baseline perceptions on sustainability were gathered to understand perceptions and mental models regarding sustainability before undergoing targeted SHARED exercises on sustainability planning.

A participatory exercise allowed stakeholders to move to a designated 'station' agreeing or disagreeing with the statement 'Is the woodfuel system sustainable?', followed by an interactive plenary discussion to capture the viewpoints and ideas on sustainability.

Positive viewpoints on sustainability centred around rules, laws, policy and regulations in place to govern the system. However, the lack of adherence to laws, limited land planning and resultant destruction of natural forests meant that the key perception is that the system is currently unsustainable. The core reasons for unsustainability, the effects of these factors and overall impacts being seen are described in Table 2.

## 3.2 Defining sustainability

A capacity building session on sustainability described sustainability across four key dimensions: economic, social, environmental and institutional. Participants within the workshops were prompted to define each dimension, describing examples in the context of the woodfuel system. Aspects within the woodfuel system that need to be addressed to achieve sustainability are provided in Figure 14.

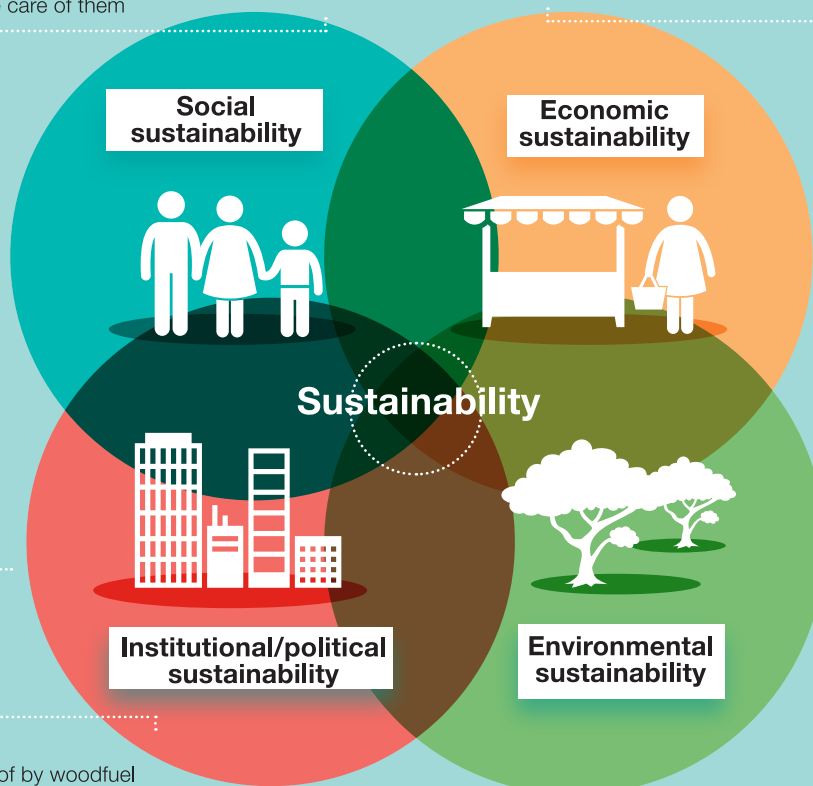
Table 2: Analysis on whether current system is sustainable

Reasons the system is not sustainable	Effect	Impact
<ul style="list-style-type: none"> <li>• Economic poverty among communities</li> <li>• Low awareness among communities on sustainability issues</li> <li>• Harvesting and processing practices are not efficient</li> <li>• Communities do not adhere to government regulations</li> <li>• Low awareness and education (high unemployment and poverty rates)</li> <li>• Low enforcement and corruption issues related to officers in implementation</li> </ul>	<ul style="list-style-type: none"> <li>• Forests are diminishing at a very alarming / high rate</li> <li>• Deforestation</li> <li>• Excessive destruction of forest</li> <li>• Soil erosion</li> <li>• Low quality soil and extensive degraded landed</li> </ul>	<ul style="list-style-type: none"> <li>• Climate change -frequent droughts, floods</li> <li>• Shifting cultivation practices due to low productivity</li> <li>• Illegal harvesting</li> </ul>

Figure 14: Aspects within the woodfuel system that need to be addressed to achieve sustainability

- Users to minimize domestic fuel amounts used in charcoal stoves and firewood open fires
- Awareness on energy-saving stoves and utilization
- Stakeholders should be educated on how to conserve the environment and water resources
- Publicity of good utilization and enhancement of sustainable practices
- Dialogue with the key stakeholders in the charcoal business
- Woodfuel is socially acceptable by communities
- Beliefs that certain tree species should be conserved hence communities take care of them

- Introduction of modern agroforestry agricultural activities
- Alternative livelihoods and income sources to reduce pressure on trees
- Alternative activities such as cash and food crops to earn money to pay for alternative sources of fuel such as gas
- Poverty alleviation through job creation
- Prioritization in the national budget to address forestry issues
- Education and training for charcoal producers
- Modern and efficient kilns to produce more charcoal hence more income



- Preparation of by laws
- Awareness and training of by woodfuel regulations
- Training communities on how to raise awareness
- Certification of woodfuel system production, transport and marketing
- Increased access through subsidies for other fuel types
- Charcoal should be weighed according to its volume and not its kilograms
- Reduction of long procedures / processes of obtaining transport pass

- Modern technology for charcoal production
- Increased tree plantations close to demand for example schools and prisons
- Training and replanting of trees
- Afforestation program
- Practicing agroforestry
- Avoid cutting trees near water sources
- Influencing people to plant new trees to replace the old one or those cut down





- Sustainable harvesting of woodfuel and establishment of forest plantations for woodfuel
- Resource assessment, inventory and harvesting plan for every district
- Enhancing knowledge on impact of deforestation to take urgent action
- Regional government to establish by-laws about tree harvesting
- Modern farming and soil and water conservation for cash crops and vegetable gardens



### 3.3 Barriers to achieving sustainability

The table below shows barriers to achieving sustainability.

Table 3: Barriers to achieving sustainability in woodfuel systems



















 <b>Harvesters</b>	 <b>Processors</b>	 <b>Transport and marketing</b>	 <b>Consumers</b>
<ul style="list-style-type: none"> <li>• Political interference in laws governing utilisation of trees</li> <li>• Lack of funds and attribution on who is responsible for raising awareness</li> <li>• Insecure land tenure systems, may lead to unsuccessful forest management</li> <li>• Lack of trained personnel to develop land use, harvesting and management plans</li> <li>• Climate change (wind, drought and reducing rainfall)</li> </ul>	<ul style="list-style-type: none"> <li>• Traditional beliefs which cause resistance to the adoption of new technologies and processes for producing cleaner woodfuel. This is especially evident in areas deeper within rural areas.</li> <li>• Cost implications of modern kilns</li> </ul>	<ul style="list-style-type: none"> <li>• Unreadiness for change as a result of newly established by-laws</li> <li>• Preference for cash crops plantations versus investing in tree plantations (eg cultural influence and knowledge in Mtwara favours cashew nut plantations)</li> <li>• Poor infrastructure like forest roads and river bridges, which is a barrier to achieving a sustainable woodfuel system</li> </ul>	<ul style="list-style-type: none"> <li>• Unaffordability of other sources of energy including availability in rural areas</li> <li>• Poor availability and promotion of alternative sources of energy e.g. gas stoves</li> <li>• Improved stoves are sold at a high price that most of the people are not able to buy</li> <li>• Knowledge/experience of use; stoves, gas, solar energy need to be used but not all the people have the knowledge and other areas have no electricity</li> <li>• Low knowledge in efficient woodfuel consumption</li> </ul>
<b>Across the system</b>			
<ul style="list-style-type: none"> <li>• Financial barriers and lack of funds</li> <li>• Low level of government prioritisation on woodfuel</li> <li>• Lack of willingness to change as a result of newly established by-laws</li> <li>• Political changes</li> <li>• Lack of skills and education on sustainable woodfuel production</li> </ul>			

### 3.4 Integrated livelihood planning

In addition to intervention planning directly within the woodfuel system, an understanding of the woodfuel system being within the wider processes of the supporting landscapes and livelihood functions was stressed with stakeholders throughout the consultations. Through an interactive session on a systems approach, recommendations for integrated livelihood and landscape planning were undertaken. The result of this was targeted recommendations for the promotion of alternative livelihood opportunities that can be pursued

across the coastal ecosystem region, to reduce the dependence on woodfuel-related livelihoods as the primary source of income and employment. Key reasons livelihood transitions are currently not happening include inadequate training, limited budget at secretariat and local government for this, unreliable farming and local climate (rainfall) to support sustainable small-scale agriculture. Consequently, the promotion of alternative livelihoods needs to consider these existing barriers within the three districts hampering livelihood promotion.

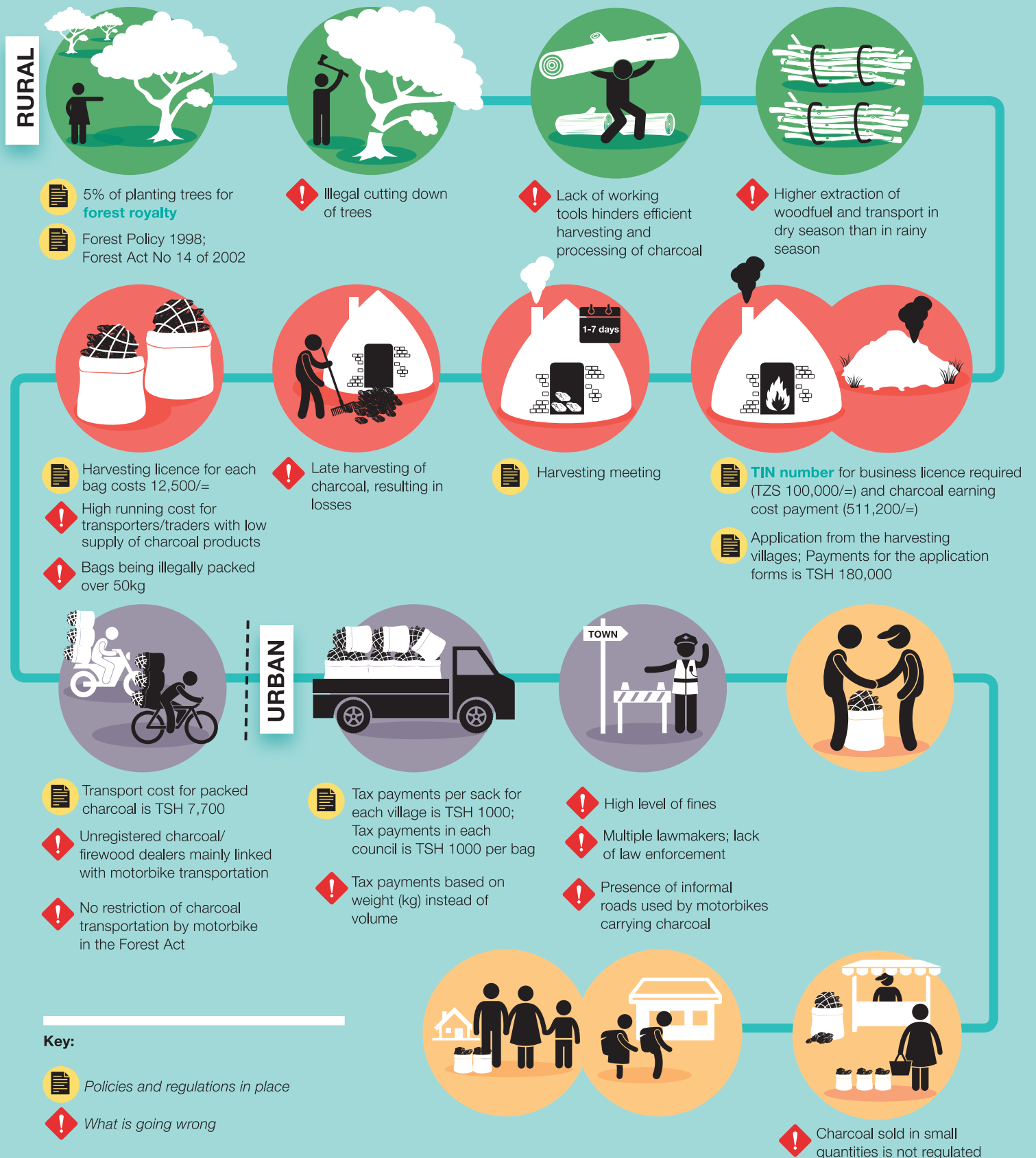
Table 4: Alternative livelihood options outlined by stakeholders

	Alternative livelihood options	Requirements
<b>Harvesting</b> 	 Bee keeping – management by households and extension officers	Capital – to buy hives, processing equipment
	 Food crops (cassava)	
	 Cash crops (cashew nuts)	Extension to create awareness
	 Agriculture inputs – certified seeds and fertilisers and pesticides	
	 Small stock farming e.g. local chickens	Farm implements, vaccines, loan programs
	 Fish farming	Training and provision of fish fingerlings
	 Harvesting of non tree forest products (NTFPs) (mushrooms, fruits, medicines)	Extension to create awareness
	 Introduction of fast growing multi-purpose tree species e.g. for timber	Wood lot establishment and tools for on-farm
	 Introduction of agroforestry	
<b>Processing</b> 	 Fuel briquette making	Capital for purchasing machines
	 Marketing strategies	
<b>Marketing</b> 	 Selling of alternative energy sources (gas, kerosene)	Provision of subsidies
	 Alternative small business opportunities	Education and entrepreneurial training
	 Establishment of women's groups	
	 Introduction of loans to improve access to capital	

### 3.5 Regulations in the woodfuel system

The figure below illustrates the woodfuel system and perceptions from the stakeholder engagement on policies and regulations that are currently not being adhered to and need to urgently be addressed as key issues.

Figure 15: Regulations in place across the woodfuel system as outlined by stakeholders





## Case study on charcoal policy regulations

### Described by:

Twahiry Hussein Mmwiry +255 672509062, Email: tmmwary@gmail.com District Forest Officer, Rufiji.

Hussein Mohamed Tingi: +255 784322465, Email: tingehussein60@gmail.com. Charcoal trader at Kibiti and Rufiji Districts.

### Background

Charcoal producers pick an application form (FD1.) at a fee of Tsh180,000 from the District Forest Office (DFO) make an application to the Village Committee for harvesting of charcoal and pay Tsh50000-200000 per year as its negotiated as for charcoal or for firewood. The applicants are people from the village so that they feel responsible in conserving trees. The Village Committee makes the decision on whether to issue or not. The Village Committee has designated areas for crop production, tree harvesting, charcoal production, tree conservation and trees that can be harvested for charcoal in collaboration with DFO. Tree species that are mainly harvested for charcoal include mseni and Mgunga while Dalbegium should not be harvested as it is protected. The Village Committee then forward the application forms to DFO. The form shows the name, photo, village, forest, number of bags for charcoal and cubic metres for firewood. Once the producer or trader is licensed they are requested by the Village Committee to make some contributions to support development in the village as need arises.

The approved form is then forwarded by the DFO to the District Harvesting Committee. The District Harvesting Committee is comprised of District Commissioner who serves as the chairperson, DFO as member, District Executive Director as secretary and village chairpersons. The District Harvesting Committee goes through all the applications from the villages and if the applications have too many number of bags or too many applicants than an area can supply reductions are made. The call for applications to be submitted are supposed to be made in July but sometimes are delayed and made in October. It takes about a week to one month for the permits to be ready.

Once the applicants receive letters from the District Harvesting Committee with approved forms showing amount of charcoal or firewood to harvest they then make an application for registration as a charcoal or firewood producer with Tanzania Forest Services (TFS) at DFO at a fee of Tsh261,000 per year. The registration form shows the details of the producer and the person who will be assisting in transportation. The producer also registers the business with District Trade Office (DTO) and get an annual license at Tsh100,000. The producer or trader also pay Tanzania Revenue Authority (TRA) Tsh512,000 per year. The applicant acquire license for charcoal production and firewood production at DFO and this license is valid for 30 days and takes a few minutes to acquire at a fee of Tsh 6500 per metre cubic of wood for firewood and Tsh12,500 per bag of 50kg to Tanzania Forest Service (TFS), another 5% of this payment is made to Tanzania Forest Fund (TaFF) and another Tsh1000 per bag to District Council and to the Village Committee Tsh1000 per bag.

To transport charcoal and firewood one requires a transit pass at a fee of Tsh7700 per lorry of 7 tonnes through the DFO. The transit pass shows date of issue, license number, number of bags, source and destination, vehicle number, expiry date. The transporter must show the license of the charcoal producer's legal document.

The charcoal and firewood selling stores are registered with TFS and have commodity-based trade license at a fee of Tsh261,000 per year. The stores have a ledger book that shows details of suppliers, name, license number for production, name of transit pass and vehicle number, origin of the charcoal, number of bags transported, date of arrival of the goods.

The documents that a charcoal trader requires include

- Registration as a charcoal producer with TFS at the respective DFO valid for one year
- Business registration license by DTO valid for one year
- Revenue payment to TRA
- License for charcoal production valid for 30 days with TFS at respective DFO
- Transit pass per trip with TFS at respective DFO
- Business trade license to TFS at respective DFO

### Challenges

- Delay in issuing of the production license from the District Harvesting Committee and are out sometimes in October. The government annual year starts in January and hence charcoal producers have about three years of trade before paying the revenue in January. The revenue fee to TRA of Tsh512,000 per year irrespective of the number of bags and sometimes charcoal producers may trade few bags.
- Payments are made based on kg while trade is in bags.
- Poor charcoal producers are unable to pay for the required fee for legal documents and their charcoal is confiscated. The confiscated charcoal is auctioned and the funds go to TFS.
- There are no formal systems for advancing loans for charcoal trade.

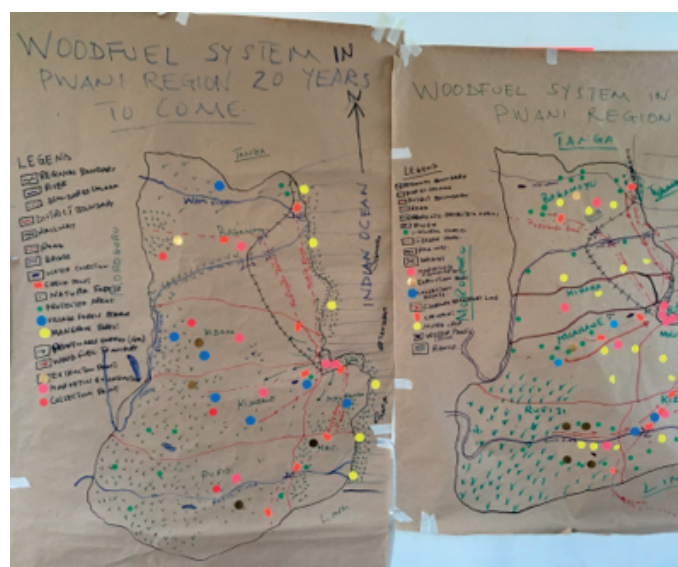
### Recommendations

- Need for a uniform charcoal bag in the country
- Ease and shortening of time in assessment of allowed weights



# Mapping natural resource areas

In facilitated exercises, communities mapped their area indicating past, present and future woodfuel systems. The future outlooks were mapped for the year 2030 and integrated suggested intervention outcomes from the workshops, including rural-urban flows. In this way, trends in woodfuel systems were developed.



(Top) Figure 16: Participants in Pwani mapping out proposed woodfuel system for 2030

(Above) Figure 17: Woodfuel for the current system and 2030 in Pwani developed during the workshop

Figure 18: Current (top) and 2030 (below) context for Mtwara

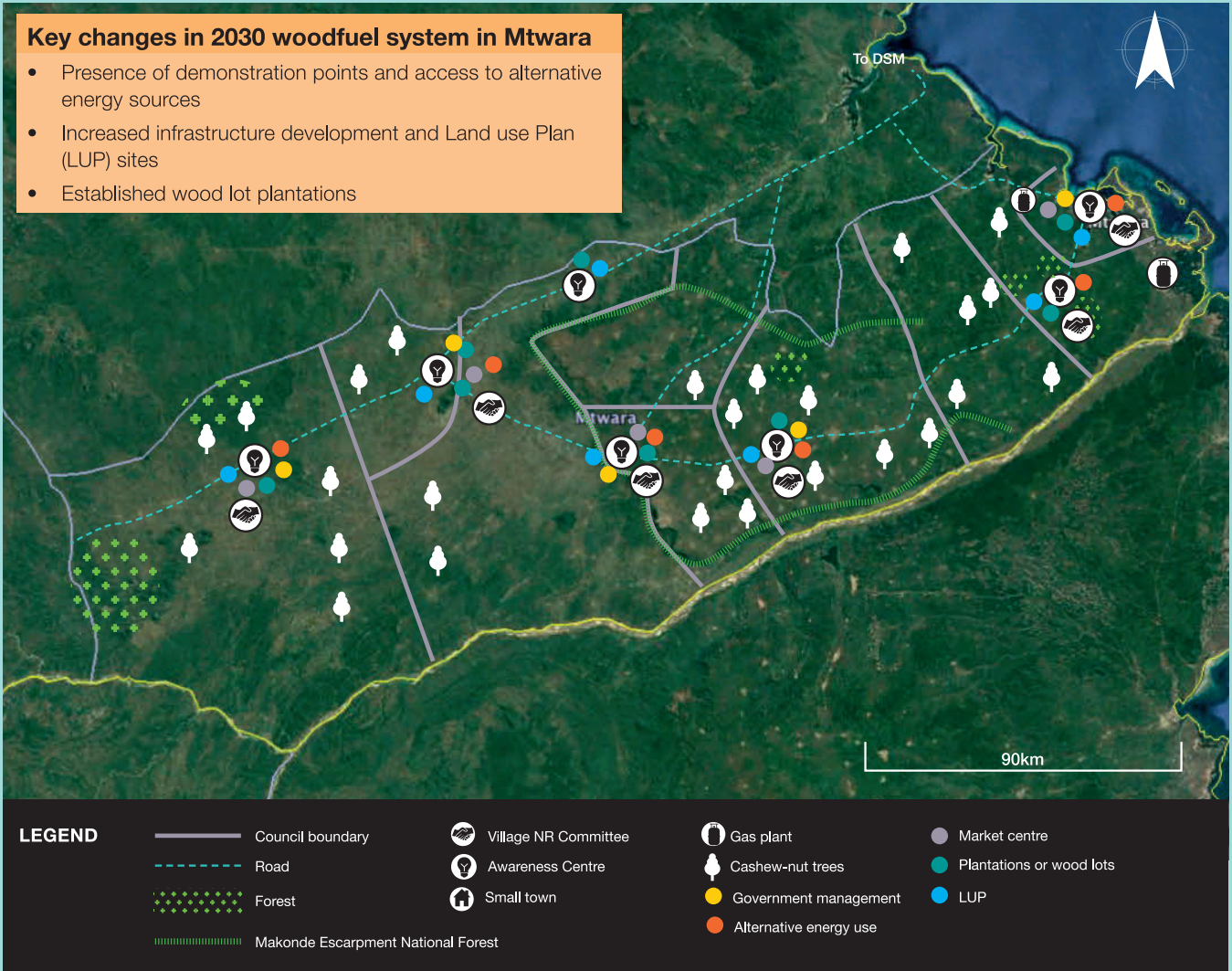
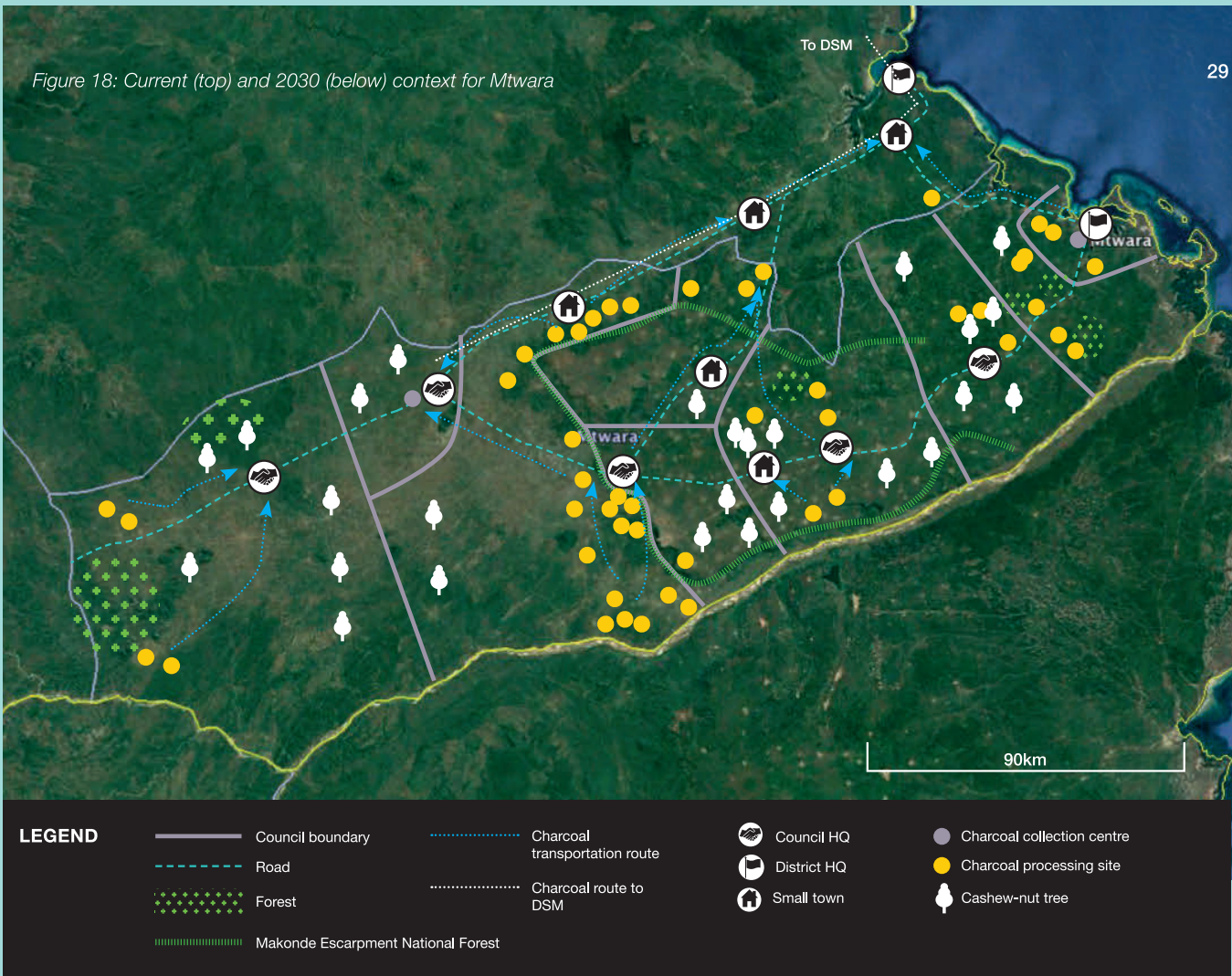
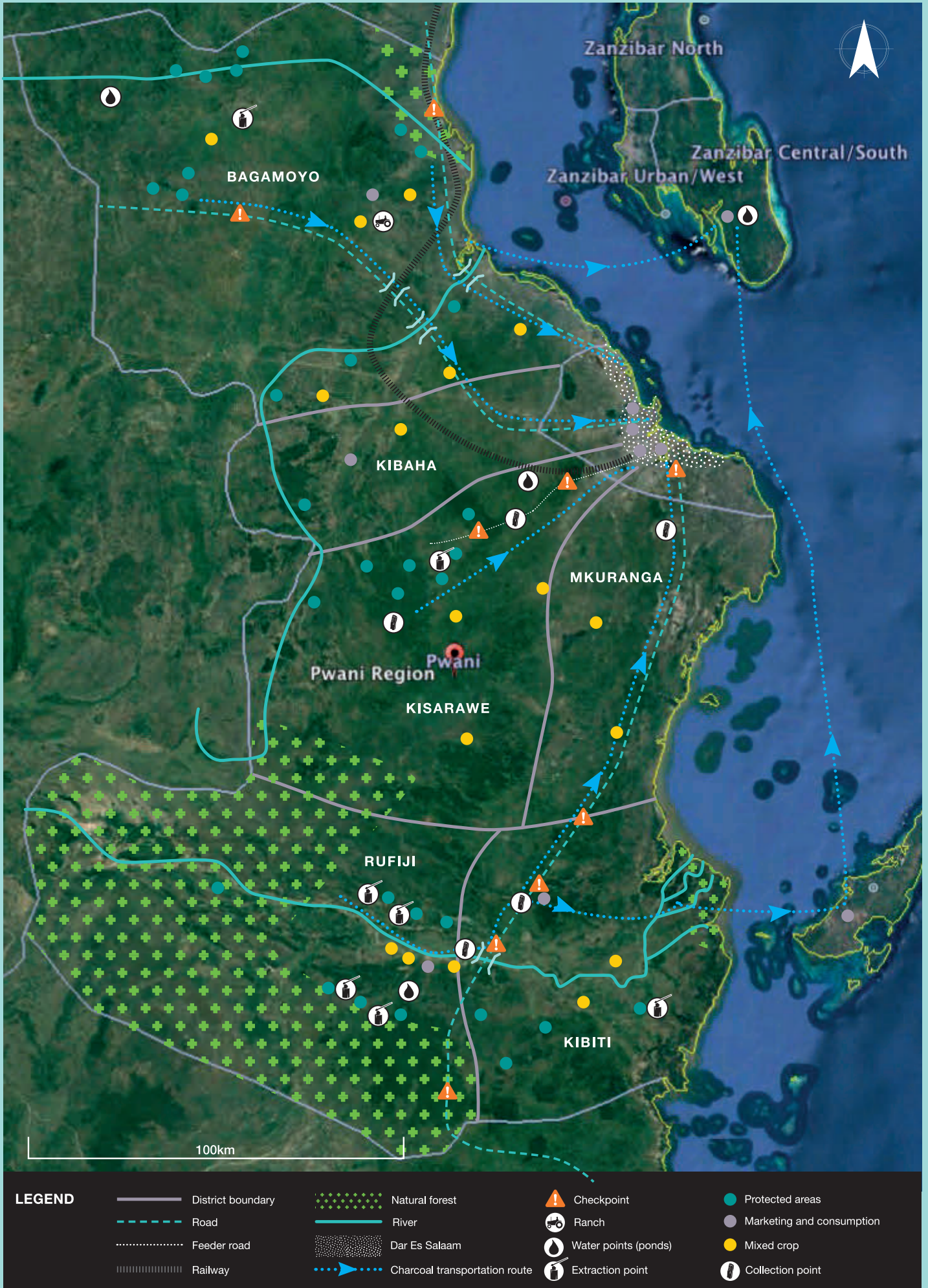


Figure 19: Current (left) and 2030 (opposite page) context for Pwani



**LEGEND**

- District boundary
- Road
- Feeder road
- Railway
- Natural forest
- Dar Es Salaam
- Charcoal transportation route
- Checkpoint
- Ranch
- Water points (ponds)
- Extraction point
- Protected areas
- Marketing and consumption
- Mixed crop
- Collection point

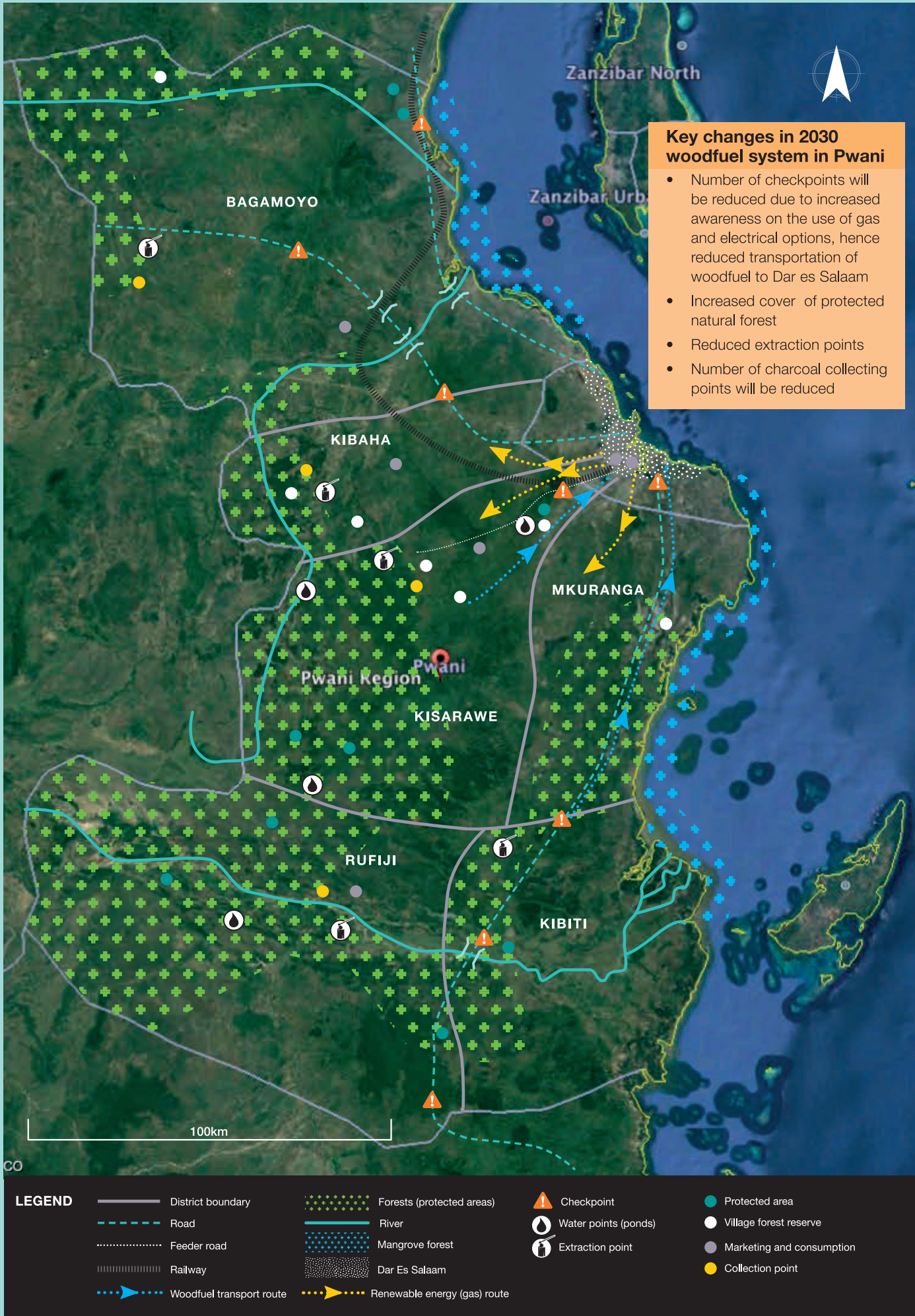
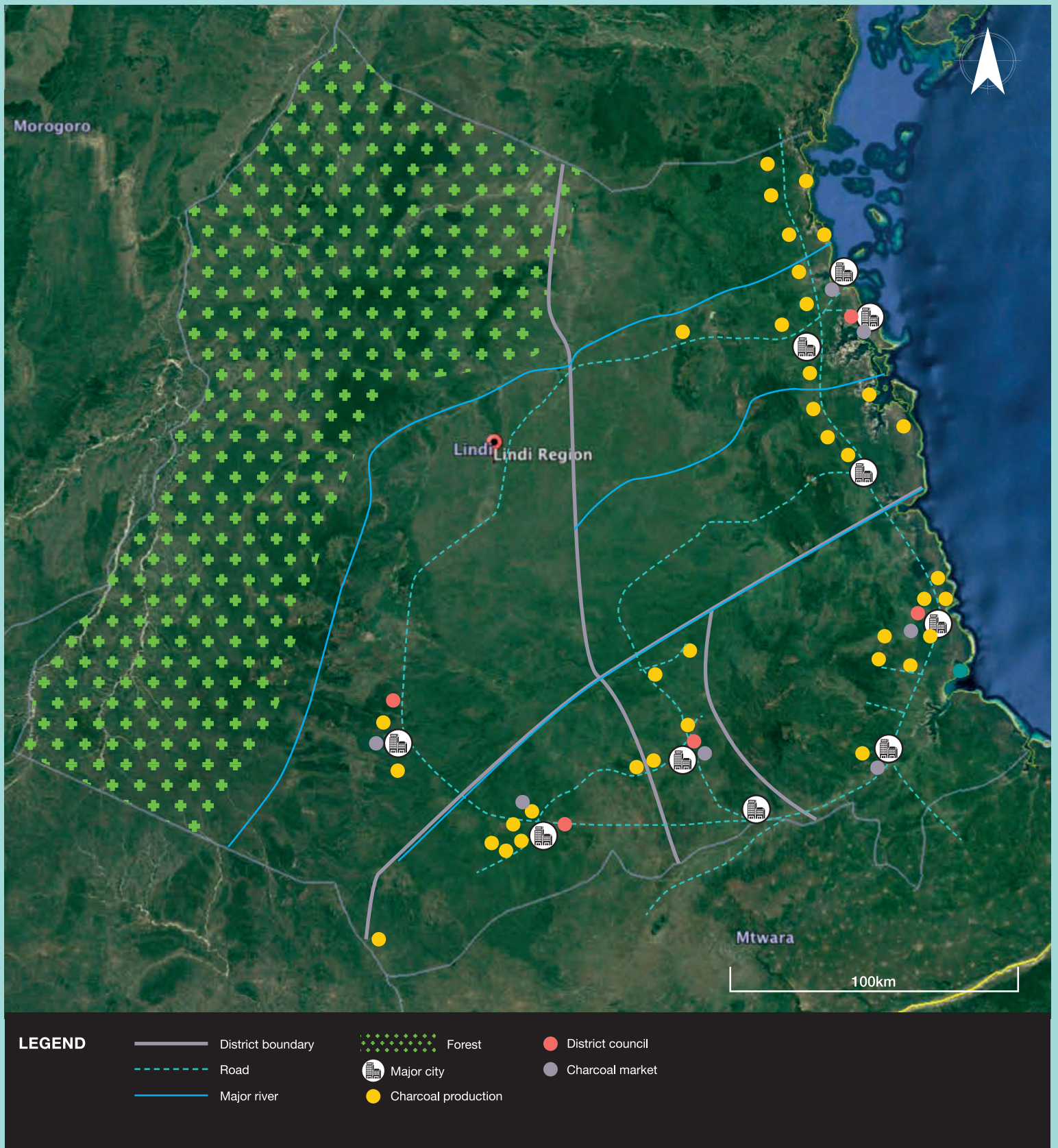
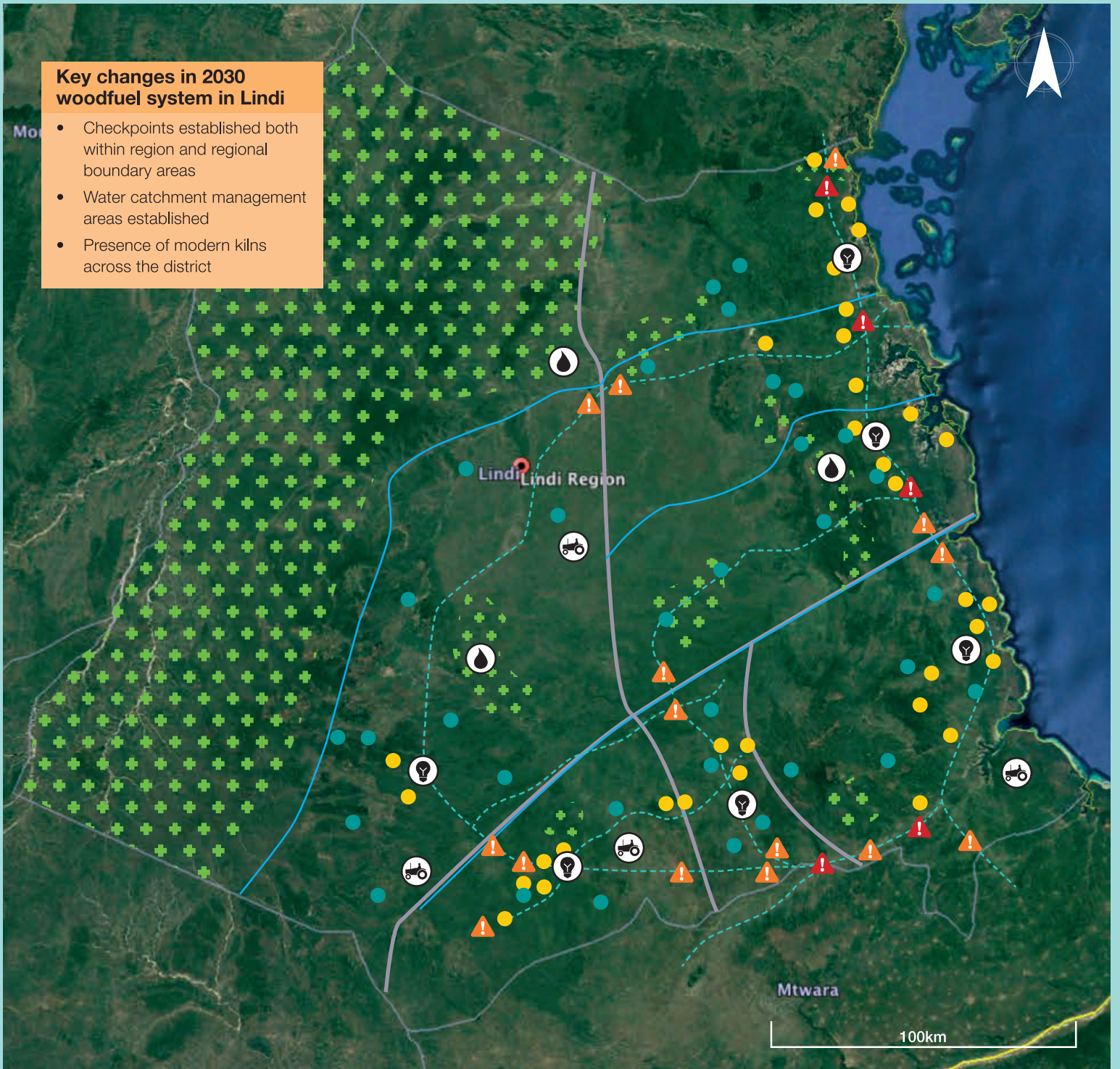


Figure 20: Current (left) and 2030 (opposite page) context for Lindi



**Key changes in 2030 woodfuel system in Lindi**

- Checkpoints established both within region and regional boundary areas
- Water catchment management areas established
- Presence of modern kilns across the district



**LEGEND**

- |                   |                     |                            |                                 |
|-------------------|---------------------|----------------------------|---------------------------------|
| District boundary | Forest              | Awareness centre           | Croplands (subsistence farming) |
| Road              | Checkpoint (FS)     | Large-scale farming        | Modern kiln                     |
| Major river       | District checkpoint | Water catchment/shed areas |                                 |

# Priority feasible interventions and implementation strategy

for sustainable woodfuel systems in both rural and urban areas in the coastal region of Tanzania

## 5.1 Participatory prioritization of feasible interventions

Drawing from the participatory context analysis, using the woodfuel framework working groups brainstormed on intervention options for making woodfuel systems sustainable (Table 5). Through participatory voting, these intervention options were prioritised and planned out

in detail. The planning guided stakeholders to critically evaluate why the interventions were required, who would benefit within the woodfuel system, including how the intervention addressed sustainability dimensions and key stakeholders and roles within the proposed interventions.

Table 5: Identified interventions for making woodfuel systems sustainable

Pwani	Lindi	Mtwara
Using fuel from alternative source of biomass e.g. sawdust, organic waste	Use of alternative sources of biomass energy such as briquette made from sawdust, charcoal dust	Use of alternative sources of energy and awareness campaigns
Provision of subsidy on alternative sources of energy	Awareness on effective transporting and marketing for the community	Awareness creation on sustainable woodfuel
Awareness / education on benefits of energy efficient stoves	Use of modern kilns	Awareness on forest policy, laws, regulation
Introduction of modern kilns	Training on improved cookstoves	Carrying out a land use plan
Production of energy saving stove	Conduct exhibitions / shows on improved cookstoves	Formation of village natural resource committees
Forest Act Review	Improved processing of charcoal by sharing experiences	Encourage use of forestry plantation
Tree Planting	Land use planning	Effective governance and management
Reduced price of gas cookers by the government	Use offcuts from timber harvesters for making charcoal and briquettes	Availability of permanent marketing centres
Working facilities for effective control and regulation – weighing scales, database	Identification and registration of harvesters and charcoal producers	Ease of access to transport permits and transit passes
Facilitate alternative livelihoods	Establishment of farm trees	Government loans to producers of stoves
Technical knowledge and working tools for harvesters	Formation of formal groups of woodfuel production	Provision of market centre
Establishment of tree plantations / wood lots	Improvement of rural road infrastructure	Enhancing communication and transportation





Figure 21: Participants in the Lindi workshop assessing land degradation and vegetation cover maps.



## 5.2 Proposed interventions for sustainability in harvesting and sourcing of wood for woodfuel

### 1 Land Use Plans

The intervention focused on dedicated Land Use Plans across all villages. For example in Pwani in Kisawawe district on 33 out of 69 villages have land use plans. Land use plans to clearly designate the areas of Government managed forest and communal forest land and to clearly designate areas where harvesting is allowed. Land use plans to focus on agriculture, livestock farming and settlements. In managing land use, it allows for specific plantation and re-planting areas to be designated and reforestation schemes within community areas. The land use plans are to be managed by village councils, with district facilitation team to supervise the implementation. To achieve the vision 2030 for sustainable woodfuel systems, there is need to include management of other activities in the landscape such as livestock grazing, land clearing for agriculture.

### 2 Forest Act Review

The Forest Policy was developed in 1998 and the Forest Act came into place in 2002. It has been almost 20 years since the policy was developed and many of the legalities and regulations are out of date. Key issues such as transport modes and carrying of woodfuel products by motorbike are not mentioned within the Act, despite this being a major means of transport. The Act needs to be urgently reviewed to take into account the current situation.

### 3 Cross-sectoral policy development for the woodfuel system

Integrated policy on agriculture, livestock and natural resources to address linkages in the woodfuel systems to be developed by 2030. This requires facilitated policy dialogue, analysis of the current policies and gaps, and building cross-sectoral synergies.

### 4 Formulation of village natural resources committees (VNRC)

At the village level, the VNRCs have a crucial role in local level management and enforcement of regulations, especially around harvesting and forest access. In addition, they are the first on hand to deal with disputes around the implementation of by-laws and a strong VNRC can have a significant impact on the status of forest conservation and creating the buy-in at the community level for sustainable woodfuel systems. The VNRCs, if present across many communities ensure engagement of stakeholders and the community in decision-making.

### 5 Tree planting awareness

A key intervention required is for tree planting to be carried out, and this activity could be carried out by harvesters. As harvesters and stakeholders sourcing the wood, they have the closest link and best knowledge of forest areas. Incentives and sensitisation on the importance of tree planting needs to be carried out. This could be linked to national tree planting days, but also to be popularised at village level for example through songs and local sayings that encourage when one tree is cut to plant two more. Key stakeholders would be VNRCs and community leaders, as well as at district and national level for a strong communication and social strategy to have national tree planting days throughout the year.

### 6 Tree planting campaign

- Initiate a national campaign for tree planting, for example linking tree gifting culture with wedding ceremonies and birthdays.
- National target of 2,000,000 trees each year
- Potential for payment of 5% of total royalties for business earnings from the woodfuel sector to be put into tree planting.



## 6 Establishment of tree nurseries

Tree nurseries, with appropriate species for the local context need to be established, with clear business models and access to seedlings, technical knowledge and specialised tools required as well as training. Larger scale forest plantation and wood lots also need to be established to be run and managed by TFS. In order to establish nurseries, demonstration plots and provision of technical support as well as inputs like tree seedlings and polythene tubes are needed. In addition to formal nurseries promotion of agroforestry systems within farms is necessary.

## 7 Tree production for woodfuel

Increasing number of plantations and adoption of agroforestry systems in homesteads. For instance through planting fast-growing tree species that do not affect water availability in soils within homesteads and in plantations. It is anticipated that this will also increase diversity of species within farms and forests.

## 8 Awareness raising

Widespread awareness raising, education and communication is needed across the woodfuel system, but specifically on sustainable harvesting of woodfuel where awareness on deforestation impacts and sustainable solutions is very low. Facilitated technical knowledge transfer, through community workshops, demonstrations, meetings and group discussions. Key gaps for awareness raising include forestry policy, regulation, by-laws and sharing knowledge on where forest reserve exist and options for community management.

## 9 Open-land protection

Creating awareness on protecting open land where deforestation is occurring. Key stakeholders to be involved include village councils, village environmental committees, farmers, livestock keepers, consumers

## 10 By-laws

Have established by-laws implemented at local authority level, which requires intensive capacity building and resources for village committees. Organisation and leadership for this needs to come from Tamisemi – Regional Administration and Local Government, Local Authorities and NGOs to facilitate capacity and awareness raising.

## 11 Facilitate implementation of options for alternative sources of income / livelihoods

In order to address a future sustainable woodfuel system, alternative livelihoods away from wood harvesting need to be encouraged and a wider approach to rural transformation. This requires technical knowledge and development partners and local government to engage in demonstrating and promoting alternative livelihood options and to assist with access and loans for materials.



(From far left to right) Figure 22: Transport of wood for charcoal processing; Figure 23: Mohoro checkpoint; Figure 24: Transported charcoal.



## 5.3 Proposed interventions for sustainability in processing within the woodfuel system

1

### Subsidised use of off-cut material for making charcoal: Introduction of technology on alternative sources of fuel

The intervention is based on the use of off-cuts and alternative material, instead of raw wood products in charcoal making. This requires diversifying material for processing and use of sawdust and briquettes. Competing uses of waste material, for example sawdust as a fertiliser need to be understood in specific areas before promoting the intervention. Control and overseeing of the process would be done by district council to enforce use of offcuts and limit cutting of new trees. The TFS would be engaged in awareness raising and linking timber producers with charcoal producers. Village committees' (VNRCs) role would be monitoring collection of offcuts and use in charcoal production.

This intervention links closely with the need for awareness raising with consumers on sustainably produced charcoal and the benefits of avoided deforestation through current practices of charcoal production using trees. Land zoning will allow clear delineation of land rehabilitation areas and for harvesters to be easily identified and access managed within land use zones. The key stakeholders to manage the intervention include VNRCs, and district councils to facilitate land use planning and the central government via the National Land Use Planning Commission (NLUC) to approve land use plans and policy development. Additional benefits include the culture of reuse and recycling waste which will be taken up by the community.

2

### Use of modern kilns

Improved kilns will increase production yields and reduced costs, Government could train and manufacture kilns (SIDO, VETA), politicians should contribute to minimization of cutting of trees in order to maximise production of charcoal, Government, NGOs e.g. WWF, need to support with funding and awareness raising through charcoal makers (entrepreneurs), NGOs and community, Government royalties. Benefits include reduced production losses, increased efficiency and charcoal recovery, stable ecosystems and reduced deforestation and degradation

4

### Identification and registration of charcoal producers

The aim of the intervention is to establish a management and control system that ensures enforcement of regulations transparency. The foreseen benefits are an efficient system for collecting revenue by the local and national government and to ensure fair incomes to charcoal producers. In addition, the registration will allow closer control on access and number of harvesters in a specific region weighing it against available biomass resources and longer-term benefits will include enhanced environmental protection.

3

### Training and skills sharing

- Improve processing through experience sharing – sustainable and efficient production
- Charcoal makers who undertake training will enable cultural skills to permeate the community
- Politicians supporting through evidence-based decision-making
- Experienced charcoal makers and NGOs to participate in delivery of the trainings
- Tree harvesters, charcoal producers, traders and users, each could become a key participant in their own right

Identification and registration procedures should be carried out by village natural resource committee and village council for identification and registration at village level, district council for registration at district level, Tanzania Forest Service to be in charge of the registration and specifically the Forest and Bee Keeping Division (FBD) to help in overseeing adherence to the guidelines and regulations.



## 5.4 Proposed interventions for sustainability in transport and marketing within the woodfuel system

### 1 Awareness creation on the issue of transport and marketing

Working facilities to be put in place for clear control and monitoring of transporters, volumes carried and movements. Key facilities include weighing bridges, scanners, scales and assessment of transport routes including illegal movement of charcoal by transporters using motorbikes. A control system and awareness raising will improve government revenue collection, and extraction records and enable TFS to manage independent audit at control stations.

### 2 Support improved transport

Improvement of rural road infrastructure will allow ease of accessibility to markets. Key stakeholders to lead the intervention would be the Tanzania Rural and Urban Road Agency (TARURA). Ease of access to transport permits and transit passes from authorised offices will also improve the use of the road infrastructure.

### 3 Availability of permanent marketing centres

Key stakeholders to implement would be district councils and engagement of charcoal traders.

### 4 Encouragement on formation of formal groups of woodfuel production to link with financial institutions

Key stakeholders to manage the intervention include district councils, village councils, community, LGAs, NGOs, TFS.



## 5.5 Proposed interventions for sustainability in consumption and use of woodfuel products

### 1 Alternative sources of energy

- Provision of subsidies on alternative sources of energy (gas, solar, electricity) to help community afford and buy alternative sources of energy
- Support by government and partners through removal of taxes and financial support to producers of alternative sources of energy
- Reduction of price of cooking gas - 90% of people in the community are using charcoal and if they use gas it will reduce the amount of charcoal consumed

### 2 Awareness on benefits of efficient stoves

To educate community on the use of energy savings stoves and their positive impacts, time to repay investment in purchasing the stoves, through lower use of charcoal and firewood there will be less loss of trees, and health benefits from reduced emissions.

### 3 Facilitate local manufacture of energy efficient stoves

Capital and low rate loans to producers of efficient stoves to be managed by the Vocational Education Training Authority (VETA) and supported by the Small Industries Development Organization (SIDO). This intervention will contribute in to reduced volumes of charcoal demand and health benefits in terms of reduced smoke and in-door air pollution from cooking.

## 5.6 Participatory prioritisation of interventions

Each participant was given three dots allowing them to vote for their top three interventions. These were then counted to allow for the priority interventions, as outlined in Table 6. Prioritized interventions include:



**Awareness raising and education:** lessons on sustainable woodfuel systems that include rationale for making woodfuel sustainable; policy issues: permits for production, transport and marketing



**Alternative sources of energy** to add to the options of woodfuel hence a woodfuel + systems/ energy mix. This will reduce demand and prices of woodfuel and potential negative impacts.



**Sustainable sources of woodfuel:** land use plans, plantations and wood lots, tree planting



**Review of Forest Act** (Forest Policy 1998 and Forest Act in 2002) – out of date, review in line with current situation



**Improved woodfuel cook stoves**, and market opportunities for clean cook stoves. This will reduce woodfuel consumption, improved kitchen environment less smoke less soot,



**Woodfuel system link to landscape:** conservation of water catchment areas, addressing climate change, improved livelihoods (people cooking the food they prefer the way they like it, affordable energy, improved health, sustainable urban environments)



Figure 25: Participants carrying out the participatory prioritization of interventions

Table 6: Results of participatory ranking of interventions across the three workshops

Pwani	Votes	Lindi	Votes	Mtwara	Votes
Awareness/education/training (sustainable tree harvesting, modern kilns, improved stoves, regulations, woodfuel system approach)	15	Land use planning	6	Awareness and education/ communication, (e.g. on policy, by-laws, regulations, sustainable woodfuel system)	15
Review of Forest Act (Forest Policy in 1998 and Act in 2002) – review in line with current situation	5	Awareness raising (improved stoves, woodfuel system, sustainable tree production, market opportunities, regulations, permits, taxes)	6	Alternative energy sources plus woodfuel as an energy mix	3
Tree planting (wood lots, plantations, tree nurseries)	4	Use of modern kilns	3	Land use plan	2
Alternative livelihood options (agriculture, fisheries, mushrooms, poultry, livestock)	4	Recovery and reuse of resources to diversify sources of energy	3	Forest plantations/wood lots	1
Affordability/accessibility/availability of gas (cookers, accessories, gas) and alternative sources of energy (electric, solar)	1	Formal groups for sustainable woodfuel formation and registration	2	Support for improved stove producers (loans and capital)	1
Modern technology in charcoal making (kilns, tools)	0	Establishment of trees on farms (e.g. wood lots)	2	Village natural resource committees	0
Effective control and regulations (weighing, scales, database)	0	Rural road infrastructure improvement (village roads are poor especially during the raining season and increases costs of transport)	1	Improved governance and management (access to transport permits and transit passes)	0
Energy saving stoves	0	Capacity development	0	Establishment of marketing centres	0

# Priority communication processes and implementation strategy for sustainable woodfuel systems

One of the strongest recommendations from the stakeholders was the need to raise awareness and educate stakeholders across the whole supply chain on sustainable woodfuel systems.

The table below summarises key stakeholders to be involved and key suggested message formats and responsibilities during communication campaigns.

Table 7: Awareness needs and modes of raising awareness for stakeholders across the woodfuel system

Stakeholder	What awareness is needed?	How to raise awareness and communicate?	Stakeholders to be involved
Tree harvesters	<ul style="list-style-type: none"> <li>• Need for and options for income diversification</li> <li>• Involvement in land use planning</li> <li>• Tree planting</li> <li>• Forest harvesting plans</li> <li>• Sustainable harvesting</li> <li>• Laws and regulations</li> </ul>	<ul style="list-style-type: none"> <li>• Seminars, workshops, training</li> <li>• Meetings</li> <li>• TV, radio</li> </ul>	Central government Politicians Development partners
Community	<ul style="list-style-type: none"> <li>• Effective ways of making charcoal</li> <li>• Replanting and tree planting</li> <li>• Use of alternative sources of energy</li> <li>• Sustainability dimensions</li> <li>• Stages of the woodfuel systems and their linkages</li> </ul>	<ul style="list-style-type: none"> <li>• Trainings, workshops, exhibitions</li> <li>• Brochures, posters</li> <li>• TV broadcastings, video, local radio</li> <li>• Meetings</li> </ul>	Extension officers Councillors WEO VEO
Environmental conservationists	<ul style="list-style-type: none"> <li>• Nursery establishment</li> <li>• Policy</li> <li>• By-laws</li> <li>• Forest management</li> </ul>	<ul style="list-style-type: none"> <li>• Meetings</li> <li>• Brochures</li> </ul>	CBOs DFO TFS NGOs

Stakeholder	What awareness is needed?	How to raise awareness and communicate?	Stakeholders to be involved
Village ward leaders and Village Natural Resource Committees (VNRC)	<ul style="list-style-type: none"> <li>• Policies</li> <li>• By laws</li> <li>• Sustainable woodfuel system</li> <li>• Forest management</li> </ul>	<ul style="list-style-type: none"> <li>• Meetings</li> <li>• Leaflets</li> </ul>	TFS DFO NGOs CBOs
Charcoal makers	<ul style="list-style-type: none"> <li>• Importance of resource sustainability</li> <li>• Improvement of kilns</li> <li>• Sustainable use of woodfuel</li> <li>• Advanced cleaner processing of charcoal</li> <li>• Standard price packaging</li> </ul>	<ul style="list-style-type: none"> <li>• Through village executive officers</li> <li>• Posters</li> <li>• Leaflets</li> <li>• Meetings</li> <li>• Radio, TV programmes</li> </ul>	LGAs, farmer field schools, NGOs, Government centres Charcoal makers DFO DFM
Stove makers	<ul style="list-style-type: none"> <li>• Improved stoves to meet the consumers needs</li> </ul>	<ul style="list-style-type: none"> <li>• Meetings</li> <li>• Demonstration</li> </ul>	NGOs DFO DFM LGAs
Policy makers / government	<ul style="list-style-type: none"> <li>• Policies and laws in place</li> <li>• Understanding implementation of policies and laws</li> </ul>	<ul style="list-style-type: none"> <li>• Training, workshops</li> <li>• Meetings with different sectors</li> </ul>	
Policy makers (agriculture, forestry, natural environment)  Central and local government	<ul style="list-style-type: none"> <li>• Need for integrated policy, approach and interventions for woodfuel system</li> <li>• Clear understanding of rules</li> <li>• Laws and a systems approach to woodfuel</li> </ul>	<ul style="list-style-type: none"> <li>• Email</li> <li>• Phone</li> <li>• Stakeholder meetings</li> <li>• Policy brief, posters, seminars</li> <li>• SHARED workshops, meetings</li> <li>• By-laws and rule handbooks</li> </ul>	LGAs NGOs Central government extension officers Forestry officers
Institutions	<ul style="list-style-type: none"> <li>• Awareness of alternative sources of energy</li> <li>• Tree planting</li> <li>• Natural resource sustainability</li> </ul>	<ul style="list-style-type: none"> <li>• Trainings</li> <li>• Meetings</li> <li>• Radio, TV, Broadcasting</li> <li>• Advertisements</li> <li>• Brochures</li> <li>• School syllabus</li> </ul>	Extension officers CBOs NGOs Teachers
Businesses / entrepreneurs (charcoal traders)	<ul style="list-style-type: none"> <li>• Understanding of the laws</li> <li>• Rules</li> <li>• Regulations</li> </ul>	<ul style="list-style-type: none"> <li>• Trainings</li> <li>• Meetings</li> <li>• Advertisements, brochures, broadcasting, TV, radios</li> </ul>	Extension officers Policy makers NGOs LGAs, development partners, NGOs, CBOs
Extension officers	<ul style="list-style-type: none"> <li>• Training of trainers</li> </ul>	<ul style="list-style-type: none"> <li>• Meetings</li> <li>• Seminars, workshops, in field demonstrations, systems approach</li> </ul>	Representative from each stage of the system with expertise and local relevant knowledge
Processors	<ul style="list-style-type: none"> <li>• Use of improved kilns</li> <li>• Proper packaging volumes</li> </ul>	<ul style="list-style-type: none"> <li>• Workshops, seminars, trainings, demonstrations</li> <li>• Study tour</li> </ul>	Central government, LGAs, Development partners, NGOs
Consumers	<ul style="list-style-type: none"> <li>• Use of improved stoves (woodfuels)</li> <li>• Alternative energy sources</li> <li>• Issues of deforestation and harvesting livelihoods</li> <li>• Legally harvested charcoal</li> </ul>	<ul style="list-style-type: none"> <li>• Trainings,</li> <li>• Photography</li> <li>• Brochures, posters</li> </ul>	Central government, Development partners Social media Politicians

# Design of sustainable woodfuel system training



## 7.1 Training recommendations regarding sourcing and harvesting trees for woodfuel

Topic, contents of training	Target group	Description	Best method of delivery	Contacts for delivery
Effects of forest destruction	Village leaders, harvesters, foresters, NGOs,	Effects of deforestation and skills on reforestation	<ul style="list-style-type: none"> <li>In field training</li> <li>Video</li> <li>Community leaders 'champions'</li> </ul>	ICRAF, TFS, forest extension officers
Identification of harvesting areas and tree species	Village leaders, harvesters, foresters	Site selection, species selection, felling, collection, piling procedures Location of the areas within the forests for suitable species to be harvested	<ul style="list-style-type: none"> <li>Seminars, Workshops, Awareness campaigns</li> <li>Meetings with village natural resource committees</li> <li>Local radio</li> <li>Leaflets and brochures</li> </ul>	Forests, extension officers, political leaders, NGOs Technical advisors from LGAs, NGOs
Awareness of forest rules and regulations	Harvesters and processes, traders, transporters	Identification of areas that need review, in regulations and procedure Explain the forest rules and regulations – not known by harvesters Explain Forest Policy Act and regulations	<ul style="list-style-type: none"> <li>Seminars and SHARED workshops at community level</li> </ul>	Ministry of Natural Resources and Tourism Government, ICRAF, NGOs,



## 7.2 Training recommendations regarding processing

Topic, contents of training	Target group	Description	Best method of delivery	Contacts for delivery
Charcoal making	Harvesters, charcoal processors foresters, NGOs	Improved skills on charcoal processing, unloading, packaging Piling of logs, closing of kiln, lighting the fire Construction and preparation of modern kilns. Local conservation practices in area within and surrounding the kiln after harvesting the charcoal	<ul style="list-style-type: none"> <li>Seminar</li> <li>Video</li> <li>Workshop</li> <li>Participatory training in the field</li> </ul>	Foresters, extension officers, experts (ICRAF)
Improved kilns	Harvesters and charcoal processors	Explain the wastage of woodfuel by traditional kiln and opportunities and benefits of improved technology of modern kilns	<ul style="list-style-type: none"> <li>Field training and demonstrations</li> <li>Video and pictures</li> <li>Seminars at village level</li> </ul>	NGOs with experience and local artisans who make the improved kilns





Figure 26: Participants presenting training recommendations in the Mtwara workshop



### 7.3 Training recommendations regarding marketing and transport

Topic, contents of training	Target group	Description	Best method of delivery	Contacts for delivery
Transport - Infrastructure situation and transport regulations	Transporters	Training on authorised modes of transport and required permits	<ul style="list-style-type: none"> <li>• Mass media</li> <li>• Group meetings</li> </ul>	Authorised officers
Location of the markets	Charcoal traders	Consumer needs for the market and types of bags for transporting e.g. 15kg, 50kg	<ul style="list-style-type: none"> <li>• Meetings with charcoal traders</li> </ul>	NGOs, LGA, authorised officers



### 7.4 Training recommendations regarding use and consumption

Topic, contents of training	Target group	Description	Best method of delivery	Contacts for delivery
Improved cookstoves	Institutions and individuals producing improved stoves, Entrepreneurs, Households Institutions using woodfuel Food vendors	Health and environmental impacts of inefficient woodfuel usage Preparation and manufacturing Utilisation techniques	<ul style="list-style-type: none"> <li>• Seminars,</li> <li>• Photography</li> <li>• Social media campaign</li> </ul>	VETA SIDO Government NGOs Stakeholders
Availability and location of improved stoves	Cooks in households mainly women, Institutions and food vendors using woodfuel	Consumers to know the importance of using economic stoves Ability to identify good quality charcoal Methods to improve kitchen environment	<ul style="list-style-type: none"> <li>• Demonstration within shops</li> </ul>	Private sector

# Appendix

## Workshop participant list

No	NAME	INSTITUTION	EMAIL ADDRESS	TELEPHONE	ROLE/DESIGNATION	AREA OF INTEREST	MAP ID
<b>MTWARA REGION</b>							
1	Mwajuma Mfaume	Charcoal dealer			Charcoal seller	Marketing	1
2	Tozini Azizi Ally	NANYUMBU	uhifadhimazingirakazamoyo@gmail.com	0686 433502	Processor	Processing	2
3	Jane Kajange	Charcoal dealer			Stove maker	Consumption	3
4	Ntuli Sambo	Charcoal dealer			Charcoal seller	Marketing	4
5	Anna Mlaponi	Charcoal dealer			Charcoal seller	Marketing/ consumption	5
6	Saidi Jabu	Charcoal dealer			Consumer	Consumption	6
7	Ally Linjenje	REGION SECRETARIAT	Linjenje77@gmail.com	0783 732015	Processor	Processing	7
8	Machota Masobe	DFO MASASI DC	72machota@gmail.com	0712 469922	Regional Agriculture adviser	Marketing/ processing	8
9	Athuman Hamis	LIVESTOCK OFFICER MTWARA -DC	athumanikarumberia@gmail.com	0689 505056	District forest officer	Consumption	9
10	Fokas E. Mlelwa	DFO NANYUMBU		0784 488 675	District livestock officer	Processing	10
11	Ronald N. Pangah	REGIONAL SECRETARIAT MTWARA	roniimaqamara@gmail.com	0656 045336	District forest officer	Processing	11
12	Issa Naumanga	DAICO TANDAHIMBA	naumangaissa@gmail.com	0658 552808	District forest officer	Processing	12
13	Leodegard Kimario	DAICO NANYUMBU	lamranga@yahoo.com	0753 446868	District Agriculture officer	Marketing/ processing	13
14	Sharafi Makumbila	NEWALA		0788662394	District Agriculture officer	Processing	14
15	Elibariki L. Muriatoi	DFO TANDAHIMBA	elibarikiloserian@yahoo.com	0767 143607	Stove maker	Processing	15
16	Wriggleberth D Mushi	DFM NEWALA	sirmushi@yahoo.com	0766 718049	District forest officer	Processing	16
17	Nurbin Basekangaya	OFM MTWARA	naddbase@gmail.com	0717 567854	District forest officer	Processing	17
18	Alford Mpanda	DAICO NEWALA	alfordmpanda@gmail.com	0714 297422	District forest officer	Processing/ Transporting	18
19	Lukumbusho J Mbwilo	DFO NEWALA	ljmbwilo@yahoo.com	0784 594202	District Agriculture officer	Harvesting/ Processing	19
20	Dr. SUBIRA SIMBEYE	Regional Livestock Adviser	Sub_simbe@yahoo.com	0785 648115	Regional livestock Adviser	Consumption	20
21	Norsbety Cloud	Charcoal dealer			Charcoal seller	Marketing	22
22	Alfred Luanda	RAS	alfredluanda@gmail.com				
23	Amani Rusaka	Ag AASS	amanisaidi@gmail.com	0785 581807			
24	Augustino Mwangosi						
25	Joshua Geoge						
<b>LINDI REGION</b>							
26	Bibie Umbili	Mtengeneza majiko	-	0715 171358	Farmer	Processing/ Transporting	23
27	Muhidin M Mandandu	Liwale WMA	Muhidinimandandi48@gmail.com	0714 595050/ 0758 467853	Secretary (Wildlife management area)	Processing/ Transporting	24
28	Phllimon A chikawe	Mkulima Nachingwea		0716 492866	Stove maker	Consumption	25

No	NAME	INSTITUTION	EMAIL ADDRESS	TELEPHONE	ROLE/DESIGNATION	AREA OF INTEREST	MAP ID
29	Zuhura Makota	DEMO- RUANGWA	lawmp@yahoo.com	0717022547/ 0785967979	District environment management officer	Consumption	26
30	Violeth Byanjweli	DAICO LINDI DC	Vai2009@yahoo.com	0682005486	District Agriculture officer	Marketing	27
31	Hadija Hemedi	TFS Ruangwa	hadijahemedi@gmail.com	0758 145831	District forest officer	Processing	28
32	James Kabutta	Ruangwa District Council	jameskabutta@yahoo.com	0786146011	District Natural Resources officer	Processing/ Marketing	29
33	Raymond A Ndumbalo	Kilwa Dc	Raymbaro@yahoo.com	0787 471212/ 0656268539	District Natural Resources officer	Marketing	30
34	John mkinga	DAICO KILWA	mkingajohn@gmail.com	0784619012	District Agriculture officer	Harvesting/ Processing	31
35	Raphael Ajeri	Nachingwea DC	ajetur@yahoo.com	0716140488/ 0786063556	District Agriculture officer	Harvesting/ Processing	32
36	Joseph Mnanwone	TFS Nachingwea	Denislestie53@gmail.com	0677-452611	District Forest Manager	Harvesting/ Processing	33
37	Husein Mwapili	Lindi Manispaa	Husseinmwapili@aol.com	0712499163	District Agriculture officer	Processing	34
38	Azaria Kilimba	MCDI /MJUMITA	Azaria.kilimba@ mpingoconservation.org	0658 035535 0756 035535	Asst. Project manager- Mpingo conservation	Harvesting/ Processing/ Transportation	35
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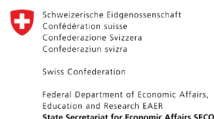




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