SUSTAINABLE WOODFUEL BRIEF #10

Sustainable woodfuel management through community action planning and assisted natural regeneration in Zambia

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This publication is part of a series of briefs describing findings from the EU-funded Governing Multifunctional Landscapes Sustainable Woodfuel project, which aims to contribute to knowledge, options and engagement for more sustainable woodfuel value chains across Sub-Saharan Africa.

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Key messages

- Local rules on woodland management across many multifunctional landscapes exist, mostly verbally and/or orally expressed, but the extent of enforcement is limited and not well exercized by traditional institutions.
- Local communities recognize changes in woodlands and showed interest in managing forest resources through participatory approaches and collaboration with institutions mandated to manage forests.
- The natural resilience in woodlands for woodfuel production was demonstrated through assisted natural regeneration strategy involving management of threats (e.g., fires, weed and animal grazing) for improved vegetation recovery rates of woodfuel (charcoal and wood) production sites.
- Local communities can be trained to envision better management of forest resources and create management plans for their landscapes, but there is need for continued support on capacity and finances to ensure self-reliance in managing forests resources.
- The evidence-based knowledge on assisted natural regeneration and participatory forest action planning is potentially relevant for policymaking on rural development, energy production and natural resource management.

Forest degradation and potential for community woodfuel management systems

Woodfuel production has emerged as a major contributor to forest loss and forest degradation in Zambia, thereby affecting the livelihoods and resilience of those who are directly dependent on local forest resources (Vinya et al. 2011; Gumbo et al. 2013; Mwila et al. 2015). Charcoal contributes to the degradation of 190,000 hectares (ha) of forest annually, and the demand for fuelwood and charcoal will continue to grow (World Bank 2019). An estimated 85% of the urban population depends directly on charcoal as their main energy source for daily cooking (Kalinda et al. 2008; Day et al. 2014).

To combat the continuous loss of forested landscapes, and mitigate and reduce the corresponding threat to local livelihoods, the Center for International Forestry Research and World Agroforestry (CIFOR-ICRAF) – under its European Union-funded Governing Multifunctional Landscapes (GML) programme – supported participatory forest action planning (PFAP) and assisted natural regeneration (ANR) in Zambia as potential solutions for more sustainable woodfuel management.

This brief provides practical steps on working with communities and stakeholders towards PFAP, in which local communities identify forest management strategies and respective responsibilities for their own benefits. We present lessons from developing PFAP in Zambia's Mushindamo, Nchelenge and Mufulira districts, which integrated ANR options.

The brief demonstrates the potential for ANR across the Miombo landscape and how it can be monitored by different stakeholders working on improving the value and management of forests and remnant areas.

Charcoal producers around a charcoal kiln in Ngala village, Mufulira. (Karl Lüneburg/CIFOR)

Background

In practice, most customary and state forests in Zambia are managed without basic management plans. Fuelwood sourcing is supposed to be managed under customary systems and with support from government district forestry offices (DFOs), except in private tenure where access and use rights are prescribed by private owners. However, in Zambia, as in the rest of Sub-Saharan Africa, the woodfuel industry is highly informal and considered one of the primary causes of forest degradation and national carbon stock loss (Gumbo et al. 2013; Lwaile and Gumbo 2016; Schure et al. 2019[1]). Although woodfuel, and especially charcoal production, is highly informal, it is well organized and has shown great potential to help alleviate poverty and offer informal employment opportunities (Gumbo and Mwaanga 2011; Schure et al. 2019). However, the lack of sustainable woodfuel management remains a great concern.

The shrinking biomass in the old mining province of Copperbelt (Ranked 8th at 4.4% or 64.1 ton ha^{-1}) is already shifting pressures to the new mining districts of North-Western Province (Mukosha and Siampale 2009 ; Forestry Department 2016). Though North-Western Province ranks first in biomass per hectare (100.7 tons), Mushindamo District is one of the main suppliers of fuelwood for many communities, both in Zambia and the Democratic Republic of Congo (DRC) through the border town of Kipushi (Mukosha and Siampale 2009; Forestry Department 2016). Other districts, such as Nchelenge, have also observed increases in woodfuel usage due to fish smoking on Lake Mweru and an influx of refugees from the DRC.

Finding solutions that mitigate forest and tree loss in those already heavily fragmented landscapes while benefitting local livelihoods remains a complex challenge, given multiple land uses over spatial and temporal spaces (Gumbo and Mwaanga 2011; Gumbo et al. 2014; Mwila et al. 2015). The objective of GML-led activities in Mushindamo, Mufulira and Nchelenge districts was to inform and promote sustainable community management of forest resources by promoting woodfuel management systems that balance both costs and benefits of woodfuel production.

1 Total biomass (above and belowground) for the province fell by 64.6 million metric tons (MT) from 245.4 million MT in 2009 to 131.8 million MT in 2016 [See Forestry Department 2016, p. 42 and Mukosha and Siampale 2009, p. 68).

Participatory land management for woodfuel

In acknowledging the complexity of the woodfuel industry in Sub-Saharan Africa, calls for holistic and participatory interventions to improve woodfuel production, trade and utilization have become louder – while claims for different land uses and tenure competition have to be navigated (Schure et al. 2019; Reed et al. 2020).

The potential of participatory approaches in landscape management has long been acknowledged, even though actual experiences for Zambia and particular relevance for woodfuel management are still missing. The rationale behind participatory planning is that acknowledging how communities envision the future of their landscapes allows them to make informed decisions and build more effective collaboration with local government (Evans et al. 2010; Diaw et al. 2009).

Participatory forest action planning (PFAP) is one participatory approach in landscape management that has proven capable of addressing challenges in participatory forest management (Forestry Department 2016; Gonzalez 2021). It is simple to design, cost-efficient in its implementation, and adapted to local circumstances. PFAP fits within multipurpose and integrated landscape management approaches. The following assumptions contributed to the basis for PFAP:

- Forest reserves in Copperbelt, North-Western and Luapula provinces, and Zambia as a whole are experiencing encroachment and undergoing anthropogenic disturbances, particularly charcoal manufacturing.
- Communities in rural areas generate income from fuelwood but have no information and capacity on 'after harvest' management options.
- There is no sufficient scientific/technical information to merge with indigenous capacities to guide communities in practicing sustainable woodfuel management.

PFAP can assist communities in Zambia in developing sustainable woodfuel management options to manage forests in already heavily fragmented landscapes and under increasing population pressures. PFAP is context-specific, that is, it differs between communities in form and in specific objectives, but has common goals of natural resource benefit sharing and transfer of ownership to local community institutions. At the core of PFAP is the support to and development of local livelihoods across spatial and temporal spaces. In addition, it aims to reverse landscape degradation and deforestation by applying ANR mechanisms and techniques, among other approaches.

Assisted Natural Regeneration (ANR)

There is sufficient evidence on the potential for landscape recovery of dry forest and woodland species through natural regeneration (Chidumayo 1990; Chirwa et al. 2014; Gumbo et al. 2018). Consequently, we applied the ANR approach, which involves nurturing the natural regeneration of forest trees by reducing or removing barriers to regeneration: animal browsing, competition for nutrients, fires and wood harvesting (Shono et al. 2007). The general objective of ANR is thus to create a balance between local livelihood needs and strategies and ecological maintenance, biodiversity conservation, landscape heterogeneity, and provisioning of ecosystem goods and services.

The recognition of ANR as an approach to curb challenges associated with forest loss has gained traction in recent times. The ANR options identified to address sourcing of fuelwood in multifunctional landscapes were based on the concepts of ecosystem resilience and resistance of ecological systems when faced with disturbances (Holling 1973; Byron and Sayer 1999; Gunderson 2000; Cheng et al. 2019). Resilience clarifies how easily woodfuel production areas and ecological systems can withstand disturbances without changing their state (Holling 1973). Resilient ecological systems have the capacity to recover after a disturbance. For instance, the Miombo landscape can regenerate after harvesting (Holling 1973; Chidumayo and Ellegaard 1993; Abbot and Lowore 1999; Gunderson 2000; White and Jentsch 2001; Lupala et al. 2014).

To ensure the efficiency of ANR measures in the working areas, the following target activities were formulated:

- measuring the biomass increment
- understanding species richness and composition changes/dynamics
- measuring tree growth variables (height and diameter)
- understanding threats to regeneration by measuring mortality and respective causes.

A typical charcoal load being transported by bicycle from its production site in Ngala village in Mufulira District to the city of Kitwe in Zambia's Copperbelt Province.
(Bravedo M. Mwaanga/CIFOR)

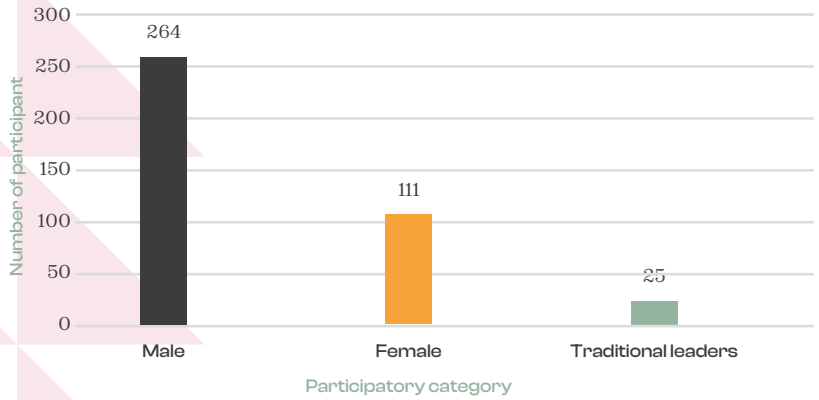
Developing participatory action plans and ANR sites: A step-by-step process towards landscape restoration

This section outlines the two participatory stages and the four steps of forest landscape restoration as executed in the three project sites. The first stage covers the identification processes and criteria used in restoration. The second stage covers assisting communities in developing PFAPs, which further illustrate situation analyses of issues, conflicts and threats to both processes and proposed actions. This is in addition to forest resource mapping and future landscape scenario building.

Stage 1. Identify processes and criteria used in the restoration of degraded and deforested landscapes using ANR

The steps and processes outlined here are based on the participation of a total of 400 community members across 10 villages in the three districts using focus group discussion (FGD) approaches and techniques. In addition to 264 male and 111 female villagers, 25 local traditional leaders, including chiefs of Mulonga, Kanyembo, Munsaka, Kambwali and Kalilele, participated and approved the woodfuel management options proposed under the project.

Community and traditional leader participation in the participatory planning process during the development of sustainable woodfuel management options



Additionally, we held engagement meetings with Forestry Department representatives at the provincial and district levels to gain insights into the general woodfuel status across border districts, such as sourcing patterns, movements and woodfuel hotspot areas. A total of 90 stakeholders were consulted, including transporters (truckers), several government officers from district councils, the Zambia Revenue Authority (ZRA) at border customs, the Zambia Police and Forestry Department, and other cross border entities such as the Cross Border Traders' Association.

Experiences from the above interactions provided us with a strong basis for suggesting the following steps:

Step 1: Create the necessary baseline knowledge and identify suitable target communities for an ANR component of the project by:

- conducting regional scoping activities, including monitoring border points, for example, between Zambia and its neighbouring countries
- establishing quantities and direction of movement of woodfuel during the period
- identifying hotspot areas that supply both neighbouring countries and local woodfuel markets.

Step 2: Select ANR sites

Use the criteria listed below to find new demonstration sites for restoration of degraded and deforested areas using the ANR approach and mechanism.

The preferred sites/areas for ANR should:

- not be covered by water (areas devoid of water)
- be 0.04 ha of land or more for economic reasons
- have a slope gradient between 2% and 4% so erosion is minimal
- be deforested[2] and degraded, but in the case of customary areas, be mapped participatorily by traditional leaders and community members for conservation and sustainable management
- be in different tenure classes (state [protected forest], customary)
- not have settlements – a 150 m wide protected zone should be applied around any settlement area
- not be crossed by a gravel/dust road or highway (10 m buffer)
- be actively considered, whereby men, women, youth and marginalized groups are actively involved in the process in each area (except where the whole community is involved in site selection).

Step 3: Establish demonstration plots

After selecting ANR sites, establish demonstration plots. For the GML project, a total of five research plots for ANR were established across three districts, namely Mufulira, Nchelenge and Mushindamo.

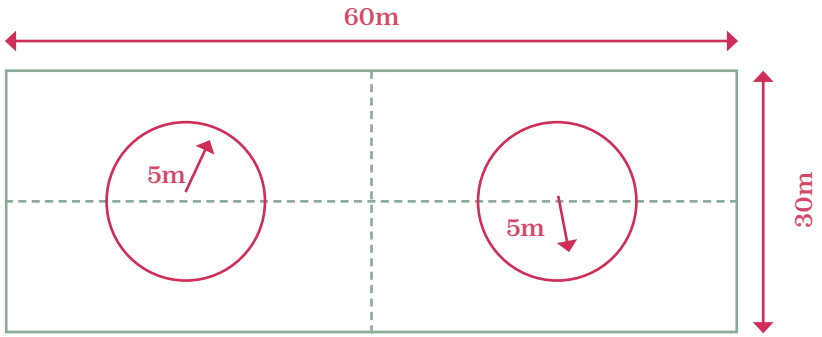
The average size of plots was approximately 1,800 m^2. Each one was determined as follows:

1. Locating the abandoned charcoal production kiln site
2. Locating the centre of the charcoal production kiln site
3. Identifying the stumps of all trees that were cut to make charcoal production kilns
4. Measuring all distances from the centre of the charcoal kiln site to all tree stumps identified in step 3 above
5. Calculating the average distances measured in step 4, or the catchment radius
6. Calculating the catchment area for the charcoal production kiln (using the Model $A = \pi r^2$, where A = area and r = radius from the kiln centre as in step 4) based on the catchment radius
7. Repeating steps 1 to 6 for a number of charcoal production kiln sites (e.g., 10 were sampled for the GML)
8. Determining the standard size for research plots by calculating the average size of the kiln catchment
9. Laying out the demonstration plots using the established standard size or equivalent area calculated in step 8 above.

Step 4: Monitor the demonstration plots to collect data on social use and biophysical change, such as

1. Social: harvest, fires, grazing, use

2. Biophysical: diameter, height, type and number of tree species of both existing and regeneration, mortality (number and causes, e.g., fires, drought, etc.)



Design of the demonstration and control plots

Stage 2. Help selected communities to develop PFAPs

To strengthen participatory multifunctional landscape governance, one PFAP was developed in each project district. Each PFAP development process involved the following:

1. Identification of threats/issues and conflicting land uses regarding natural resource management

2. Mapping of land uses to understand the local resource management context

3. Village resources mapping

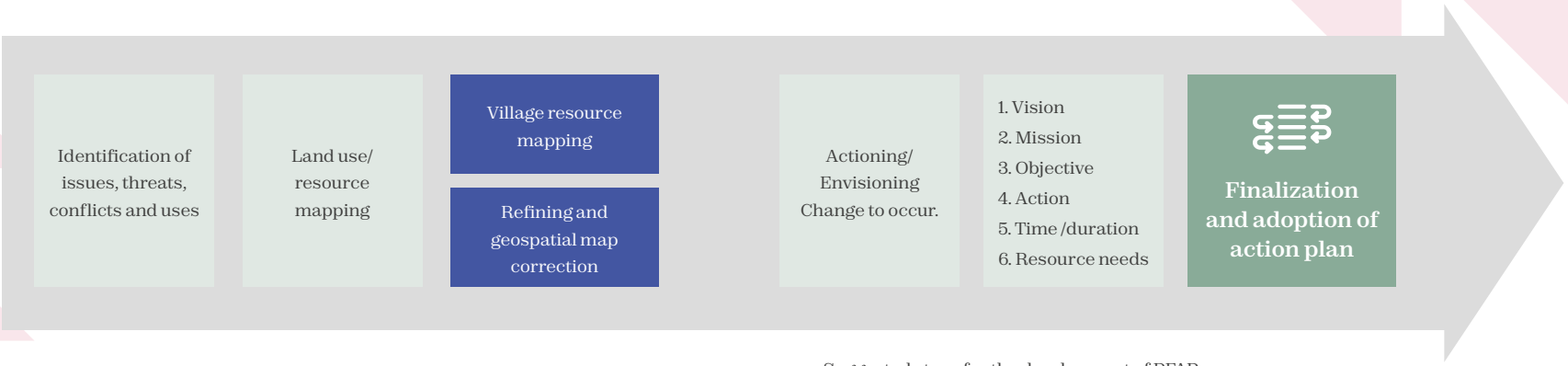
4. Refining and geospatial map correction

5. Communities envisioning future scenarios for their landscapes

6. Action planning to address current threats, and proposed priority actions and their respective solutions towards the preferred future scenario of landscape management and use

7. Formulation of the PFAP

8. Finalization and adoption of the PFAP by the community



Suggested steps for the development of PFAPs

The steps involved in stage two of developing PFAPs are explained below.

Step 1: Identify existing issues, conflicts and threats

Existing issues regarding natural resources in the target areas were identified through a situation analysis approach using interviews and discussions, especially in meetings where CIFOR-ICRAF, the Forestry Department and communities were participating. The issues identified reflected the perceptions target communities held on the state of local forests across the three districts and five project sites (Ngala, Mashimba, Lwenge, Nshoka and Kepipa). The target communities identified strategic conflicts, challenges and potential solutions associated with forest resources, such as current land uses and existing rules and regulations. The following table provides a matrix of issues, threats, and other factors identified in the different project communities.

Identified issues, threats, conflicts and land uses impacting natural resources in Ngala, Mashimba, Lwenge, Nshoka and Kepipa villages in the Copperbelt, North-western and Luapula Provinces of Zambia

Occurring changes / natural resource issues - What has changed?	Does the change occur? Yes ✓, No ×				
	Ngala	Mashimba	Lwenge	Nshoka	Kepipa
Reduced size of stems of trees [quality[3] and quantity] / trees closer to the village are getting scarce/depleted / big trees are found very far from the village	✓	✓	✓	✓	✓

3 Quality = Some tree species, such as Nshoka, are not found in villages; Quantity = Reduction in the number of poles. Few young trees are growing around the forest due to wildfires. In Ngala, this was viewed as being caused by Congo fires resulting from increased grass biomass accumulating after tree cover is cleared. People cut big trees for charcoal production.

Ngala, Mufulira district
Bravedo Miwaanga / CIFOR-ICRAF

What are causes of change in the current status of natural resources?	What are strategic action(s) to address the identified changes/ issues?
• Charcoal production / Charcoal production finishing trees / construction materials i.e., poles • Business representatives from Kitwe enter the area and camp to make churches • Cutting without documents/permits • Increase in early marriages in Kitwe leading to more charcoal production in Ngala	No cutting down trees / alternative options i.e., gardening/stop cutting small trees for charcoal to allow regrowth / replant trees / teach community about the importance of managing trees / formulate bylaws and enforce them / concentrate on and use improved farming methods / measures to stop early marriages (Inshila) measures / use metal sheet roofs for constructing houses / people in the community guard forest

Occurring changes / natural resource issues - What has changed?	Does the change occur? Yes ✓, No ×				
	Ngala	Mashimba	Lwenge	Nshoka	Kepipa
Reduced rainfall and variation in start of rain season - usually late / shift in rainfall calendar / low rainfall	✓	✓		×	×
The forest is now open / land has changed, has become infertile / bare land	✓	×	×	✓	✓
Reduction in wildlife / wildlife is rarely present or even absent	✓	✓	✓	✓	✓
Lack of wind break (Congo winds) leading to increased fire spread	✓	×	×	×	×
Good thatch grass is far from the village / only short and poor quality grass remains	✓	×	×	×	×
Firewood shortage near the village / big trees are only found at a distance	✓	×	×	✓	×
Reduced stream water	✓	✓		✓	×
Poor performance of fruit trees (Amasuku, Impundu infungo) and hence poor harvests	✓	×	×	×	×
Wild honey and other products such as mushrooms are scarce and rarely collected now	✓	✓	✓	✓	✓
The number of people has increased / population increase, too many people now	✓	✓	✓	✓	✓

What are causes of change in the current status of natural resources?	What are strategic action(s) to address the identified changes/ issues?
Reduced tree cover (trees have finished from charcoal production), and increased population Cutting trees along riparian areas	No cutting of trees so that the forest can regenerate / need help from CIFOR in assisting people and teaching the community how to protect treesneed capacity-building support from CIFOR-ICRAF on how to protect trees
Numbers of people have increased leading to increased need to cut trees down making land bare / opening new land and expansion of old fields / late burning	• Stop cutting trees / supply fertilizer (women) to maintain fields / sensitize communities • Maintain same fields; no shifting from own farm premises / adopt conservation farming systems
Habitat loss through clearing / forest is open / overhunting of animals	Avoid late burning / stop hunting (poaching)
Small trees cannot stop wind	Have plan to allow cutting on one side, but not on the other
Early burning before people get the grass	Reduce cutting trees
Radial cutting of trees near the village	Stop cutting trees near the village so they can grow
Drought / cutting trees along streams	Raise awareness on the importance of trees to reduce cutting
Poor harvesting methods (tree felling) and climate change (*ukuchinja kwamwela*)	Raise awareness of proper fruit collection methods to avoid harming trees
Increasing distances of harvesting	Government and local leaders to co-monitor

Occurring changes / natural resource issues - What has changed?	Does the change occur? Yes ✓, No ×				
	Ngala	Mashimba	Lwenge	Nshoka	Kepipa
Lack of land tenure for individuals	✓	✓	✓	✓	✓
Reduced timber trees	×	×	×	✓	✓
Unmanaged wildfires	✓	✓	✓	×	×

What are causes of change in the current status of natural resources?	What are strategic action(s) to address the identified changes/ issues?
• Encroachment • Population increase	Government to legitimize communities in some reserves to co-manage
Uncontrolled trading with Tanzania	• Government to put laws in place that communities need to know and follow • Strong rules to be enforced
Clearing of trees allows more grass biomass / Few to no fire management regimes by government and traditional leaders	Return Forestry Department fire management practices of distributing matches / early burning / discourage late burning / fire management training

Ngala, during the formulation of participatory Forest Action Plans, Mufulira District
Bravedo Mwaanga/CIFOR-ICRAF

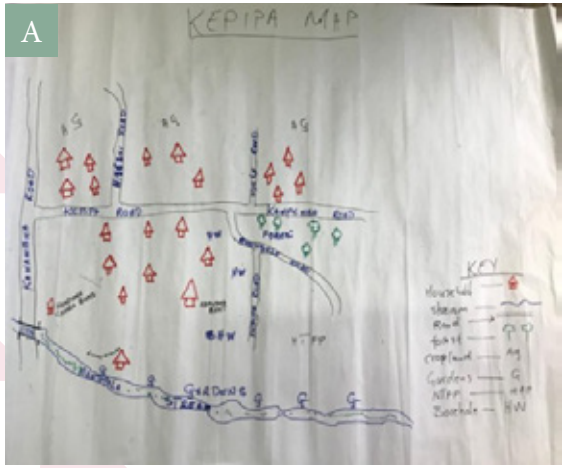
Step 2: Map village land uses and correct geospatial maps

A crucial aspect of participatory forest management is the consideration and acknowledgement of current land utilization (Wegmann et al. 2016). This step should include the following:

Mapping of village resources

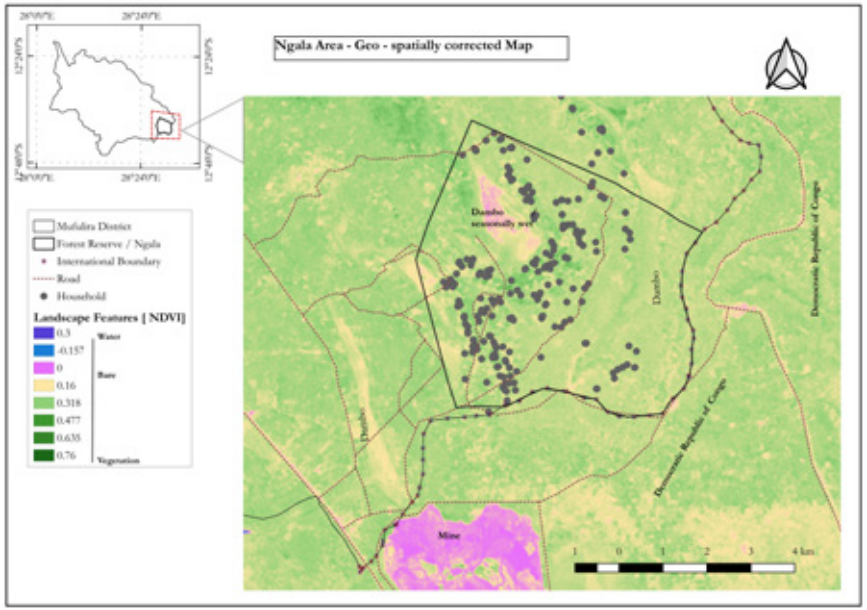
After establishing baseline knowledge on the extant challenges, village forest resources mapping activities were conducted, including initial sketches of the spatial layout of local forest use in the respective target areas, and the collaborative verification of spatial lines (i.e., roads, paths) and points of interest (i.e., households, local marketplaces) with members of the local communities. This information was collected through transect walks, followed by geospatial alignments to prepare the maps for digitization. The photos below illustrate products of these processes.

Village sketch maps



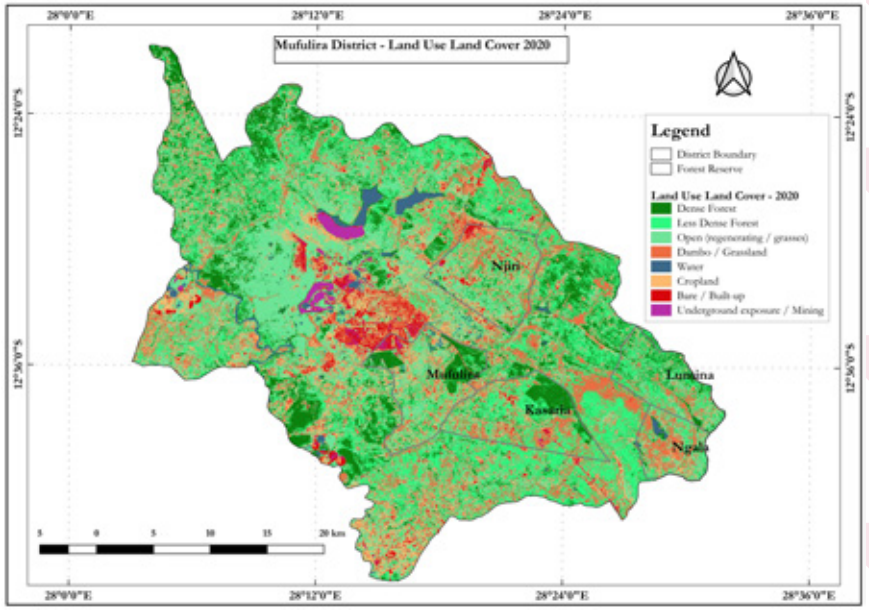
Examples of village sketch maps on resource mapping across GML sites: (a) Kepipa and (b) Nshoka villages in Nchelenge District, and (c) Ngala village in Mufulira District. Photos by Bravedo Mwaanga/CIFOR-ICRAF

Refinement and correction of geospatial community maps:



Map 1, an example of a spatially corrected village map of Ngala in Zambia's Mufulira District

CIFOR-ICRAF



Map 2, Landcover map for Mufulira District, Zambia - CIFOR-ICRAF

Abandoned charcoal kiln taken in Lwenge, Mushindamo District.
Bravedo Mwaanga / CIFOR-ICRAF

Step 3: Build future landscape scenarios

To build future scenarios for landscapes, meetings should first be conducted with community members and/or their representatives using different techniques such as brainstorming during focus group discussions (FGDs), meetings, etc. For the GML project, meetings were conducted with each community and representatives of social groups in the target areas to plan and formulate PFAPs collectively. A total of 24 FGDs in iterations of three groups per site were conducted, during which a total of 88 people participated. Community members (men, women and youth), traditional leaders, CIFOR-ICRAF staff and government officers from the Forestry Department took part in the discussions.

General cross tabulation of participation during the formulation of PFAPs in Mufulira, Mushindamo and Nchelenge districts

Area	Stakeholder	Male	Female	Total
Mufulira District (Ngala village)	Government	2	0	2
	Community	22	14	36
	NGOs	0	0	0
	CIFOR	3	2	5
		27	16	43
Mushindamo District (Mashimba and Lwenge villages)	Government	2	0	2
	Community	23	21	44
	NGOs	0	0	0
	CIFOR-ICRAF	1	1	2
		26	22	48
Nchelenge District (Kepipa village)	Government	1	0	1
	Community	11	10	21
	NGOs	0	0	0
	CIFOR-ICRAF	2	1	3
		14	11	25
Nchelenge District (Nshoka village)	Government	1	0	1
	Community	10	6	16
	NGOs	0	0	0
	CIFOR-ICRAF	2	1	3
		13	7	20

Future scenario building involved dividing participating community members into small groups of men, women and youths to brainstorm on the desired future state of their landscape. The smaller groups had five people on average. The FGDs involved planning, selecting the groups, moderating discussions, analysing and reporting. Dividing participants into smaller groups allowed various ideas to be captured and individual views to be represented (Narayanasamy 2009). The participants then came together in larger groups to present, discuss and explain the forest management actions they came up with during the smaller group brainstorming sessions.

Following these meetings and based on the discussions mentioned above, forest management actions adapted to local circumstances, needs and perceptions should then be identified.

Step 4: Identify constraints and threats to proposed actions

Under this step, assist community members to articulate what they perceive as bottlenecks to sustainable management of forests and other natural resources. For each proposed activity in the project sites, the participants identified what they perceived to be challenges and threats to their success. Acknowledging the local perspective and knowledge allowed the collective formulation of solutions to these problems. The problems were similar across sites because they are all within the same agroecological zone. Nevertheless, a few site-specific challenges and threats are highlighted in the following table.

Perceived constraints/challenges to the success of PFAPs in Mufulira, Mushindamo and Nchelenge districts

Constraints	Proposed solution/actions
Communities not being legitimate owners of land Community members being hesitant to implement conservation plans due to fear of eviction	The government should allow the community to manage forests, i.e., co-management/legitimacy for conservation or tree resource management
Mining exploration by Rio Tinto threatening Ngala and Lwenge communities with displacement	
Limited control over individual farms	Enhance community engagement Strengthen traditional forest management structures
Local dependency on charcoal production causing overharvesting of trees, as it is the only cheap source of income requiring little capital investment	Promote alternative livelihood activities
Lack of awareness raising activities with local people about forest protection and conservation	Enhance information sharing on community forest management Promote joint forest management
No community sensitization on forest protection and conservation	Enhance information sharing on community forest management Promote joint forest management through sensitization programmes
A lack of community bylaws/rules in place (at village level) on forest management / no proper rules to protect and conserve forest areas	Develop community bylaws on forest protection, conservation and management, and enforce them
The Forestry Department must train communities to care for forest resources	Conduct special training on forest protection
Short longevity of forest restoration programmes, which end before benefits are realized, contributes to reduced interest in restoration among community members	Promote alternative livelihood activities to cover short-term needs

As a last action in the process of developing PFAPs, during community meetings validate the respective visions, missions, objectives and activities proposed under the action plans. While the feedback and validation of the action plans were valuable, further verification by partner institutions, which will be responsible for continuous monitoring activities, may be required.

Achievements and limitations of PFAP and ANR as sustainable woodfuel management options

The PFAP development process and the testing of ANR as options for sustainable woodfuel yielded the following results.

Environmental factors

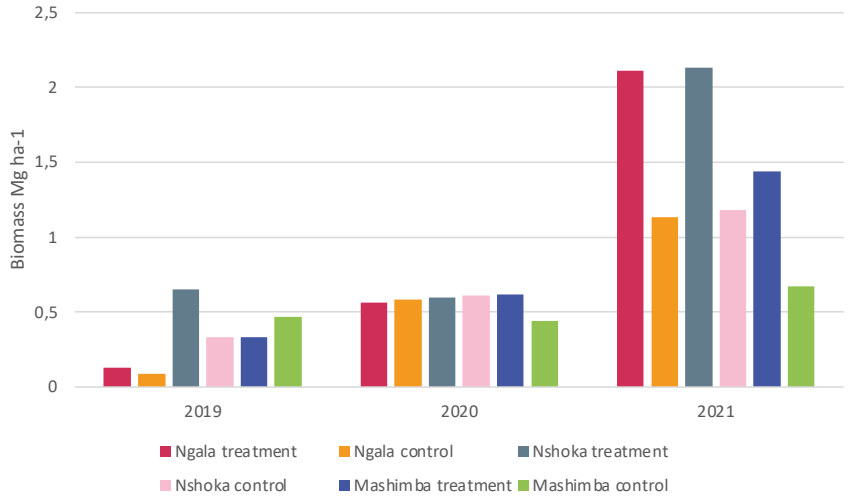
A total of five ANR demonstration plots were established on both state and customary landscapes by 117 charcoal producers and farmers. A total of 76 charcoal producers and farmers were engaged in the process of establishing ANR demonstration plots. The charcoal producers and farmers are now engaged in managing naturally regenerating native species (*Julbernardia paniculata, Brachystegia spiciformis, Brachystegia floribunda* and *Isoberlinia angolensis*) on their degraded farmlands to use as feedstock for charcoal, fuelwood and other products. The target communities recognized and appreciated the changes their plots went through after applying management of tree regrowth through regeneration from seeds and coppicing activities. Photos below show an ANR plot in Ngala village in Mufulira District before the interventions (around three months after charcoal was produced on the plots), and the changes in vegetation cover following the implementation of ANR activities.

A target plot in Ngala, Mufulira, prior to the implementation of ANR activities (left) and after ANR activities (right). Photos by Bravedo M. Mwaanga/CIFOR

The target communities were inspired to state their claims regarding land ownership, their roles in land restoration, and rules guiding tree harvesting, fruit tree harvesting and species selection. For instance, communities claimed that they want to conserve their community lands, and in some cases, co-manage with respective government departments such as the Forestry Department. To achieve the latter, communities plan to improve resource management by better communicating land use claims, management options and conflicts of interests among themselves and with the Forestry Department.

Community members participated in identifying regenerating trees, measuring tree growth, and monitoring tree mortality and respective causes. This demonstrated to the participants first hand that forest regeneration can be enhanced on charcoal production sites, with the management of fires, weeds and animal grazing. From the data collected by community members, we were able to retrieve information on biomass accumulation and propose solutions on harvesting prospects from local woodlands.

Some significant observations made on the ANR sites were that rates of biomass accumulation in megagrams per hectare (Mg ha-1) were faster on the ANR plots than on control plots (see figure). This can be attributed to the management of fire and weeds on the ANR plots. Fire proved to have two effects on the control plots where it was allowed to sweep through. One was that it stimulated the resprouting of remnant species from seeds and root suckers. These findings are reflected in existing literature suggesting that fire has different impacts on plants depending on intensity and timing in relation to plant phenology (Campbell 1996). As the intensity of fires on business-as-usual plots was not measured, the observed fire effect in causing resprouting needs to be explored further. The other observed effect of fire on the business-as-usual plots was that it caused regeneration mortality and stunted growth, some of the natural regenerations were scorched by the fire outbreaks and later dried up.



Biomass accumulation on GML sites over a three-year period

Another factor observed to have had an effect on growth performance was competition for nutrients essential for plant growth between naturally regenerated trees, tall grass and other non-woody herbs. The competition was observed in the first two years of growth. This led to the introduction of spot weeding, which is a management strategy designed to address competition by removal of unwanted vegetation around target vegetation for improved biomass accumulation (Wong et al. 2014). Furthermore, we observed that the protection of the ANR plots from fire allowed grass and woody vegetation to thrive, and this led to increased competition. Seemingly, competition was the reason why control plots had higher biomass in the second year compared to treatment plots, which lacked the accumulation of tall grasses and other unwanted vegetation because fire was allowed to pass through them.

We further observed that precipitation directly contributed to higher biomass accumulation rates between the second and third year. The ANR plots received high amounts of annual rainfall because they are located in the wet Miombo ecoregion. However, in the third year, most parts of Zambia, including ANR plot locations, received higher precipitation compared to the previous years.

Our findings suggest that ANR improved the recovery of the harvested pieces of land, which were deforested and to some extent degraded, ultimately improving biomass accumulation. These findings are reflected in existing literature suggesting that firebreaks mitigate fire impact and result in improved biomass from natural regeneration, and that ANR practices such as weeding, slashing and burning, thinning and the reduction of plant competition promote improved regrowth rates (Chidumayo et al. 2013b).

Socioeconomic factors

Five PFAPs were developed and validated in Ngala village, Mufulira District; Lwenge and Mashimba villages in Mushindamo District; and Nshoka and Kepipa villages in Nchelenge District. PFAPs and related strengthening of local agency are expected to increase the resilience and productivity of the landscapes in the long term, and in the process contribute to the realization of the engaged communities' visions. These visions had similarities across the sites, in that all communities wanted to improve forest conservation and livelihoods from forests adjacent to their areas.

While short-term ecological benefits were difficult to measure given the slow growing nature of the Miombo landscape, the communication platforms for forest management showed great potential in building local agency. Isolated communities in particular seemed to benefit from sensitization and education, and became better linked to the Forestry Department. As a result of this improved communication, the Forestry Department was able to share extension activities with the respective communities and distribute 66,000 *Julbernardia paniculate, Khaya aesthetica, Faidherbia albida, Acacia polyacantha* and *Syzygium spp* seedlings to Ngala communities.

Community indigenous and exotic nursery at the Ngala site. Photos by Esnelly Katongo/CIFOR-ICRAF

Institutional framework

Increased involvement and participation of community members in the development of PFAP has the potential to improve communal organizational capacity, and strengthen agency and ownership over local forest resources. The increased capacity of communities to plan and implement aspects in PFAP will be key for enhancing sustainability in forest management.

In the short term, the implementation of PFAPs benefits the livelihoods of charcoal producers not only by improving feedstock availability through ANR activities, but also through the promotion of fruit tree planting and suppression of bush fires. PFAPs now impact over 1,500 people across an estimated 54,342 ha of land (3,174.19 ha in Ngala and 51,168.69 ha in Kalilele NF)

The evidence suggests that formerly weak communal institutional structures were strengthened and that communities are now better able to enforce compliance with rules and regulations related to the use of forest resources. This was more pronounced in state-owned areas where communities had settled informally.

Training on tree nurseries and fire management as part of tree planting actions will potentially strengthen livelihood resilience. The process of action planning is also expected to reduce competition and conflict over land ownership and allow for co-management of natural resources in protected forest reserve areas.

The established ANR plots serve as instruments for engagement with the target communities and allow for the co-production of knowledge on landscape restoration, which in turn can inform policy decisions. Villagers in Ngala have imitated the project ANR plots where they applied their indigenous technical knowledge and planted stems to enrich plant biomass.

CIFOR-ICRAF's efforts in ANR create data that add to other comparable studies on restoration, such as projects in Serenje and Kazungula where the ANR restoration approach is being used by the Forestry Department.

In Mushindamo District in communities where ANR was implemented, 10 charcoal producer groups were established as an initial step towards the formalization of community charcoal producer groups. These groups took part in exchange programmes with the Choma community, where the Forest and Farm Facility (FFF)[4] is implementing ANR activities. In collaboration with the Forest Department, the FFF programme established three demonstration sites with improved kilns for charcoal production. This work is still under development as more awareness creation activities such as radio announcements and exchange visits among producers have yet to be implemented.

4 The Forest and Farm Facility is a partnership between the Forest Department and the Food and Agriculture Organization of the United Nations (FAO)

Stakeholder story
Protecting Nchelenge's forests

Photocredits: Gabriel Mulenga, CIFOR-ICRAF

Forests blanket the hills behind Zambia's lake Mweru, Nchelenge district, Luapula Province. The district covers 470,000 hectares of land, but only about 8% of these lands, covering two national forests and a small local forest, are protected by the national Department of Forestry, explained Charles Chalwe, Senior Technician at the Department of Forestry and District Forest Officer in Nchelenge. Today, even those protected areas are threatened by deforestation and land-use change.

"Fishing communities were the first to settle this area, and deforestation mostly occurred around the lake in areas where fishermen were cutting firewood for drying their fish," explained Chalwe. "As the fishstock became depleted, people started moving inland to engage in agricultural activities; they are growing cassava, maize and groundnuts."

An inflow of refugees from the Democratic Republic of the Congo (DRC) has further exacerbated deforestation in the area. Because the Mantapala refugee settlement sits between Nchelenge's two national forests, newcomers often go there to cut trees for charcoal, timber, and agricultural land. "These factors have contributed to ongoing landscape change," noted Chalwe.

In response, CIFOR-ICRAF has been working with the Department of Forestry to study deforestation drivers and implement sustainable land-management solutions. So far, the organizations have helped two villages — Nshoka and Kepipa — to establish demo plots where locals and scientists can experiment with different agricultural techniques and test the effectiveness of assisted natural regeneration (ANR).

> *These factors have contributed to ongoing landscape change*

"People realized, 'if we destroy our forests, it's not CIFOR-ICRAF who will suffer but ourselves," said Chalwe. The two villages also created participatory forest action plans (PFAPs) with rules about how to protect the forests while also supporting livelihoods. For example, the forests are full of bees and can support a thriving beekeeping industry, if managed sustainably.

"One tree species, locally called Mutondo (*Julbernardia paniculata*), is a good tree for charcoal manufacturers; the same tree has good nectar and very good pollen, so now the beekeepers are protecting this tree. They have realized that if we cut down all these trees, we are killing our beekeeping industry."

Three more villages in Nchelenge are planning to establish ANR plots and PFAPs in the near future. The Department of Forestry and CIFOR-ICRAF will continue working with communities and policymakers to scale-up and implement locally driven forest management solutions, according to Chalwe.

Conclusion and recommendations

Findings of the GML project in Zambia suggest that PFAP and ANR activities are promising means for improving woodfuel value chains, protecting forests and creating resilient rural livelihoods. Based on these findings, the study provides the following recommendations:

- The importance of managing forest resources needs to be recognized and acknowledged by community members, who should also take responsibility over the management of forest resources.
- The value of sustainable woodfuel management should be clearly indicated to communities and producers, and management objectives, responsibilities and potential conflicts and solutions clarified prior to the implementation of PFAP and ANR activities.
- One aspect critical to the successful implementation of PFAP is capacity building, which can be partly achieved through training on fire management and tree planting. However, implementation of some activities, such as tree planting, agroforestry, beekeeping, climate-smart agriculture, and tree nursery management, still require the expertise of external partners (e.g., Forestry Department, CIFOR-ICRAF).
- While ANR is based on interventions at the local level, it is important to see these in a broader, cross-regional context, as the multipurpose nature of these interventions has implications for policymaking on rural development, energy production and natural resource management. Therefore, there is a need for continuous close cooperation with government departments and, if possible, the inclusion of PFAP in the annual plans of district forestry offices. This will allow for an enhanced and long-term collaboration between the government, communities and other stakeholders beyond project life.
- The inclusion of PFAP under Community Forest Management Groups (CFMGs), which are supported under national forest laws, could provide growth opportunities and allow access to funding under the Constituency Development Fund.
- More incentives to support short-term ANR actions (e.g., tree nurseries, agroforestry) and awareness raising activities are needed to increase the adoption rate of improved woodfuel production processes.
- More attention must be paid to the management of movement of charcoal between countries, and increased monitoring and management of woodfuel meant for export and currently stuck at border points between countries is needed to improve woodfuel value chains.
- Organization of charcoal producers through associations helps them escape informality/illegality and helps the government reach these important stakeholders more easily in building their capacities in sustainable practices such as ANR, improved kilns etc.

References

Abbot PG and Lowore JD. 1999. Characteristics and management potential of some indigenous firewood species in Malawi. *Forest Ecology and Management 119* (1-3): 111–121.

Byron N and Sayer J. 1999. Organising forestry research to meet the challenges of the Information Age. *The International Forestry Review*. 4–10.

Campbell, B., Frost, P., & Byron, N. (1996). The Ecology of Miombo Woodlands. The Miombo in Transition: Woodlands and Welfare in Africa, January 1996, 266. https://doi.org/10.1371/journal.pone.0058209

Cheng SH, MacLeod K, Ahlroth S, Onder S, Perge E, Shyamsundar P, ... Miller DC. 2019. A systematic map of evidence on the contribution of forests to poverty alleviation. *Environmental Evidence* 8(1): 1–22. Evidence. https://doi.org/10.1186/s13750-019-0148-4. Accessed 1 May 2022.

Chidumayo EN. 1990. Above-ground woody biomass structure and productivity in a Zambezian woodland. Forest Ecology and Management 36(1): 33–46.

Chidumayo EN and Ellegaard A. 1993. Responses of miombo to harvesting: Ecology and management.

Chidumayo, Emmanuel N., & Gumbo, D. J. (2013b). The environmental impacts of charcoal production in tropical ecosystems of the world: A synthesis. Energy for Sustainable Development, 17(2), 86–94. https://doi.org/10.1016/j.esd.2012.07.004.

Chirwa PW, Syampungani S, Geldenhuys CJ. 2014. Managing southern African woodlands for biomass production: The potential challenges and opportunities. *Bioenergy from Wood*. 67–87.

Day M, Gumbo D, Moombe KB, Wijaya A, Sunderland T. 2014. *Zambia country profile: Monitoring, reporting and verification for REDD+* (Vol. 113). CIFOR.

Diaw MC, Aseh T, Prabhu R. eds. 2009. In search of common ground: Adaptive collaborative management in Cameroon. CIFOR.

Evans K, De Jong W, Cronkleton P, Nghi HT. 2010. Participatory Methods for Planning the Future in Forest Communities. Society and Natural Resources 23(7):604-619

Forestry Department. 2016. Ministry of Lands, Natural Resources and Environmental Protection. Integrated Land Use Assessment Phase II - Technical Paper 1, *Classification of Forests in Zambia*. Food and Agriculture Organization of the United Nations, Ministry of Foreign Affairs Finland. Lusaka, Zambia.

Forestry Department. 2016. Ministry of Lands, Natural Resources and Environmental Protection. Integrated Land Use Assessment Phase II - Technical Paper 5, *Zambia Forest Action Plan Preparatory Review*. Food and Agriculture Organization of the United Nations, Ministry of Foreign Affairs Finland. Lusaka, Zambia.

Forestry Department. 2016. Ministry of Lands, Natural Resources and Environmental Protection. Integrated Land Use Assessment Phase II - Technical Paper 1, *Classification of Forests in Zambia*. Food and Agriculture Organization of the United Nations, Ministry of Foreign Affairs Finland. Lusaka, Zambia.

Forestry Department. 2016. Ministry of Lands, Natural Resources and Environmental Protection. Integrated Land Use Assessment Phase II - Technical Paper 5, *Zambia Forest Action Plan Preparatory Review*. Food and Agriculture Organization of the United Nations, Ministry of Foreign Affairs Finland. Lusaka, Zambia.

Gonzalez A. 2021. Engaging Zambian charcoal producers in sustainability efforts. https://forestsnews.cifor.org/74333/engaging-zambian-charcoal-producers-in-sustainability-efforts?fnl=en

Gumbo D and Mwaanga B. 2011. Charcoal production, poverty alleviation and woodland change in the Kapiri Mposhi District of Zambia.

Gumbo DJ, Moombe KB, Kandulu MM, Kabwe G, Ojanen M, Ndhlovu E, Sunderland TC. 2013. Dynamics of the charcoal and indigenous timber trade in Zambia: A scoping study in Eastern, Northern and Northwestern provinces (Vol. 86). CIFOR.

Gumbo D, Clendenning J, Martius C, Moombe K, Grundy I, Nasi R, ... Petrokofsky G. 2018. How have carbon stocks in central and southern Africa's miombo woodlands changed over the last 50 years? A systematic map of the evidence. Environmental Evidence 7(1): 1–19.

Gunderson LH. 2000. Ecological resilience in theory and application. *Annual review of ecology and systematics*. 425–439.

Holling CS. 1973. Resilience and stability of ecological systems. *Annual review of ecology and systematics*. 1–23.

Kalinda T, Bwalya S, Mulolwa A, Haantuba H. 2008. Use of integrated land use assessment (ILUA) data for forestry and agricultural policy review and analysis in Zambia. Report prepared for the Forestry Management and Planning Unit of the Department of Forestry, FAO, and the Zambian Forestry Department, Ministry of Tourism, Environment and Natural Resource Management. Lusaka, Zambia. 119.

Lupala ZJ, Lusambo LP, Ngaga YM. 2014. Management, growth and carbon storage in miombo woodlands of Tanzania. *International Journal of Forestry Research*. 2014.

Lwaile M and Gumbo DJ. 2016. Integrated land use assessment phase II–Technical Paper 6: Measuring the informal forestbased economy as part of the national forest monitoring and assessment.

Mukosha J and Siampale A. 2009. Integrated land use assessment Zambia 2005–2008. Lusaka, Zambia: Ministry of Tourism, Environment and Natural Resources, Forestry Department, and Rome, Italy: Food and Agriculture Organization of the United Nations.

Mwila RM, Gumbo D, Mwaanga B. 2015. Linking the forest state and use to livelihoods in Nyimba District, Zambia.

Narayanasamy N. 2009. Participatory Rural Appraisal. Principles, Methods and Application. Delhi, India: SAGE Publications India Pvt Ltd.

Reed J, Ros-Tonen MAF, Sunderland TCH. 2020. Operationalizing integrated landscape approaches in the tropics. CIFOR.

Schure J, Sola P, Eba'a Atyi R, Gumbo D, Okeyo I, Awono A. 2019. Woodfuel policies and practices in selected countries in Sub-Saharan Africa—A critical review. Bois et Forêts des Tropiques 340: 5–19.

Shono K, Cadaweng EA, Durst PB. 2007. Application of assisted natural regeneration to restore degraded tropical forestlands. *Restoration Ecology* 15(4): 620–626.

Vinya R, Syampungani S, Kasumu EC, Monde C, Kasubika R. 2011. Preliminary study on the drivers of deforestation and potential for REDD+ in Zambia. Lusaka, Zambia: FAO/Zambian Ministry of Lands and Natural Resources.

Wegmann M, Leutner B, Dech S. eds. 2016. *Remote sensing and GIS for ecologists: Using open source software*. Pelagic Publishing Ltd.

White PS and Jentsch A. 2001. The search for generality in studies of disturbance and ecosystem dynamics. Progress in botany. 399–450.

Wong WK, Chekima A, Mariappan M, Khoo B, Nadarajan M. 2014. Probabilistic multi sum weed species classification for weed scouting and selective spot weeding. In IEEE. 2014. *International Symposium on Robotics and Manufacturing Automation (ROMA)*. pp. 63–68.

World Bank Group. 2019. Country Forest Note: Zambia. Towards a Sustainable Way of Managing Forest. December 2019. Country Forest Note: Zambia. December 2019.

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