

Developing small-scale bamboo enterprises for livelihoods and environmental restoration in Benishangul-Gumuz Regional State, Ethiopia

Manuel Boissière, Stibniati Soeria Atmadja, S. Benmakhlouf, M. Beyessa, Habtemariam Kassa, T. Hunde, F. Assefa

▶ **To cite this version:**

Manuel Boissière, Stibniati Soeria Atmadja, S. Benmakhlouf, M. Beyessa, Habtemariam Kassa, et al.. Developing small-scale bamboo enterprises for livelihoods and environmental restoration in Benishangul-Gumuz Regional State, Ethiopia. International Forestry Review, 2020, 22 (3), pp.306-322. ⟨10.1505/146554820830405618⟩. ⟨hal-05176876⟩

HAL Id: hal-05176876

https://hal.science/hal-05176876v1

Submitted on 22 Jul 2025

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Distributed under a Creative Commons CC BY 4.0 - Attribution - International License

Developing small-scale bamboo enterprises for livelihoods and environmental restoration in Benishangul-Gumuz Regional State, Ethiopia

M. BOISSIÈRE[a,b], S. ATMADJA[b], S. BENMAKHLOUF[c], M. BEYESSA[d], H. KASSA[b], T. HUNDE[e], and F. ASSEFA[e]

[a]*Agricultural Research for Development (CIRAD), Research Unit Forests and Societies, Campus International de Baillarguet, 34398, Montpellier Cedex 5 – France*
[b]*Center for International Forestry Research (CIFOR), c/o International Livestock Research Institute (ILRI), CMC Road, Gurd Shola, Woreda 06/ Bole Sub-city, P.O. Box 5689, Addis Ababa, Ethiopia*
[c]*Museum National d'Histoire Naturelle (MNHN), 57 rue Cuvier, 75231 Paris Cedex 05, France*
[d]*Assosa Environmental Protection Association (AEPA), Assosa, Benishangul-Gumuz Regional State, Ethiopia*
[e]*International Bamboo and Rattan Organisation (INBAR), 9th Floor, Building 2, Yobek Commercial Center, Addis Ababa, Ethiopia*

Email: manuel.boissiere@cirad.fr

HIGHLIGHTS

- Benishangul-Gumuz Regional State (BGRS) has the highest proportion and area of natural bamboo forests in Ethiopia, mostly lowland bamboo (*Oxytenanthera abyssinica*).
- In BGRS, bamboo resources were poorly managed and wasting away.
- There is a lack of bamboo-focused training among foresters, and local bamboo value chains are under-developed.
- We characterize the existing bamboo business models, and the state and non-state actors influencing the sustainable management of bamboo resources and bamboo value chains.
- We identify the support needed by small-scale enterprises, including training in business and bamboo-specific technical skills, access to financing adapted to their capacity and needs, improved infrastructure and market linkages, and land use planning that accounts for the economic and environmental values of bamboo resources.

SUMMARY

We document the perceptions, practices and policy options in managing lowland bamboo [*Oxytenanthera abyssinica*] in Benishangul Gumuz Regional State (BGRS) in Ethiopia, particularly to enable small-scale enterprises (SSE) to become more active in this field. This region hosts the largest extent of natural bamboo forests in Ethiopia. There is a recent push to realize bamboo's economic and environmental potential in Ethiopia, which puts SSEs as crucial actors. There is little or scattered published information on local perceptions and practices surrounding natural bamboo forest management and options for realizing bamboo's potential from a subnational/local perspective in Africa, including in Ethiopia. In 2018, we conducted a literature review, spatial analysis, participatory mapping, and interviewed experts working in governmental and non-governmental organizations and local stakeholders in BGRS. We find some consensus of the environmental importance of bamboo. In contrast, there is some debate at the subnational level about the economic importance of bamboo, leading to decisions favouring other land uses. Bamboo forests in this region suffer neglect, as they are perceived to be 'owned by no one and used by everyone' and will continue to be there without management. Lack of market-driven opportunities, bamboo-specific training among foresters, data on economic contributions of bamboo, and regulations or guidelines to support existing laws have prevented effective management of the bamboo resource. There are multiple bamboo management approaches that open economic opportunities for SSEs in the region. There needs to be more clarity on how to secure land use rights over bamboo forests, accessible financing, market linkages, business training, and low-tech/low-cost technologies to encourage the development of bamboo SSEs.

Keywords: dry forest, forest restoration, green economy, Horn of Africa, low emission development, private sector, sustainable forest management

Développement de petites entreprises de bambou pour améliorer les moyens de subsistance et la restauration de l'environnement dans l'État de Benishangul-Gumuz, Éthiopie

M. BOISSIÈRE, S. ATMADJA, S. BENMAKHLOUF, M. BEYESSA, H. KASSA, T. HUNDE et F. ASSEFA

Nous documentons les perceptions, les pratiques et les options politiques dans la gestion du bambou de basse altitude [*Oxytenanthera abyssinica*] dans l'État Régional de Benishangul Gumuz (ERBG) en Éthiopie, en particulier pour permettre aux petites entreprises de devenir plus actives dans ce domaine. Cette région abrite la plus grande surface de forêts naturelles de bambou en Éthiopie. Le bambou y est de plus en plus considéré pour son potentiel économique et environnemental, ce qui donne aux petites entreprises un rôle d'acteur crucial. Il existe

cependant peu ou pas d'informations publiées sur les perceptions et les pratiques locales concernant la gestion des forêts naturelles de bambou, ni sur les options pour exploiter le potentiel du bambou au niveau local, en Afrique et plus particulièrement en Éthiopie. En 2018, nous avons effectué une revue de littérature, une analyse spatiale, une cartographie participative et interviewé des experts travaillant dans des organisations gouvernementales et non gouvernementales et d'autres acteurs locaux de ERBG. Nos résultats montrent qu'il existe un certain consensus sur l'importance environnementale du bambou. En revanche, un débat au niveau infranational sur l'importance économique du bambou conduit à des décisions favorisant d'autres types d'utilisation des terres. Les forêts de bambou de cet État sont négligées, car elles sont perçues comme "n'appartenant à personne et utilisées par tout le monde" et, selon les acteurs locaux, elles continueront d'être là, même si elles ne sont pas gérées. Le manque d'opportunités en relation avec le marché, de formations pour les forestiers spécifiques sur le bambou, de données sur la contribution économique de la ressource et de réglementations ou directives pour soutenir les lois existantes, ont empêché une gestion efficace des ressources en bambou. Il existe cependant de multiples approches de gestion du bambou qui ouvrent des opportunités économiques aux petites entreprises de la région. Il faut plus de clarté sur la manière de renforcer les droits fonciers sur les forêts de bambou, un financement plus accessible, des liens renforcés avec le marché, la formation au commerce et aux technologies à faible coût pour encourager le développement de petites entreprises de bambou.

Desarrollo de pequeñas empresas de bambú para los medios de vida y la restauración medioambiental en la región de Benishangul-Gumuz (Etiopía)

M. BOISSIÈRE, S. ATMADJA, S. BENMAKHLOUF, M. BEYESSA, H. KASSA, T. HUNDE y F. ASSEFA

En este artículo se documentan las percepciones, prácticas y políticas en la gestión del bambú de tierras bajas [*Oxytenanthera abyssinica*] en la región de Benishangul Gumuz (Etiopía); especialmente, aquellas que permiten que las pequeñas empresas tengan un papel más activo en este ámbito. La región de Benishangul Gumuz alberga el bosque de bambú natural más extenso del país. El aprovechamiento del potencial económico y medioambiental del bambú en Etiopía que se ha impulsado recientemente ha convertido a las pequeñas empresas del sector en actores principales. La información que se ha publicado sobre la percepción y las prácticas locales entorno a la gestión de los bosques naturales de bambú y las opciones para el aprovechamiento de todo el potencial del bambú desde una perspectiva subnacional o local en África, incluyendo a Etiopía, ha sido escasa y aislada. En 2018 llevamos a cabo revisiones bibliográficas, análisis espaciales, mapeos participativos y entrevistas tanto a expertos que trabajaban en organizaciones gubernamentales y gubernamentales como a los locales involucrados en la región de Benishangul Gumuz. De forma consensuada, confirmamos la importancia medioambiental del bambú. Por el contrario, existe un debate a nivel subnacional acerca de la importancia económica del bambú, que ha llevado a la toma de decisiones que favorecen otros usos de las tierras. En esta región, los bosques de bambú son víctimas de abandono debido a que se perciben como "tierras sin dueño pero explotadas por todos" y que continuarán existiendo incluso sin ser gestionadas. La falta de impulso de oportunidades de mercado, de formación específica en bambú de los guardas forestales, de datos sobre las aportaciones económicas del bambú y de regulaciones o normas que apoyen a las leyes actuales, ha impedido que se efectúe una gestión efectiva de los recursos de bambú. Existen diversas estrategias de gestión que suponen oportunidades económicas para las pequeñas empresas de la región. Tenemos que ser más claros en cuanto a la protección los derechos de explotación de tierras ante los bosques de bambú, el acceso al financiamiento, los vínculos comerciales, la formación empresarial y la tecnología low cost para fomentar el desarrollo de las pequeñas empresas que explotan el bambú.

INTRODUCTION

African countries face unique challenges in sustainably managing bamboo resources and developing bamboo value chains. International forest policy focuses on treed lands, marginalising bamboo forestry development and making it difficult to integrate bamboo within existing forestry institutions and practices (Buckingham *et al.* 2014, Buckingham *et al*. 2011). At the national level, many African countries find it difficult to develop their bamboo resources, due to the following challenges: (1) Unclear governance: Bamboo is not a core business of either agricultural or forestry departments, and is therefore caught between the two sectors; (2) Where bamboo is clearly in the forestry sector, foresters are not trained to manage it. Western silvicultural science powerfully influences the training of young foresters in African countries through a history of international development cooperation. Bamboo is not a predominant part of western forest management and is traditionally excluded from forestry training. Forests are equated with trees, but silvicultural management logic and statistics are fundamentally incompatible with bamboo life cycles and ecology, leading to poor bamboo management (Buckingham *et al*. 2011).

While bamboo management is well-documented in the Asian context, there is comparatively little information about the issues facing African countries (Lobovikov *et al*. 2007). Bamboo has a strong potential to combat serious environmental problems and contributes to the local and national economies of many African countries, who are also struggling to realize bamboo's potential (Musau 2016). There is little or scattered published information on local perceptions and practices surrounding natural bamboo forest management in Africa, and options for realizing bamboo's potential from a subnational/local perspective. This knowledge is essential for identifying effective and locally relevant approaches to realize bamboo's potential as a valuable natural resource.

Our study addresses this gap by analyzing existing literature and empirical evidence of the challenges of developing bamboo resources at the subnational level in Africa, using a case study of lowland bamboo [*Oxytenanthera abyssinica*] in Benishangul-Gumuz Regional State (BGRS), Ethiopia. This work complements existing analysis on the economic value and value chains of bamboo in Ethiopia at the national level

(e.g. Kelbessa *et al*. 2000, Tsinghua University and INBAR 2018, Durai *et al*. 2018). Lowland bamboo resists drought and thrives on poor soils, indicating its economic and land restoration potential. BGRS has a vast endowment of naturally-occurring lowland bamboo forests that is poorly managed, leading to rapid loss and degradation (Bessie *et al*. 2016).

Small-scale enterprises (SSEs) are essential actors in developing Ethiopia's bamboo sector. Ethiopia recently published a 2019–2030 national bamboo development strategy (EFCCC and INBAR 2020), marking an important milestone in acknowledging bamboo's strategic role in Ethiopia's environment and economic development. The Ethiopian government targeted 0.7 million ha of degraded land to be afforested/reforested with bamboo by 2020 and aim to develop bamboo-based furniture, pulp and paper, construction material, energy, crafts and timber substitutes. The general objective of the strategy is "To transform and sustainably manage bamboo resources by focussing on the development of green industries and livelihood promotion to produce value-added products catering for domestic, regional and global markets." Achieving these objectives imply empowering SSEs, who are currently still "small, informal and survivalist" (EFCCC and INBAR 2020, 11).

Our research questions seek to understand local **perceptions** (What is the perceived role of bamboo for environment and livelihoods?), **practices** (How is lowland bamboo being managed?) and **policy options** to economically develop bamboo resources (What options can be proposed for enabling SSEs to sustainably utilize the bamboo resource in BGRS?) in the context of BGRS. We focus on SSEs, due to their crucial role in linking environmental with economic objectives at multiple levels. In this study, SSEs include what Ethiopia's Central Statistics Authority defines as small-scale enterprises (that employ less than 50 employees of which less than 10 are using motorized equipment), and micro-scale enterprises (with less than 10 employees, none of which uses motorized equipment).

In this article, we summarize the context of bamboo at the national level in Ethiopia and answer the above research questions at the subnational level using methods described in a subsequent section. We conclude our findings by arguing that to better develop bamboo SSEs in BGRS, there needs to be more clarity in land use rights, accessible financing, market linkages, business training, and low-tech/low-cost technologies to encourage the development of bamboo SSEs.

BAMBOO AS A FOREST RESOURCE IN ETHIOPIA

Ethiopia's bamboo resource

Figures on national bamboo forests (i.e. forests dominated by bamboo species) in Ethiopia vary between 0.9 m ha (LUSO Consultant Gmbh 1997), 1.1. m ha (Kelbessa *et al*. 2000) and 1.4 m ha by Tsinghua University and the International Network for Bamboo and Rattan (INBAR) (2018). Lowland bamboo comprises the majority (>80%) of bamboos found in Ethiopia (Kelbessa *et al*. 2000). These variations could reflect the population's natural variability due bamboo's fast growth rate and sudden large-scale die-out due to mass flowering (Sertse *et al*. 2011). It also reflects the difficulties in differentiating bamboo forests from other land covers (Tsinghua University and INBAR 2018).

There are 2 main bamboo species in Ethiopia, highland bamboo (*Oldeania alpina)* and lowland bamboo (*Oxytenanthera abyssinica*). Most of the bamboo in Ethiopia are lowland bamboo. The majority (64%) of bamboo forests are found in BGRS (Table 1 and Figure 1). They mostly grow between 500 and 2200 m above sea level (Personal observation, Hunde).

Managing bamboo resources in Ethiopia

The majority of bamboo forests are naturally occurring rather than planted bamboo located on state-owned lands that are de-facto managed by local communities (Tsinghua University and INBAR 2018). There are unclear rights over bamboo forests that prevent local people from sustainably managing natural bamboo forests (Moreda 2017). Some highland bamboos are planted by farmers in farmlands, which are under the purview of the agricultural sector. Legally, bamboo was included in the definition of forest in 1994, 2007 and then in 2018 forest proclamations. Bamboo was firmly included as part of the forest definition in FAO's 2015 Forest Resource Assessment (FAO 2012). The 2018 forest proclamation, Article 2 Sub-article 3 confirmed bamboo in the definition of a tree, which is "*any woody plant regardless of its age or size and includes bamboo, reed and palms as well as other plants to be designated per se by the Ministry*" (FDRE 2018).

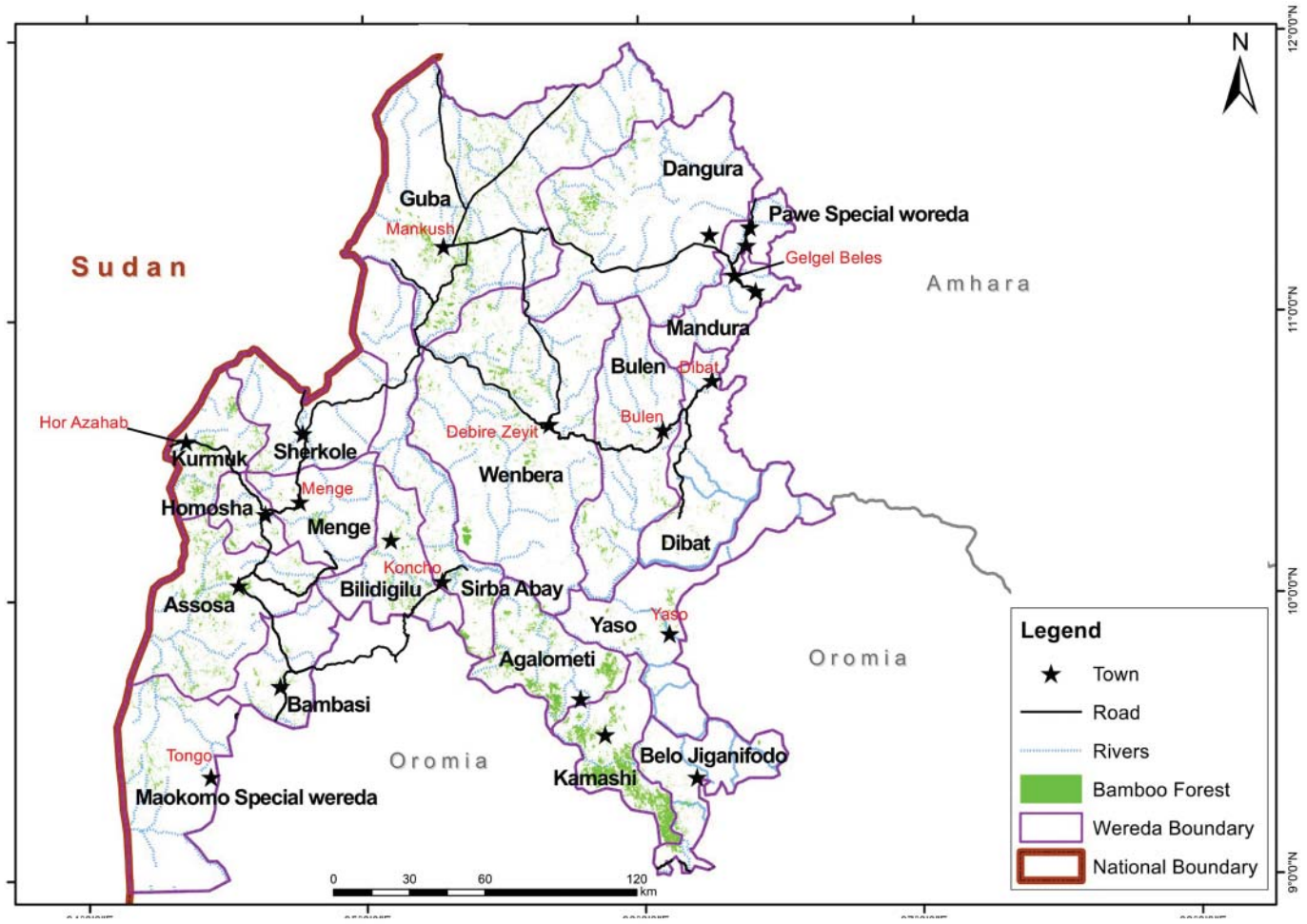
Since bamboo is part of the forest definition, the governance and management of bamboo resources depends on

TABLE 1 *Bamboo area in Ethiopia*

Regional State	Bamboo area in ha	Dominant bamboo species
Benishangul-Gumuz	944 759	Lowland bamboo (*O. abyssinica*)
Amhara	312 229	Lowland bamboo
Oromia	211 724	Lowland bamboo
Southern Nations, Nationalities, and Peoples'	4 856	Highland bamboo (*O. alpina*)
Gambela	894	Lowland bamboo
Total	1 474 463	

Source: Tsinghua University and INBAR (2018)

FIGURE 1 *Bamboo land cover map of BGRS*



Source: (Boissière *et al.* 2019), based on the map developed by FAO from 2013 satellite images, updated with Landsat, date of acquisition 28/02/2018, from http://www.usgs.org, software QGIS

forestry institutions and training of foresters. Government institutions and forestry professionals still lack the capacity to understand and responsibly manage the resource base. Until 2013, forests and bamboo were governed under the Ministry of Agriculture and Natural Resources (MoANR). During this time, forest governance and management (including bamboo) received little attention and institutional support within MoANR (Ayana *et al.* 2013). The forestry sector gained a foothold in Ethiopia's government administration since 2013 with the establishment of the Ministry of Environment, Forest and Climate Change (MEFCC) and the ensuing regional forestry bureaus. In 2018, the Ministry became the Ethiopian Environment, Forest and Climate Change Commission (EFCCC). No longer a ministry, the forestry sector in BGRS lost some regional presence as the regional forestry bureau was absorbed into the agricultural bureau.

Forestry education in Ethiopia was founded on technical support from European foresters (Ayana *et al.* 2013), whose approach to forest management was on forest conservation and managing timber species. Training did not emphasize on specific and strategic forest species in Ethiopia such as bamboo. Generations of foresters are therefore ill-equipped to manage bamboo forests because the forestry training in the country has not adequately integrated bamboo management into its curricula. There are efforts by the Ethiopian government led by the EFCCC, civil society and development partners to improve the capacity of local actors in managing and utilizing bamboo resources. Institutions that have been supporting such efforts are the Ethiopian Environment and Forest Research Institute (EEFRI), INBAR, Swedish International Development Cooperation Agency (SIDA), and United Nations Industrial Development Organization (UNIDO).

Economic context of bamboo resources

Currently, the economic contributions of bamboo in Ethiopia are minimally or poorly documented, giving rise to the public perception that bamboo is an inferior product (Lin *et al.* 2019). From the economic perspective, bamboo pales in value compared to agricultural crops such as sesame, sorghum, corn, or cotton (Boissière *et al.* 2019). Developing SSEs could be a way to increase the economic benefits from bamboo resources, kick-start rural economies, while creating incentives for improving the management of the bamboo stands.

Similar effects were found in Nepal and elsewhere (Lamsal *et al.* 2017). Nevertheless, SSEs in Ethiopia are prone to fail due to inadequate finance, low business and technical skills, lack of training, and inability to re-invest profits (Bekele and Worku 2008). The national business climate is difficult; Ethiopia ranks 167 of 190 economies in terms of starting a new business[1]. These reasons may explain the low number of operational bamboo-based SSEs.

Potential role of SSEs in adding value to an undervalued resource and benefit surrounding communities

The Ethiopian government has recognized the role of SSEs as a vehicle to create employment, promote entrepreneurship, and enhance the role of the private sector in the economy (EFCCC and INBAR 2020). In national strategy documents, employment creation is seen as a way to alleviate poverty and enhance food security (e.g., the Poverty Reduction Strategy, the Industrial Development Strategy, the Micro and Small Enterprises Development Strategy) (Gebrehiwot and Wolday 2006).

National data from Ethiopia's Central Statistics Authority (CSA) indicate that small-scale manufacturing industries can bring significant value-added income (i.e., gross income minus cost) and employment to the national economy. In a 2013 survey, furniture manufacturing – of which bamboo is an important input – has generated 17.4% of national added value. This is only surpassed by agribusiness-related industries such as food production and mill services, which generated 42% of value-added income from small-scale manufacturing nationally (Central Statistics Authority 2014). This trend is partially reflected in BGRS, where 68% of small-scale manufacturing are flour mills (Central Statistics Authority 2014).

METHODS

Our research questions (See Box 1) focuses on perceptions, practices and policy options relevant to lowland bamboo in BGRS, Ethiopia. Data were collected under two research activities: (1) technical assistance funded by UN-REDD through the Food and Agriculture Organization (FAO) to develop guidelines on sustainable forest management in dry lands of Ethiopia, with a focus on bamboo forest management in BGRS (Boissière *et al.* 2019). Field visits for data collection took place between March and May 2018 in Assosa zone, especially in Homosha, Kurmuk, Assosa, and Bambassi districts; and (2) research for a Masters thesis, conducted in parallel with the aforementioned technical assistance, on village and household-level perceptions of bamboo forests and its management in Abramo and Abende Mengeda villages, Assosa District (Benmakhlouf 2018). Data collection took place between March and July 2018. Table 2 summarizes the various data collection approaches and how they contributed to answering our research questions.

RESULTS

Q1: Bamboo's perceived role for the environment and the economy

Using bamboo products can reduce pressure on dry forests
Experts at the national level and NGOs that were engaged in PFM at the regional level believed that one of the main environmental contributions of better lowland bamboo management is its potential to replace wood products and reduce pressure on dry forests. One of the categories of forests in Ethiopia is dry forest, existing in dry or arid environments and forming unique vegetation types (Atmadja *et al.* 2019). Forests and woodlands in the dry lowlands of Ethiopia are experiencing much higher rates of deforestation compared to moist forests found in the highlands due to expansion of commercial agricultural investment. Some of the economically valuable trees such as *Boswellia* and *Commiphora* species found in these dry forests have very slow regeneration rates and need decades to reach maturity. They are subjected to high rates of collection for their non-timber forest products (e.g. excessive tapping of gums and resins), and tree cutting for construction and fuelwood, and conversion to large-scale agricultural development. Also, dry forest and woodlands are widely used for grazing that seriously undermines regeneration and survival of seedlings.

Box 1 List of research questions

Q1: Perception: What is the perceived role of bamboo for the environment and the economy?
- Q1a: Environment: How is bamboo perceived to help address environmental issues?
- Q1b: Economics: How is bamboo perceived to help address economic and livelihood issues?

Q2: Practice: How is lowland bamboo being managed in BGRS?
- Q2a: Understanding: How do local actors understand bamboo management?
- Q2b: Tenure: How do land tenure and land use rights influence bamboo management?
- Q2c: Technical: How do technical and business considerations influence bamboo management?

Q3: Policy: What options can be proposed for enabling SSEs to sustainably utilize the bamboo resource in BGRS?
- Q3a: Actors: Who are the existing actors in the bamboo value chain?
- Q3b: Support: What support do they need to develop bamboo-based SSEs?

[1] See the 2019 Ease of Doing Business index, http://www.doingbusiness.org/en/data/exploreeconomies/ethiopia

TABLE 2 *Data collection methods and link to research questions*

Data collection methods	Research questions*
Data collection for UN-REDD technical assistance (Boissière *et al*. 2019)	
Literature review: Google Scholar and Google search with keywords such as "small scale enterprise", "Ethiopia", "bamboo management", "bamboo forest cover", "bamboo value chain" using; With regards to the legal aspects of bamboo management in Ethiopia, we used information published by government organisations; Results from a study on dry forest management under the same project (Atmadja, Eshete, and Boissière 2019).	1a, 1b, 2b, 2c
Participatory mapping to understand local bamboo management practices across the region. A one-day workshop held in Assosa, capital of BGRS, in May 2018. Twenty-three key stakeholders in natural resource management at the regional level. Four groups of participants identified different types of bamboo management they envisioned for the region and drew the areas where these management types would be ideally located. The four maps were merged, reviewed, corrected and approved by all the participants, and used to discuss potential actions for bamboo management.	2a, 2b, 2c
Key informant interviews (National level) – experts from EEFRI, EFCCC, INBAR	2c, 3a, 3b
Key informant interviews (District level) – NGOs supporting participatory forestry management based on bamboo (Farm Africa, Assosa Environmental Protection Association (AEPA)); Regional government bureau staff (Cooperatives Promotion; Agriculture; Finance and Economic Development; Investment; and Environment, Forest and Land Administration); District level experts from the Agriculture bureau; Managers of local bank branches (Commercial Bank of Ethiopia; Development Bank of Ethiopia); production manager of the only bamboo processing factory present in BGRS; bamboo traders and buyers in Assosa market	1a, 1b, 2c, 3a, 3b,
Site visit (Existing bamboo SSEs) Bamboo Star and AgroForestry PLC workshop in Assosa; Bamboo market in Assosa; bamboo forests in Assosa and Kurmuk districts; Bamboo nurseries around Assosa town (government, private, community); INBAR workshop in Addis Ababa	1b, 2c, 3a, 3b
Data collection for Masters thesis (Benmakhlouf 2018)	
Key informant interviews (Village level) Bamboo wholesalers and traders; PFM committee members and leaders; Bamboo cooperative; community and district heads;	1a, 1b, 2a, 2b, 2c, 3a, 3b
Group discussions (Village level): Groups of by gender (women, men) and membership in collective action (PFM/cooperative) (members and non-members)	
Field observations: bamboo harvesting, processing, trading, bamboo forest resources, decision making processes in collective action	

* Refers to research question numbers in Box 1

Lowland bamboos coexist with other dryland species in these semi-arid areas. But unlike trees, lowland bamboos reach maturity in about 3 years, and culms (i.e., individual bamboo stems) can be harvested annually afterwards without negative consequences for the sustainability of the bamboo forest stands. This incredibly fast growth rate makes lowland bamboos ideal substitutes for (slower-growing) trees as a source of fuelwood, construction material and fodder, which in turn contributes to reduce deforestation indirectly.

Bamboo can protect national economic interests

Based on interviews with experts from INBAR and our review of literature, bamboo can play an important role in protecting national interests, since BGRS is home of the largest hydroelectric dam in Ethiopia (i.e. the Grand Ethiopian Renaissance Dam/GERD) and a main destination for large-scale agricultural investment in Ethiopia. The GERD is a significant national investment and its lifespan is affected by siltation. There is a strong national interest to ensure catchments feeding to the GERD can effectively reduce siltation and extend the life span of the dam. Large-scale agricultural investments in BGRS are threatened by desertification. BGRS receives dust storms every year from the Sahara desert (Goudie and Middleton 2001)[2].

Due to its fast-growing nature and extensive root and rhizome system, experts we interviewed argued that bamboo should be an important component in forest conservation and land restoration efforts. Bamboo thrives even in difficult conditions, such as poor and shallow soils, and low rainfall (between 700 and 1000 mm/year) as it develops shallow large

[2] https://earthobservatory.nasa.gov/images/38464/dust-storm-over-sudan-and-ethiopia

root and rhizome structures. This means bamboo can quickly stabilize soil in highly degraded areas and can be an effective tool to reduce dam siltation. As it grows in drier areas, lowland bamboo can help to fight desertification and minimize the effects of dust storms on the soil and on farmlands.

Bamboo's perceived economic importance varies across different actors

From our interviews with community members, NGOs, forestry experts at the regional and national levels, and discussions during our workshop in Assosa, we identified a wide array of domestic uses from bamboo by the people of BGRS. Bamboo forests are used as source of food (shoots) and medicine. Shoots and leaves can be fed to livestock, while bamboo culms were used for fuel wood, building houses and livestock shelters, and making crafts such as mats and utensils. Bamboo provides cheap or free materials for local people that they would otherwise have to harvest from dry forests, buy at high cost from far away or replace with slow-growing trees. If monetized, the true economic value of bamboo for households could be significant. The economic value of bamboo for local people that were identified by our respondents, however, have not been estimated nor recorded in official statistics, and are therefore not well-integrated in decision-making at higher levels. Existing studies (Durai *et al*. 2018) focus on the value of marketed products. The value of non-market products and services from bamboo forests (e.g., collected for own consumption, or environmental services) remains undocumented.

Our interviews with regional-level policymakers regarding landuse, and data on land allocation in BGRS suggested that bamboo forests were seen as less valuable from an economic perspective compared to other landuses. Some workshop participants perceived that the bamboo forests will always be there even without management and conservation, benefit from fire, and – unlike crop production – have little economic potential.

Lands where bamboo forests are found have been allocated for large-scale agriculture. Participants of our participatory mapping noted that over the past few years about 350,000 ha of land have been transferred to investors in BGRS and another 220,000 ha were planned to be taken over by the artificial lake to be created by the Great Ethiopian Renaissance Dam. All of these come at the expense of bamboo forests in the region. The 2011–2015 bamboo mass flowering also significantly reduced the area of bamboo forest, with much of the resulting seeds destroyed by fires and land conversion to agriculture. This was also confirmed during our field observations in 2018. The overall effect of shrinking bamboo forests is supported by Bessie *et al*. (2016). Forestry practitioners and local people participating in bamboo SSEs were frustrated by the meager support they received in managing, using and conserving forests, being helpless in preventing forests from disappearing, and watching large-scale agricultural investors get priority in acquiring and clearing forest lands.

Q2: The practice of lowland bamboo management and governance in BGRS (Q2)

There is a lack of understanding on how to manage bamboo forests to maximize economic benefits

The regional government of the BGRS recognized that almost all (96.7%) of the domestic energy needs were met by using biomass including bamboo: "such an extensive use of bio-fuels naturally has a negative impact on forest resources and wildlife. Especially the dense bamboo forests have been greatly affected by intensive cutting down of bamboo culm to meet the ever-growing demand for household energy" (BGRS BoFED 2017, p.34). BGRS must meet the fuelwood needs of large refugee camps hosting tens of thousands of refugees for many years.

Bamboo experts we interviewed identified that the across Ethiopia, forest managers and the public assume that bamboo forests should be managed like any other (tree-dominated) forest by conserving the resource and preventing use as much as possible. From an expert's perspective, this assumption reflects a widespread misunderstanding on how to maintain and sustainably use lowland bamboo forests. If sustainable bamboo development and harvesting principles are applied, 25% of bamboo culms in a clump *can and should* be thinned annually following a seasonal calendar. Regular thinning, coupled with active bamboo planting around homesteads, can provide a sufficient and sustainable supply of bamboo culms for different uses, including for fuelwood. Dense bamboo stands left un-thinned for many years will degrade, provide little economic benefits and pose fire risks especially if located near human settlements. Fires regularly occur in BGRS during the dry seasons. They prevent germination of bamboo seeds and threaten the survival and growth of bamboo seedlings.

Lowland bamboo from the same rhizome will simultaneously flower approximately once every 40 years when it produces viable seeds, and then dies. Mass flowering and the ensuing die-out can affect large expanses of bamboo forests sharing the same rhizome network. In 2011 one flowering event led to the death and regeneration of 85% of bamboo forests in BGRS (Sertse *et al*. 2011). This could be seen as an opportunity to collect valuable bamboo seeds for resale/establishing nurseries. Nevertheless, bamboo experts at the national and district levels mentioned that many farmers cleared the area to convert the land into agricultural fields, and/or to prevent the spread of what they thought was a plant disease. Respondents at the national and district level felt this lack of knowledge is due to weak or absence of extension services in forestry in general and bamboo management in particular.

The tragedy of the commons: bamboo forests are owned by the government, protected by no one, and used by everyone

From our field observations and interviews with district-level informants, the poor management of lowland bamboo forests in BGRS can be associated with a lack of clarity in forest tenure and use rights. Most bamboo forests in BGRS are located in areas belonging to the state. At the time of our

study, these lowland bamboo forests in BGRS have not been demarcated, certified and classified as forest lands even though they are considered by local authorities as state-owned forests. These bamboo forests are mostly managed and used by people in surrounding communities, as observed in the two study villages and as expressed by experts at the national and district levels. Legally, communities can have the right to use forest resources in their surroundings as per a forest management plan. Nevertheless, most state-owned forests in Ethiopia do not yet have forest management plans. The 2018 Forest Law recognises community forests as one of the four types of forest ownership and use rights in Ethiopia.

In practice, experts at the national level noted that these legal provisions have not been implemented because detailed regulation and guidelines on how to acquire community rights over forests have not been issued. Hence, communities cannot acquire their legal rights because the proclamation cannot be implemented yet. This reduces their willingness to invest in sustainably managing them. In addition, some of the language in the 2018 forest proclamation are more advantageous for tree-based forests. For example, the length of tax breaks are expressed in terms of "harvest cycles", which is a mere 1–2 years for bamboo compared to 10–15 years for trees.

Limited knowledge of stand management and harvesting practices

Bamboo experts that we interviewed observed that in BGRS and Ethiopia in general, there is limited knowledge of bamboo's life cycle, leading to poor management and harvesting practices in natural bamboo forests. Knowledge of bamboo management for maximizing economic value is poor in BGRS, both among local communities and forestry experts. Respondents expressed that better extension service regarding appropriate time and method of harvesting is urgently needed to develop lowland bamboo into a resource that can provide regional and national level environmental and economic benefits.

Immature bamboo culms (<3yo) are harvested, which deprives the next generation of bamboo from sugars needed to grow. Conversely, old bamboo culms (>3yo) are left aside and continue to compete with new culms for space and nutrients. Culms are cut too high from the soil (i.e. above 30 cm from the ground), which increases exposure to diseases and wastes resource.

Culms are harvested all year round, resulting in low-quality bamboo, increased disease and pest risk, and degradation of the bamboo resource in the long term. Harvesting is recommended at the end of the rainy season and the start of the dry season, when the starch content of the culm lowest and the likelihood of wood borer attacks on bamboo products is consequently reduced (Brias and Hunde 2009). Conversely, there are periods when harvesting is not advised. At the end of the dry season, harvesting is detrimental for the development of the new culms. It increases the risk of parasite spread and it deprives new shoots arising in the rainy season from nutrients that were accumulated and conserved throughout the dormancy period in the preceding dry season. Culm harvests should avoid the sprouting period of shoots, as the operation will damage developing shoots. Thus, better extension service regarding appropriate time and method of harvesting is urgently needed to avoid unsustainable harvesting practices.

Limited local opportunities to rely on bamboo for a living

The livelihood opportunities from lowland bamboo in BGRS is declining with the declining resource base. The existing goods and services from bamboo forests and the resulting livelihood benefits have not been adequately captured in regional and national statistics, which are oriented towards sectoral data (e.g., forestry, agriculture, trade, manufacturing). This lack of data is related to the low capacity in the forestry sector to manage bamboo.

There are limited business opportunities for bamboo outside of the trade of bamboo culms. There are very few bamboo processing plants in BGRS. Based on our field visit, the single company with industrial tools for bamboo processing ceased to function. Industrial tools provided by bamboo training projects were not being used because of high turnover of the trainees. Local livelihoods in the region depended largely on growing crops, mainly cereals, pulses, and oil crops. Unlike bamboo, demand for food crops was growing as food-processing industries (e.g., flour mills, food product processors, transporters, wholesalers) in the region produced value-added products that attracted farmers to grow more food crops.

Locally-made bamboo furniture (e.g. chairs, beds, tables) existed and were underdeveloped. Experts we interviewed mentioned that furniture makers were not efficiently using their time because they could only access low-quality tools or imported tools that were un-adapted to the specific characteristics of lowland bamboo. In Assosa, the regional capital city, small businesses tried to produce bamboo products, such as for chopstick, floor, toothpicks and charcoal briquettes. Business actors we interviewed said they have not been successful because they could not compete with imported finished goods, especially from China. They also have trouble acquiring production inputs such as adhesives and replacement parts, and face heavy domestic competition from producers using highland bamboo. In contrast to lowland bamboo, highland bamboo was planted by farmers in other regions (e.g., Amhara, Oromia) and better-linked with manufacturers and end consumers, notably for construction in Addis Ababa.

Q3a: Enabling SSEs: Local actors

Existing bamboo SSEs in BGRS

There are two forms of bamboo SSEs we identified in BGRS during out field visits and key informant interviews: (1) Small businesses, owned either by individuals (i.e., sole proprietorship) or a group (i.e., partnerships), and (2) Cooperatives.

Small businesses: During our fieldwork, we observed that bamboo businesses in BGRS consist mostly of:

- Bamboo culm collectors: people who harvest bamboo from the forest and transport it to their neighbours,

or sell it to bamboo wholesalers who transport it to Assosa market.

- Retail bamboo trader: individuals – whose houses are typically located near the bamboo forest – sell unprocessed bamboo culms to households and traders within their village. They operate in localized markets confined to their villages. They sell up to one cart worth of bamboo (about 100 culms) at a time.
- Wholesale bamboo traders: business representatives mainly from Assosa town, who come to buy bamboo in large quantities in units of 100 culms directly from villagers for a particular purpose, after getting permission from the relevant district offices. They sell bamboo culms for fences, furniture, house construction, and firewood. They buy culms from villagers/harvesters living near bamboo forests, buy from bamboo cooperatives and other harvesters and set the price of culms. They pay an ETB 50 tax (roughly USD 2) for each donkey cart brought to Assosa market and ETB 50 for their place in the market. For example, a hotel owner went to a village famous for its bamboo resource to buy thousands of culms to build a fence. Large-scale trading was initiated by the local government in the district of Homesha during the time of bamboo mass flowering. It included trucking bamboo to neighboring Sudan.
- Transporters: people who charge bamboo traders or buyers for transporting large volumes of bamboo to a specific destination using trucks.
- Craftspeople: people who transform raw bamboo materials into value-added crafts.
- Others: we found a group of enterprising farmers that opportunistically collected bamboo seeds during a 40-yearly mass flowering for resale to nurseries, research institutions and other farmers.

Many of these business actors are self-employed. Villagers may produce handicrafts from bamboo culms they collected from communal lands or sell the culms to traders. These traders may have their own means of transportation (e.g., donkey cart, own trucks). There is also demand for transportation services (e.g., rented trucks/carts).

We observed that most small businesses in BGRS are informal[3]. The environment for small businesses is tightly regulated and weakly supported by the government, leading many businesses to exist informally. According to national statistics, informal small businesses in urban areas employ on average 1.3 persons, most of whom (60%) are female. But because they are so many, they employ ten times more workers than large and medium scale enterprises (CSA 2004). Most of them have low productivity and income, and limited access to organized markets and credit. They often lack training and they either operate without fixed location or in places such as small shops, outlets, or homes. Most small businesses in Ethiopia have single owners (Gebrehiwot and Wolday 2006).

Collective action including cooperatives and forest user groups: cooperatives are "an association of persons who have voluntarily joined together to a common end through the formation of a democratically controlled organization, making equitable contribution to the capital required and accepting a fair share of the risks and benefits of the undertaking, in which the members actively participate" (Federal Cooperative Agency 2007 p.1, in Emana 2009). There is a long history of traditional cooperatives in Ethiopia. For example, *Eqqub* associations, which consist of a small group of people that manage a rotating fund for business purposes, are common in rural and urban areas (Teshome 2008). There is also the 'modern' cooperative model. In 2007, an estimated 4.7 million people in Ethiopia were members of these modern cooperatives (Emana 2009). In 2010, this grew to 8 million people in 38,454 cooperatives[4]. These cooperatives cover a wide range of activities (e.g., consumers' cooperatives, producers' cooperatives) and commodities (e.g., leather, coffee, honey). There is a negative perception of cooperatives: during the Derg regime (1974–1991), farmers were forced to join cooperatives and sell their products to the government at a low price. During the federal regime that followed, cooperatives may still be perceived by some as a communist approach to business.

In BGRS, we observed the following types of collective action relevant to lowland bamboo management:

Participatory Forest Management (PFM) groups and cooperatives: PFM is a "forest management approach executed through the agreement between the state and the local community that inhabit inside or around the forest area over the management, protection and utilization of forests owned by the state on the basis of predefined responsibilities and benefit-sharing mechanisms" (FDRE 2018). Under this approach, forest cooperatives are established as the legal entity to manage a community's bamboo forests and generate economic benefits (Lemenih and Bekele 2008).

In the villages we studied, members of PFM groups were organised into forest user groups and subsequently into cooperatives. Cooperatives are legally recognised entities that could engage in forest management and trade of bamboo products. The forest cooperatives we observed received training and were engaged in activities on sustainable bamboo forest management. Until the time of data collection, the establishment of PFM in BGRS relied on external facilitation. We identified that facilitators supporting the establishment of PFM cooperatives are notably NGOs, including Farm Africa and the Assosa Environmental Protection Association (AEPA). The relevant government bodies such as the Cooperative Bureau and the Environment, Forest and Land

[3] The informal sector is defined as activities mainly engaged in marketed production that are not a registered company, have no complete book of accounts, have less than 10 persons engaged in the activity and have no license (CSA 2004).

[4] http://www.fca.gov.et/

Administration Bureau assisted the legalization process. PFM cooperatives focused on the sale of indigenous bamboo culms harvested from a part of the forest that is put under PFM and allocated for this purpose. Based on our observations, no processing of the raw material took place at the cooperative level. The main objective was to give autonomy to the cooperative so that it could manage its bamboo resources sustainably and connect with the local market.

One PFM cooperative in Assosa district that we studied had five administrative members that worked continuously on the development of PFM: the leader, the vice, the accountant, the judge who intervened in case of disputes, and the secretary. The cooperative grew from 80 members in 2017 to 230 members in 2018, consisting of 170 female and 60 male members. According to the group leader, the high number of female members was due to encouragement from the local administration, who wanted to ensure that more women in the community are involved in and benefit from the process. This PFM managed 555 hectares of land. PFM members sell bamboo to wholesalers equipped with trucks that could transport up to 2,000 stems. Harvests were done between March and May by groups of PFM members, coordinated by the PFM leader. Each group's leader divided the group into subgroups of 3 to 5 people who went to the forest to cut as many stems as possible. Groups alternated so that all members benefited from harvesting. Part of the income was re-invested in the cooperative, while the other part went to members according to the volume they harvested. The Regional Bureau of Agriculture and Livestock imposed annual bamboo harvest quotas per village in consultation with agricultural development agents working at the village level, who would enforce the quota.

Other (non-PFM) cooperatives: These cooperatives were either multi-purpose or purpose-specific cooperatives. Their establishment and legalization were done through the Cooperatives Promotion Offices at the district level. In one of our study villages, the establishment of the cooperative was facilitated by experts from the Bureau of Agriculture and Livestock and was set up by the Micro and Small Enterprise Development Agency. The establishment of this cooperative was part of the Eastern Africa Bamboo Project funded by the CFC (Common Fund for Communities). The project's objective was to support the marketing of bamboo furniture and to train users of bamboo forests outside PFM areas, sustainably and profitably.

UNIDO through INBAR provided training to members of one cooperative that we studied in Assosa district on bamboo ecology, management (techniques and cutting periods), restoration, and transformation into furniture. INBAR, along with the Bureau of Agriculture and Livestock, established a nursery with native and exotic bamboo to replant in a delimited (3 hectares), protected, and monitored area. At maturity, the culms were to be cut and processed into furniture. At the time of our field visit, this 3ha space was not used because cooperative members were not familiar with how to process the exotic bamboo planted. Instead, bamboo culms for processing were harvested from the communal forest, which created some tension between members and non-members of the cooperatives. The cooperative can sell a maximum of 2,000 culms to wholesalers using trucks. The cooperative sells or processes the raw bamboo and shares the income equally among members when buyers place orders. Non-members are only allowed to sell bamboo to wholesalers using donkeys and carts with a maximum load of 100 culms.

Nurseries: In BGRS, nurseries have been established by a wide range of actors: government agricultural offices, private individuals, and NGOs. Local communities followed suit by owning or managing some of those nurseries. Nurseries need to be near streams (for irrigation) and roads (for transportation), adding to the difficulty of finding ideal locations. Nursery workers collect bamboo seedlings or seeds from the forest or buy them from villagers living near the bamboo forest and replant them in the nurseries to produce more seedlings. The seedlings are sold to other farmers or used to establish bamboo plantations. During our field visits, the local market for seedlings appeared limited.

Non-SSE actors and their link with SSEs in BGRS

SSEs exist in a constellation of other actors, all of who are interlinked. In Table 3, we describe non-SSE actors identified during our study and their links with the aforementioned SSE actors.

SSEs can contribute in managing a large portion of bamboo resources in BGRS

Participants in our participatory mapping workshop identified opportunities for SSEs to contribute to sustainable bamboo management and restoration of bamboo forests in BGRS. Of the six bamboo management approaches in BGRS, five (sustainable harvest, area exclosures, PFM, plantations and nurseries) have opportunities for profit-oriented SSEs if given enough support. The remaining approach is bamboo conservation for biodiversity, which is expected from non-profit entities such as NGOs, community organizations and government institutions.

Based on the participatory mapping exercise, the five approaches relevant for SSEs can be located on approximately 838,000 ha of land, or 16.7% of total land area in BGRS (Figure 2). The remaining bamboo land cover is for community or government-based conservation (26.6%) or was not identified as areas to be managed (43.7%). In many areas, no management approach was suggested due to existing and potential land allocations for the GERD, large-scale agricultural investments and protected areas.

Existing NGOs working in topics relevant to developing Bamboo SSEs

NGOs and other development actors can be partners in developing bamboo SSEs. Of the 39 NGOs and development actors working in BGRS in 2017, 15 were involved specifically in developing livelihood options, economic empowerment, and developing market linkages for farmers (BGRS BoFED 2017). Among them, three organizations were involved specifically in bamboo forest management and development. INBAR, an inter-governmental organization working with the

TABLE 3 *Other market actors and links with SSEs in BGRS*

Market Actors	Description	Link with bamboo SSEs in BGRS
Large scale bamboo enterprises	One of the six industrial bamboo companies in Ethiopia had a workshop in BGRS, which was not functional at the time of fieldwork. Other companies had workshops in Addis Ababa and Amhara regions, which use highland bamboo to produce flooring tiles, mat, boards, curtains and incense sticks[1]	No direct link
Community members adjacent to bamboo forests, but not part of bamboo SSEs	People living in the same communities as communities with bamboo-based collective action or small businesses but are not part of these enterprises (i.e., non-members). They are mostly farmers.	Potential members of bamboo collective actions; Potentially competing landuse interests
Bureau of Agriculture and Livestock, Bureau of Environment, Forest and Land Administration	Provided limited training, funds, and equipment for SSEs. Had local staff knowledgeable in developing bamboo products and markets, but focus on crops and prioritize land for agriculture investments	Levied taxes; provided training and seedlings
NGOs/IGO – Mainly FARM Africa, AEPA, INBAR.	Promoted PFM for bamboo and frankincense. Mainly FarmAfrica, AEPA, INBAR.	Facilitated the establishment of PFM projects and formation of cooperatives; provided training to cooperative members and other community members; established bamboo nurseries
Final consumers	Bought bamboo for construction or fuelwood; came to markets and negotiated with traders.	Link via traders

[1](Durai *et al*. 2018)

EFCCC, developed training on processing handicraft from bamboo using low-tech tools for farmers in Assosa. FarmAfrica, an international NGO, in collaboration with AEPA, developed business models for non-timber forest products (e.g., frankincense from *Boswellia* trees that grow near or along with bamboo forests). They aimed to increase the income of rural households by 35% through sustainable forest product enterprises. They also provided training on developing and managing a cooperative in the context of PFM, accounting, and transforming bamboo into value-added products.

Q3b: Enabling SSEs: Support needed

Through our study, we identified several challenges in enabling SSEs to use the bamboo resources in BGRS sustainably: (1) lack of essential business skills or knowledge specific to lowland bamboo, (2) lack of access to finance, (3) poor market linkages, and (4) large-scale conversion of bamboo forests to other land uses. This section identifies the support needed by SSEs to overcome the above challenges based on our interviews, literature review and field observation.

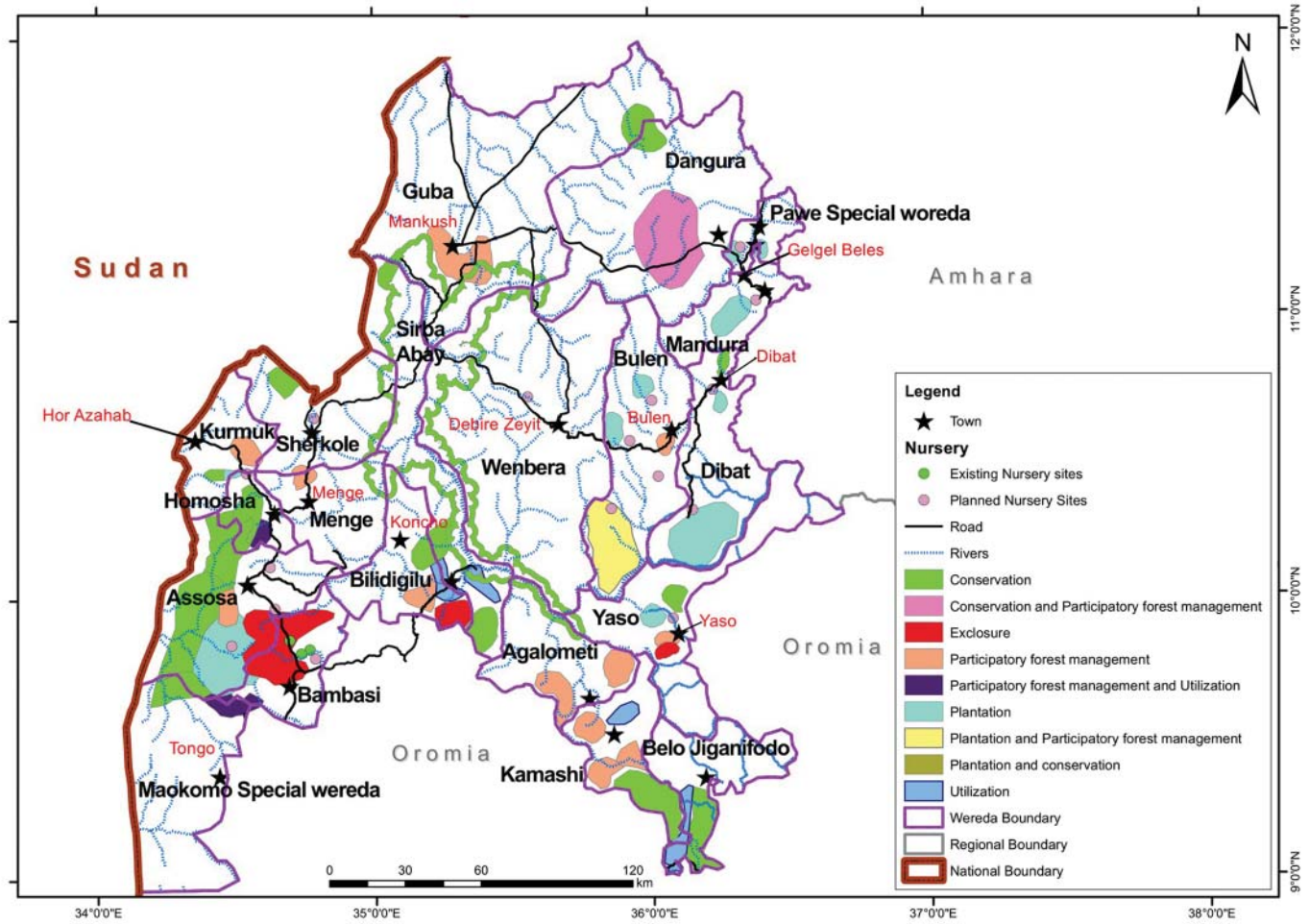
Improve business skills and technical knowledge specific to lowland bamboo

Training for bamboo SSEs needs to balance between business management and technical knowledge of bamboo management and utilization. A focus on improving stand management is necessary to get uniformly-aged culms of good quality for processing. Bamboo SSEs lack the skills to process the raw material and produce low-tech and low-cost products in line with market demand, such as furniture, lampshades, mats, panels, and curtains.

The bamboo business models we identified in BGRS heavily relied on the sale of raw materials and seedlings. The local market for poles and fences was growing, driven by significant local demand. With external support, there are market opportunities that can be further developed, as suggested in Table 2. For example, there is untapped demand in large cities like Addis Ababa, for scaffolding and construction of houses and fences. Currently, scaffolding material in Addis Ababa is dominated by *Eucalyptus* poles. In many countries in Southeast Asia, bamboo is the dominant scaffolding material. Fuelwood from trees is marketed widely in many urban centres, but there is no market for (more sustainable) bamboo fuelwood. If well-promoted, bamboo could be an alternative to the use of slow-growing trees for households in BGRS and outside the region. Bamboo culms can be sold in alternative forms that may be more marketable to urban or industrial consumers, such as charcoal or briquettes. Training and financing will be needed to produce these alternative forms.

Current production methods can also become more productive by making small changes in the production process and introducing locally adapted technologies. The number of culms transported can be increased by selling culms cut in 2–3 m length, instead of the current practice of 5–6 m. Industries in Addis Ababa only use the 2–3 m central part of the culm for example for making panels or floors. By adjusting to the length needed, harvesters can ship more pieces in a more

FIGURE 2 *Potential map for bamboo forest sustainable management and restoration in BGRS*



Source: Workshop in Assosa, 7 May 2018 (Boissière *et al*. 2019)

convenient format for consumers, potentially earning more. Waste bamboo can be used for charcoal or fuelwood (Figure 3). Shrinkage during transport can be minimized by sending only mature (i.e., 3–4yo) culms. Younger culms have high moister content and shrink significantly during transport. More culms transported per trip would increase profit.

Access to appropriate manual and semi-mechanical tools (e.g., electric saw, hand saw, specialized knives), along with training targeted to existing businesses can lead to more profitable furniture manufacturing (e.g. tables, chairs, mats, baskets). For example, we observed that local businesses relied on homemade tools from low-quality metals such as car leaf springs (i.e., "spring steel"). They have a short life span of about a year and need an hour of sharpening at least once a day with the help of an oilstone (Assefa, personal communication). If using a grinding machine, it may take less time but the knife's sharpness will not last more than a day due to the poor steel used. In comparison, there is equipment purposely made for bamboo exploitation, from hardened steel, which needs sharpening only once every three to six months and has a lifespan of more than ten years. Although the cost of imported tools is higher, they are more cost-effective than local handmade tools due to the significant time savings. Access to micro-credit and facilitation to import these tools may help SSEs acquire higher-quality/low maintenance tools.

Electric or mechanized tools are not recommended for SSEs due to the high cost of purchase, lack of skilled people and materials to use and maintain the tools, and unreliable electricity supply. Additionally, there are mechanized tools imported from China or India that are not being used because they are not adapted to lowland bamboo characteristics. In particular, lowland bamboo in BGRS has higher density and silica content[5] compared to bamboo species in China or India (e.g., *Bambusa vulgaris*) and other bamboos found in Africa (Tolessa *et al*. 2017), and are often not straight.

SSEs and communities surrounding bamboo forests also need to know how to sustainably harvest and manage the bamboo resources to sustain economic benefits. For example, bamboo culm should be harvested 3 years after shoot sprouting, from the centre of the clump to avoid harm against

[5] https://uses.plantnet-project.org/en/Oxytenanthera_abyssinica_(PROTA) and https://uses.plantnet-project.org/en/Bambusa_vulgaris_(PROTA)

TABLE 4 *Suggested management practices for bamboo forests that are relevant for SSEs*

Management practices	Current practice	Actor		Business model		Ideal location
		Current	Potential	Current	Untapped potential	
Sustainable harvest of bamboo forests	Bamboo forests harvested sustainably[a]	Individuals or community groups	Individuals or community groups; cooperatives; associations (youth/women/ farmer/religious groups); small businesses	Sell bamboo culm to local traders at market price, with small price differentiation in quality	Sell low-grade culm for fuelwood to refugee camp; medium/high-grade culm to furniture producers; seeds/ seedlings to nurseries/ projects	High stock of mature bamboo, not far from market or roads, high population density
PFM on bamboo forests	Bamboo forests harvested sustainably[a], formal institutions to manage access and use, benefit and cost-sharing among members	PFM-based cooperatives				
Plantations	Established often as experimental plots using imported bamboo from China	Government; Community groups			Bamboo stand management to get uniformly-aged culms for enterprises is suggested	Near/in managed areas, e.g. PFM/ exclosure areas, nurseries, settlements, home gardens.
Bamboo nursery	Produce seedlings from seeds, rhizomes or small seedlings collected in natural forests, use vegetative propagation in the absence of seeds	Large-scale business; Associations; Government		Culm for own use, or sell seedlings to traders, restoration project	Sell seedlings of other dry forest species, as an additional source of income	Near roads, water sources, areas in need of seedlings (e.g., PFM, restoration projects, plantations)
Area exclosures	None in BGRS with bamboo stands only, but good success in other regions; some exclosures exist in BGRS that include bamboo and other tree plants; communities determine areas for natural regeneration by protecting it against human use	No actors yet	Community-based cooperatives or associations	No commercial utilization allowed; bamboo not part of the management plan	Include bamboo restoration and utilization in management plan Enrichment plantations using bamboo to make exclosure more productive	Degraded lands, within walking distance from communities managing the exclosure, in locations agreed with managing and neighbouring communities

Source: Participatory mapping workshop in Assosa, 7 May 2018. Note:[a] That is, culms of at least three years old, at the start of the dry season, no more than a few culms per clump. The cut should be done with curved, disinfected handsaw, right above the first node.

FIGURE 3 *Firewood market in Assosa (BGRS)*



Photo credit: Pierre Ciavarella, 2019

younger culms growing on the periphery. The cut should be done just above the first node to prevent the accumulation of water in the internode. A detailed cultivation guideline for Ethiopian lowland bamboo is published by UNIDO (Brias and Hunde 2009).

Access to finance

Access to financing, particularly in foreign currency, is necessary to purchase semi-mechanical equipment that requires less maintenance. Financial support will also help purchasing and planting seeds and seedlings in nurseries, and for covering costs of transportation. We could identified two types of locally available sources of finance and found that neither are adapted to meet the needs of SSEs.

- **Commercial banks** have stringent rules for providing credit to small businesses, including a substantial minimum lending amount, collateral/fundraising requirements, bookkeeping history, and a robust business plan (Wole 2004 in Bekele and Worku 2008). We approached two government banks with branches in BGRS. Respondents from both banks viewed bamboo as a valuable resource with commercial value, and were ready to provide financing for businesses such as furniture and charcoal (Boissière *et al*. 2019). Nevertheless, loan requirements were geared towards medium to large businesses. For example, the Development Bank of Ethiopia only accepted loan applications from investors that can raise a minimum of ETB 500,000 (USD 18,228)[6]. This amount is too large for most SSEs. The checklist of requirements to apply for a business loan includes many items not easily attainable by small businesses, such as an investment certificate, proof of business track record, credit history, source of equity, and a project feasibility study (including demand, supply, price and marketing analyses).
- There were at least eight **microfinance institutions** (MFIs) with 11,857 members in BGRS, 64% of which were women (Abara *et al*. 2017). Among them, only one (Benishangul-Gumuz Micro Financing S.Co./BGMF) was registered and was a member of the Association of Ethiopian Microfinance Institutions (AEMFI), a network of registered microfinancing institutions in Ethiopia. BGMF was 40% owned by the regional government. In 2011 it had nearly 29,000 members and provided ETB 51.8 million in loans (Deribie *et al*. 2013). This implies the average member borrowed around ETB 1,800 or USD 107[7]. This amount was too small for most SSEs.

There is a significant financing gap that needs to be filled for SSEs seeking loans between ETB 10,000 and ETB 500,000. Commercial banks will refer small borrowers (less than ETB 500,000) to microfinance institutions. On the other hand, microfinance institutions have limited capacity to provide loans larger than ETB 10,000.

In BGRS, most MFI borrowers have difficulties repaying their loans, using profits and reducing stock to repay their credit. Nevertheless, microfinance is viewed by borrowers as an essential service to communities, allowing them to transition into new ways of earning income. Measures that help small-scale borrowers have better outcomes from their loans, such as borrower supervision or access to extension services, can reduce the probability of loan default and diversion of loans to non-business activities (Kemaw *et al*. 2017, Abara *et al.* 2017).

Infrastructures and market linkages

The presence of adequate infrastructure is essential to develop SSEs, as transportation costs of bamboo from its place of production or harvest can be high. In 2017, there were 2068 km of all weather accessible roads, of which 936 km are old (BGRS BoFED 2017). The road density is very low (40.8 km road per km^2 of total area) compared to the national average (100.1) (BGRS BoFED 2017, Ministry of Transport, Ethiopian Road Authority 2015). Nevertheless, phone services are generally adequate in Assosa zone.

Linkages between actors in the value chain need to be established and sustained. We could not identify links between large bamboo manufacturers with SSEs based in BGRS (See Table 4). A network of bamboo trader stakeholders can put into contact producers and middle persons and industries. A bamboo marketing board or similar institutions can be created to facilitate marketing and training of bamboo producers/harvesters.

[6] USD 1 = ETB 27.429, based on 2018 rates taken from https://data.worldbank.org/indicator/PA.NUS.FCRF?locations=ET
[7] USD 1 = ETB 16.801, based on exchange rate on 30 March 2011 taken from https://www.exchange-rates.orghttps://www.exchange-rates.org)

Accelerate the development of land use planning that takes into account the value of bamboo forests

Large-scale conversion of natural bamboo forests poses a significant threat to the long-term sustainability of the bamboo resource in BGRS and the possibility of developing bamboo for environmental and economic purposes. Landuse planning at the regional level was being developed but has not yet been enacted at the time of writing. Such landuse planning can significantly improve the management of bamboo forests to support SSEs if bamboo forests are considered important natural assets.

Regional and district planners need to involve local stakeholders to ensure that their perspective of bamboo's economic values are considered in landuse planning. Stakeholders include local communities that directly benefit from bamboo management, and other actors supporting bamboo development and conservation. So far, short assessments have been done at the district level to allocate land to investors. These assessments barely take into account the presence of bamboo forest and community needs.

CONCLUSION

As the region with the largest bamboo forest in Ethiopia, the BGRS government is poised to be a national leader in developing bamboo resources for improving rural livelihoods and sustainable economic development. This study has elicited information using various data sources and data collection methods to identify the perceptions, practices and actors at the regional level, and the support needed by SSEs to move forward.

The perception that the bamboo resource is resilient, not experiencing a decline, and of low economic value for the region needs to be transformed. There needs to be more awareness that the potential of bamboo resources needs to be built, and bamboo forests need to be managed as any other forest type. In landuse planning, bamboo needs to be viewed as a valuable natural asset rather than a land cover awaiting conversion. Landuse decisions can be supported by better information on the full monetary value of bamboo for the people of the region, including environmental services benefiting agriculture production and hydroelectric dams, and non-market products for self-consumption that benefit rural households.

There is a need for increased recognition of community rights over bamboo forests. The 2018 forest proclamation (FDRE 2018) facilitates this by allowing for forest ownership under communities, or associations as well as by engaging the private sector, including individuals to manage state-owned bamboo forests through concession. Nevertheless, detailed forest regulations and guidelines are needed to enable the proclamation to be implemented on the ground.

Practices in bamboo management and utilization should be strengthened through capacity building at the regional, village and household levels. Essential information should be given about bamboo harvesting timing and methods, and the bamboo life cycle, including mass flowering. Rather than setting harvesting quotas, bamboo harvest should be guided by forest management plans adapted to the bamboo's life cycle, containing guidance on the minimum age for bamboo collection, proper rotation periods, and mean annual increment.

Bamboo SSEs can improve local livelihoods and support forestland restoration initiatives. There are existing local actors that can be engaged for relevant activities. Nevertheless, essential support for SSEs is needed to enable them to grow. This includes access to finance, technology and inputs adapted to the needs of SSEs, better transportation infrastructure and forest management, landuse planning that recognizes bamboo's values, and tighter links between market actors.

ACKNOWLEDGEMENTS

We would like to acknowledge the UN-REDD for its financial support, through the Food and Agriculture Organization of the United Nations to undertake this study.

This research was carried out by the Center for International Forestry Research (CIFOR) and the Agricultural Research for Development (CIRAD), as part of the CGIAR Research Program on Forests, Trees, and Agroforestry.

We would also like to thank the Ethiopian Environment, Forest and Climate Change Commission for its support and technical guidance, the Ethiopian Environment and Forestry Research Institute, for its valuable expertise; the regional administration of Benishangul-Gumuz Regional State, especially the Bureau of Environment, Forest and Land Administration, for its support; the three anonymous reviewers, who have been instrumental in improving this; and all of the people involved in our field visits interviews and workshop, for their patience, kindness and wisdom.

REFERENCES

ABARA, G., MENGESHA, B., and REDDY, P.A.K. 2017. "Determinants of Credit Default Risk of Microfinance Institutions in Assosa Zone." *International Journal of Research in Management, Economics and Commerce* **7**(10): 45–52.

ATMADJA, S., ESHETE, A., and BOISSIÈRE, M. 2019. "Guidelines on Sustainable Forest Management in Drylands of Ethiopia." Rome, Italy: FAO.

AYANA, A.N., ARTS, B., and WIERSUM, K.F. 2013. "Historical Development of Forest Policy in Ethiopia: Trends of Institutionalization and Deinstitutionalization." *Land Use Policy* **32**(May): 186–96. https://doi.org/10.1016/j.landusepol.2012.10.008.

BEKELE, E., and WORKU, Z. 2008. "Factors That Affect the Long-Term Survival of Micro, Small and Medium Enterprises in Ethiopia." *South African Journal of Economics* **76**(3): 548–68.

BENMAKHLOUF, S. 2018. "Perception de la gestion communautaire des forêts de bambou dans la région de Benishangul-Gumuz, Ethiopie." Paris: University of Paris-Saclay and University of Sorbonne.

BESSIE, S., BEYENE, F., HUNDIE, B., GOSHU, D., and MULATU, Y. 2016. "Land Use/Land Cover Change and Its Effects on Bamboo Forest in Benishangul Gumuz Region, Ethiopia." *International Journal of Sustainable Development & World Policy* **5**(1): 1–11. https://doi.org/10.18488/journal.26/2016.5.1/26.1.1.11.

[BGRS BoFED] Benishangul-Gumuz Regional State Bureau of Finance and Economic Development. 2017. "Physical & Socio-Economic Profile." Assosa: BGRS BoFED.

BOISSIÈRE, M., BEYESSA, M., and ATMADJA, S. 2019. "Guiding Principles for Sustainable Bamboo Forest Management Plan, Benishangul-Gumuz Regional State (BGRS)." Bogor, Indonesia: CIFOR. Benish.

BRIAS, V., and HUNDE, T. 2009. *Bamboo Cultivation Manual: Guidelines for Cultivating Ethiopian Lowland Bamboo*. Vienna, Austria: United Nations Industrial Development Organization (UNIDO). https://open.unido.org/api/documents/4745831/download/BAMBOO%20CULTIVATION%20MANUAL%20-%20GUIDELINES%20FOR%20CULTIVATING%20ETHIPIAN%20LOWLAND%20BAMBOO.

BUCKINGHAM, K.C., JEPSON, P., WU, L., RAMANUJA RAO, I.V., JIANG, S., LIESE, W., LOU, Y., and FU, M. 2011. "The Potential of Bamboo Is Constrained by Outmoded Policy Frames." *AMBIO* **40**(5): 544–48. https://doi.org/10.1007/s13280-011-0138-4.

BUCKINGHAM, K.C., WU, L., and LOU, Y. 2014. "Can't See the (Bamboo) Forest for the Trees: Examining Bamboo's Fit Within International Forestry Institutions." *AMBIO* **43**(6): 770–78. https://doi.org/10.1007/s13280-013-0466-7.

CENTRAL STATISTICS AUTHORITY. 2014. "Small-Scale Manufacturing Industry Survey, 2013/2014." Addis Ababa, Ethiopia: Central Statistics Authority. http://www.csa.gov.et/survey-report/category/269-ssis-2014.

[CSA] CENTRAL STATISTICS AUTHORITY. 2004. "Report on Urban Informal Sector Sample Survey, January 2003." Addis Ababa, Ethiopia: The Federal Democratic Republic of Ethiopia Central Statistics Authority. http://www.csa.gov.et/survey-report/category/329-iss-2003?download=736:iss-2003.

DERIBIE, E., NIGUSSIE, G., and MITIKU, F. 2013. "Filling the Breach: Microfinance." *Journal of Business and Economic Management* **1**(1): 10–17. http://dx.doi.org/10.15413/jbem.2012.0115.

DURAI, J., ASSEFA, F., ASEFFA, S., JINHE, F., HUNDE, T., BEKELE, W., TSIGAYE, Z., REZA, S., and KEBEDE, B. 2018. "Value Chain Analysis and Market Assessment of Bamboo Products in Ethiopia." INBAR Working Paper. Beijing, China: INBAR.

[EFCCC] ENVIRONMENT, FOREST AND CLIMATE CHANGE COMMISSION, AND [INBAR] INTERNATIONAL BAMBOO AND RATTAN ORGANISATION. 2020. "2019–2030 Ethiopian Bamboo Development Strategy and Action Plan." EFCCC and INBAR. https://www.inbar.int/wp-content/uploads/2020/05/1579229333.pdf.

EMANA, B. 2009. "Cooperatives: A Path to Economic and Social Empowerment in Ethiopia." CoopAFRICA Working Paper No. 9. Dar es Salaam: ILO. http://ilo.org/public/english/employment/ent/coop/africa/download/wpno9cooperativesinethiopia.pdf.

[FAO] FOOD AND AGRICULTURE ORGANIZATION OF THE UNITED NATIONS. 2012. "FRA 2015 Terms and Definitions." Forest Resources Assessment Working Paper 180. Rome, Italy: FAO. http://www.fao.org/3/a-ap862e.pdf.

[FCA] FEDERAL COOPERATIVE AGENCY. 2007. *The Cooperative Development in Ethiopia (Unpublished)*. Addis Ababa, Ethiopia: Federal Cooperative Agency.

[FDRE] FEDERAL DEMOCRATIC REPUBLIC OF ETHIOPIA. 2018. Forest Development, Conservation and Utilization Proclamation No. 1065/2018.

GEBREHIWOT, A., and WOLDAY, A. 2006. "Micro and Small Enterprises (MSE) Development in Ethiopia: Strategy, Regulatory Changes and Remaining Constraints." *Ethiopian Journal of Economics, Ethiopian Economics Association* **0**(2): 103.

GOUDIE, A.S., and MIDDLETON, N.J. 2001. "Saharan Dust Storms: Nature and Consequences." *Earth-Science Reviews* **56**(1–4): 179–204. https://doi.org/10.1016/S0012-8252(01)00067-8.

KELBESSA, E., BEKELE, T., GEBREHIWOT, A., and HADERA, G. 2000. "A Socio-Economic Case Study of Bamboo Sector in Ethiopia: A Analysis of Production to Consumption System." *INBAR Working Paper*. https://www.inbar.int/wp-content/uploads/2020/05/1489482554.pdf.

KEMAW, B., YEMER, M., and SANI, S. 2017. "Determinants of Smallholder Farmer's Loan Repayment Performance: The Case of Assosa District, Benishangul-Gumuz Regional State, Western Ethiopia." *Research Journal of Finance and Accounting* **8**(21): 22–30.

LAMSAL, P., PANT, K.P., and BHATTA, D.R. 2017. "Forest-Based Micro and Small Enterprises in Nepal: Review of Status, Constraints, Scope and Approach Effectiveness." *International Forestry Review* **19**(1): 42–54. https://doi.org/10.1505/146554817820888582.

LEMENIH, M., and BEKELE, M. 2008. "Participatory Forest Management Best Practices, Lesson Learnt and Challenges Encountered: The Ethiopian and Tanzanian Experiences." Addis Ababa, Ethiopia: Farm Africa/SOS Sahel. https://theredddesk.org/sites/default/files/resources/pdf/PFM%20lessons%2C%20challenges%20and%20best%20practices.pdf.

LIN, J., GUPTA, S., LOOS, T., and BIRNER, R. 2019. "Opportunities and Challenges in the Ethiopian Bamboo Sector: A Market Analysis of the Bamboo-Based Value Web." *Sustainability* **11**(6): 1644. https://doi.org/10.3390/su11061644.

LOBOVIKOV, M., BALL, L., GUARDIA, M., and RUSSO, L. eds. 2007. *World Bamboo Resources: A Thematic Study Prepared in the Framework of the Global Forest Resouces Assessment 2005*. Non-Wood Forest Products 18. Rome: Food and Agriculture Organization of the United Nations.

MINISTRY OF TRANSPORT, ETHIOPIAN ROAD AUTHORITY. 2015. "The Road Sector Development Program: Phase V." http://www.era.gov.et/documents/10157/082f6aca-554b-4d75-bf6f-26540a936315.

MOREDA, T. 2017. "Large-Scale Land Acquisitions, State Authority and Indigenous Local Communities: Insights from Ethiopia." *Third World Quarterly* **38**(3): 698–716. https://doi.org/10.1080/01436597.2016.1191941.

MUSAU, Z. 2016. "Bamboo: Africa's Untapped Potential." *Africa Renewal* **30**(1): 22–25. https://doi.org/10.18356/d3c16c7c-en.

SERTSE, D., DISASA, T., BEKELE, K., ALEBACHEW, M., KEBEDE, Y., ESHETE, N., and ESHETU, S. 2011. "Mass Flowering and Death of Bamboo: A Potential Threat to Biodiversity and Livelihoods in Ethiopia." *Journal of Biodiversity and Environmental Sciences* **1**(5): 16–26.

TESHOME, T. 2008. "Role and Potential of 'Iqqub' in Ethiopia." Master Degree, Addis Ababa: University of Addis Ababa.

TOLESSA, A., WOLDEYES, B., and FELEKE, S. 2017. "Chemical Composition of Lowland Bamboo (Oxytenanthera Abyssinica) Grown around Asossa Town, Ethiopia." *World Scientific News* **74**: 141–51.

TSINGHUA UNIVERSITY and INBAR. 2018. "Remote Sensing-Based Regional Bamboo Resource Assessment Report of Ethiopia, Kenya and Uganda." Beijing, China: INBAR.