

Benefits, challenges and sense of ownership of communities in *Boswellia papyrifera* dominated woodland forests of Western Tigray, Ethiopia

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Abstract

Dry forests and woodlands taxa like *Acacia*, *Sterculia*, *Commiphora*, and *Boswellia* are the main source of valuable gum and resins to the international market. *Boswellia papyrifera* populated dry deciduous woodland forests in Tigray in Ethiopia is mainly located in Western Tigray. However, recently the population of the tree is getting less and the need to sustain it calls for urgent measures. Incorporating local communities' perceptions in designing policies on the management and conservation of the tree is crucial. Hence, in this study we aimed to understand the perception of local communities towards the benefits, challenges and sense of ownership in the *B. papyrifera* dominated woodland forests. We used observations, key informant interviews, focus group discussions and household surveys to collect data. Descriptive statistics and ranking index approach were used for data analysis. People ranked fuelwood as the first important benefit of the *B. papyrifera* dominated forests in Western Tigray while recreational value was ranked as the last benefit from the 12 lists of forest benefits presented to the respondents of the study. Regarding, the identified challenges of the *B. papyrifera* dominated forests, lack of sense of ownership was ranked as the number one challenge while unemployment was ranked as the last challenge from the listed 13 challenges for *B. papyrifera* dominated forests sustainability. It is crucial to communicate with local communities in charge of *B. papyrifera* product extraction policy on issues such as the user right policy change that may affect the communities' lives and their environment.

Key words: *Boswellia papyrifera* frankincense, fuelwood, ranking index, lack of sense of ownership, user right, Western Tigray

Résumé

Les taxons des forêts sèches et des zones boisées tels que *Acacia*, *Sterculia*, *Commiphora* et *Boswellia* sont la principale source de gommes et de résines précieuses pour le marché international. Les forêts sèches décidues peuplées de *Boswellia papyrifera* dans la région du Tigré en Éthiopie se trouvent principalement dans l'ouest du Tigré. Cependant, la population de cet arbre diminue récemment, et il est urgent de prendre des mesures pour la préserver.

L'intégration des perceptions des communautés locales dans l'élaboration des politiques de gestion et de conservation de cet arbre est cruciale. Ainsi, cette étude vise à comprendre la perception des communautés locales concernant les avantages, les défis et le sentiment de propriété dans les forêts dominées par *B. papyrifera*. Nous avons utilisé des observations, des entretiens avec des informateurs clés, des discussions de groupe et des enquêtes auprès des ménages pour collecter des données. Des statistiques descriptives et une approche de classement ont été utilisées pour l'analyse des données. Les participants ont classé le bois de chauffage comme le principal avantage des forêts dominées par *B. papyrifera* dans l'ouest du Tigré, tandis que la valeur récréative a été classée comme le dernier avantage parmi les 12 avantages forestiers présentés aux répondants de l'étude. En ce qui concerne les défis identifiés des forêts dominées par *B. papyrifera*, le manque de sentiment de propriété a été classé comme le principal défi, tandis que le chômage a été classé comme le dernier défi parmi les 13 défis répertoriés pour la durabilité des forêts dominées par *B. papyrifera*. Il est crucial de communiquer avec les communautés locales responsables de l'extraction des produits de *B. papyrifera* sur des questions telles que le changement de politique des droits des utilisateurs qui peuvent affecter la vie des communautés et leur environnement.

Mots-clés : *Boswellia papyrifera*, encens, bois de chauffage, indice de classement, manque de sentiment de propriété, droit des utilisateurs, ouest du Tigré

Introduction

In many respects, dry forests and woodlands taxa like *Acacia*, *Sterculia*, *Commiphora*, and *Boswellia* are the main source of valuable gum and resins in Ethiopia (Tadesse *et al.*, 2007; Eshete *et al.*, 2011; Alemu *et al.*, 2012). Specifically, gum Arabica, gum gumero and gum talha from *Acacia* species; myrrh, opopanax and hagar from *Commiphora* species; gum karaya from *Sterculia*; and frankincense from *Boswellia* species (Lemenih *et al.*, 2004; Tadesse *et al.*, 2007; Worku *et al.*, 2011). These forest products are internationally traded products and contribute to the national economy of some Sub-Saharan African countries such as Ethiopia, Eritrea and Sudan (Ogbazghi *et al.*, 2006; Lemenih and Kassa, 2011; Khamis *et al.*, 2016). Accordingly to Gebrehiwot *et al.* (2003), in Ethiopia, only 5 of the 20 *Boswellia* genus trees produce oleo-gum resins which is of commercial value. *Boswellia papyrifera* (*B. papyrifera*) one of the economic and environmental important species is mainly found in Amhara, Benshangul Gumuz and Tigray regional States of Ethiopia.

Boswellia papyrifera populated dry deciduous woodland forest in Tigray region is located mainly in western Tigray (Birhane *et al.*, 2011) and the area is famous for its non-timber product-frankincense. *B. papyrifera* is found in an area of about 183,000 ha, and in some places, there are 100-150 trees per ha according to the Department of Agriculture in Western zone of Tigray (personal communication during data collection with the Western Tigray Agriculture and Rural Development Head). Tigray is the pioneer contributor of natural gum and resin in Ethiopia which has 32.9% of the forest base that bear these products (Asfaw *et al.*, 2019). For many years, the people of Ethiopia have been collecting frankincense by tapping the tree. Frankincense is one of the gums and resins produced in Ethiopia for international commerce (Lemenih *et al.*, 2004; Tadesse *et al.*, 2007; Worku *et al.*, 2011). Frankincense is among the main gums and resins that made Ethiopia to be one of the potential countries to continuously supply good quality and quantity to the global market (Yilma *et al.*, 2016; Tadesse *et al.*, 2020). Despite this, the population of *B. papyrifera* tree is dramatically decreasing (Gebrehiwot *et al.*, 2003;

Birhane *et al.*, 2011; Derero *et al.*, 2018; Gidey *et al.*, 2020), its regeneration is under threat and the traditional frankincense harvesting is no longer robust (Bart Muys, 2019; Gidey *et al.*, 2020). The decline in *B. papyrifera* production – frankincense – is currently a challenging situation in Tigray region of Ethiopia and requires the collaboration of several most stakeholders, to protect this crucial resource.

Several studies have been conducted in Ethiopia in relation to the ecological status, resource base and the importance of the *B. papyrifera* (Gebrehiwet *et al.*, 2003; Birhane *et al.*, 2011; Yilma *et al.*, 2016; Gidey *et al.*, 2020). Some researchers have advocated for empirical research as a solution to societal problems. However, more recently, many authors have challenged these paradigm positions. Moulaert and McCallum (2019), for example, denounced such perspectives suggesting that social perspectives should reject this, as contemporary scientific and policy discourse tends to obscure the role of the ‘social’ in solving humanity’s problems in the various domains and at different scales of its existence. Increasing the endangered *B. papyrifera* species and ensuring its sustainable management and governance requires the understanding of all stakeholders the existing challenges and opportunities. Moreover, the contribution of the various stakeholders to its sustainable utilization and management has a paramount role. Of all the stakeholders, the role of local communities takes a lion share in sustaining the existence *B. papyrifera* species and the woodland forest area as the tree is found in a mixed agriculture land and woodland forest. It is therefore crucial to understand the perception of the local communities on the *B. papyrifera* dominated woodland forest benefits and the challenges for the sustainability of this economically and environmentally important tree and the forest coverage in general. Existing *B. papyrifera* related studies in Ethiopia in general and in Western Tigray in particular are mainly focusing on the ecological perspectives, as actions for managing and restoring the *B. papyrifera* tree (Birhane *et al.*, 2011), neglecting the social part in the conservation, management and governance of the tree. In this research, we focused on the socio-ecological perspectives addressing various social and ecological challenges of the peril in frankincense. Questioning the existing deforestation and degradation of the vegetation coverage and of the *B. papyrifera* tree in particular and the impact of this on the societies and the environment in general as well as the need to sustain it calls for urgent measures to conserve and restore the existing *Boswellia* woodland in the area (Bongers *et al.*, 2019). To contribute to the community based sustainable management of the *B. papyrifera*, it is crucial to understand the communities perspectives, as they are the main stakeholders, in the benefits, challenges and their sense of ownership on the forest’s management is therefore crucial.

Incorporating local perceptions to support the ecologically identified measures to protect the tree following innovative and indigenous approach is important. To get a broad understanding on the local communities’ perceptions towards the benefits, challenges and sense of ownership of the *B. papyrifera* dominated forests in general, the research is based on a case study approach in selected Tabias which have several sites covered with *B. papyrifera* dominated woodland forests. Therefore, the study was conducted with the aim (1) to explore the local communities perceptions towards the benefits of *B. papyrifera* dominated woodland forests, (2) to investigate the challenges regarding sustainable management of *B. papyrifera* dominated woodland forests, and finally (3) to understand the sense of ownership of local communities in the *B. papyrifera* dominated woodland forests.

Methodology

Study areas. Western zone, which contains four Weredas, is the western part of Tigray. Western zone borders

from Eritrea to the north direction. The temperature of the area rises to a maximum of 42 degrees Celsius (Niguse and Aleme, 2015). This maximum temperature recorded between April and June and falls to between 25 and 35 degrees Celsius during the moderate months between late June and February. It has a mono-modal rainfall regime with average rainfall varying between 400-650 millimeter per year. The area has been one of the densely forest covered areas of Tigray. There are environmentally friendly trees such as *B. papyrifera*, which is one of the economically dominant tree species in the area (Birhane *et al.*, 2020).

Western Zone of Tigray was selected for this study purposively to fit with the objective of the study because it is endowed with high population of an economic and environmental important tree - *Bosewellia papyrifera*. Two Weredas Kafta-Humera and Welkait Weredas were selected randomly from the three rural Weredas of the zone. This study focuses on four case study Tabias in Western Tigray: Adi Goshu and Maykeyih Tabias from Kafta Humera Wereda, and Megue and Korarit Tabias from Welkait Wereda reflecting different beneficiaries of frankincense and recent management perspectives in the area. Adi Goshu was chosen as a case study because it is one of the Tabias where user right transfer is being exercised and acts as a frontrunner for the user right transfer policy in Kafta Humera Wereda in particular and Tigray region in general. The other Tabias are selected because of the area coverage of *B. papyrifera* and the number of beneficiaries in these Tabias is greater than other Tabias in Tigray. The study area is also best known for its high potential for Sesame and other cereal production such as Sorghum. There is also ongoing construction of Welkait Sugar Factory in the area. All these may affect the *B. Papyrifera* tree.

Data collection. In this research, different data collection methods were applied in order to address the research objectives properly. Primary data and secondary data were collected from different sources using field observations, key informant interviews, focus group discussions and household survey data collection techniques. Critical observations can provide clue on the value of forests and the existing challenges. Hence, an intensive observation was used as a qualitative data collection technique. Through this the researchers were able to observe the forest benefits and potential challenges of the forest areas. Key informant interviews were held regarding the economic and environmental importance as well as the challenges of the *B. papyrifera* dominated forest areas. The key informant interviews were held at different levels with zonal, Wereda, and Tabia experts, and key stakeholders at different times. Thus, key informant interviews were carried-out among a total of 20 respondents using a semi-structured questionnaire. Focus group discussions were also conducted with beneficiaries of the *Bosewellia papyrifera* dominated woodland forests, i.e., with members of frankincense cooperatives in all research sites. The focus group discussions were of homogenous type (with group of similar people with commonality of opinions, backgrounds and actions towards *Boswellia*). This was to take advantage of such type of FGD as it allows people to be relaxed and comfortable with each other than they would in heterogenous group (Parasurman *et al.*, 2004). The discussants were asked to mention and explain the benefits they are getting from the *B. Papyrifera* dominated forests and the key challenges that these forests are facing and their possible solutions as well. Thus, a total of 1, 4, and 8 focus group discussions at zone, Wereda, and Tabia levels were conducted. After collecting information through key informant interview and focus group discussions we improved the household survey questionnaire. The benefits of *B. papyrifera* dominated forests were organized from the discussions held with key informants, focus group discussions and other literature.

After organizing 12 lists of forest benefits in the questionnaire (Table 4. Summary of challenges for sustainable forest management), respondents were asked to answer by yes or no to each benefit and then rank all the identified benefits. Similarly, 13 main challenges were identified and presented to respondents to rank the challenges in accordance to their effect on the *B. papyrifera* dominated woodland forests based on their accumulated knowledge. The household heads were selected from the members of the frankincense cooperatives with different gender, age, educational status, land holding, and other socio-economic status mentioned in the questionnaire from two Tabias of Kafta-Humera and two Tabias of Welkait Weredas. The survey questionnaire was pretested in 10 (ten) households. This pretest was helpful giving clue on how to address farmers perceptions and how to clarify the questions for interviewees and to test the compatibility of the survey questionnaire to the interviewees. The questionnaire was mostly structured but somewhat semi structured.

Data analysis. We used descriptive statistics and ranking analysis approaches to analyze the data collected through survey. Ranking index was used to understand the benefits and challenges in sustainable management of *B. papyrifera* dominated forests (Musa et al. 2006). The ranking index was computed as

$$\text{Ranking index} = \frac{R_n * C_1 + (R_n - 1) * C_2 + \dots + R_1 * C_n}{\sum R_n * C_1 + (R_n - 1) * C_2 + \dots + R_1 * C_n}$$

Where, R_n = Value given for the least level ranked (in this case for example in problems of forest management, the least rank is 13th then $R_n=13$, $R_n-1=12$) and C_n = Counts of the least ranked level and the count of the 1st rank = C_1

Results and Discussion

Household socioeconomic characteristics. The socio-economic characteristics of the sample households of the study area such as age, family size, education, land holding size, and income from different activities are presented in Table 1. The age of the respondents ranges from 20 years to 86 years old with the average age of 41.68. On average respondents of the study area spent 3.91 years in schooling. The average family size of respondents was 4.79. Respondent famers had an average of 1.71 ha though there were landless people in the communities. The study area is endowed with different sources of income generation options (Table 1). The main sources of income in the study areas and in Western Tigray in general is mixed agriculture, i.e., combined animal and crop production.

Table 1. Summary of socio-economic characteristics of farm households

Variables	Mean	Standard deviation	Min	Max
Age	41.68	11.59	20	86
Education	3.91	3.54	0	15
Family size	4.79	2.115	1	10
Land holding size in hectare	1.71	1.129	0	5.5
Income from milk in ETB	8,690.70	8,595.039	0	60,000
Income from meat in ETB	7,529.73	12,985.22	0	150,000
Income from livestock in ETB	1,7933.45	18,222.98	0	118,000
Income from crops in ETB	25,438.59	20,196.3	0	112,500
Income from frankincense	1,237.89	2,703.517	0	21600

Benefits of *B. papyrifera* dominated forest resources. The benefits households get from forest resources are listed in Table 2. The forest benefits were ranked nearly identically by respondents, regardless of their opinions about the importance of forest benefits (Table 2).

According to the survey, people ranked fuel wood as the first important benefit from the list of benefits presented to them (with ranking index of 0.1443). Out of the 320 households, 155 of the respondents ranked fuel wood benefit as the most important benefit of forest resources in the area. The next highly ranked benefit of forests in the study areas was fodder for livestock (with ranking index of 0.1257). This is because the area is known for its high potential of livestock and as such farmers use fodder for their animals both by letting their animals to graze freely and by preparing hay from forest areas. The thirdly ranked benefits was the building materials farmers obtain from forests (with ranking index of 0.1207). The next ranked benefits of forests were ‘sources of rainfall’ and ‘gum and incense.’ They used reasons to rank the benefit of the mentioned forests as sources of rainfall among the prioritized benefits is because of the *B. papyrifera* dominated woodland forests’ contribution to rainfall improvement which in turn enhance the productivity of crops and animal production.

Similarly, respondents ranked gum and incense benefit as the next *B. papyrifera* dominated woodland forest benefit because gums and incenses are the non-timber and economic products of the forests in the study areas (Table 3). The benefits of forests as ‘source of medicine’ and ‘recreational value’ were ranked as the least benefits of the forest areas in their communities by all respondents. This might be because people are living in a forest covered area and they do not pay more attention to the recreational value of the forests. Putting the source of medicine as the last benefit from the listed benefits of *B. papyrifera* dominated forests could also be due to the negligible amount of income and some of the target population may not generate income from the medicinal value of the forests in the areas. When asked whether the respondents have any experience with medicinal preparation from the forests traditionally, they explained that few persons prepare and sell to the community to cure human-beings and their animals but the payment the traditional healers received is very small. For example, they mentioned to treat one ox for only 10 ETB. When the participants of the discussion compare this with the fuel they collected from the forest and the income from frankincense, they said it is not comparable.

Challenges for sustainable managements of forests. *B. papyrifera* dominated woodland forests in Western Tigray have been facing many challenges leading to depletion of forest coverage and biodiversity loss in an alarming rate. Thirteen main challenges were identified and presented to respondents to rank in accordance to the effect of each challenge on the *B. papyrifera* dominated forest status (Table 4). Lack of sense of ownership was ranked as the main cause for the depletion of forest coverage in the study areas by more than 68% of the respondents (index result 0.1367). Also 16.9% and 6.6% of the respondents ranked deforestation and illegal cultivators, respectively as the main cause for the shrinkage of forest coverage and the loss for biodiversity. Deforestation is the secondly ranked problem in managing forests sustainably. Destruction of forests in the study area is done for many reasons such as for expansion of cultivating lands, for fuel wood and charcoal production, for building materials and farm equipment. Moreover, absence of zero grazing of livestock and the

Table 2. Summary of forest benefits

S.N°	Benefits of forests	Rank	1 st	2 nd	3 rd	4 th	5 th	6 th	7 th	8 th	9 th	10 th	11 th	12 th	Total	Index	Rank
Mark		12	11	10	9	8	7	6	5	4	3	2	1				
1	Fuel wood	Freq.	155	118	35	12	0	0	0	0	0	0	0	0	320	0.1443	1
		Result	1,860	1,298	350	108	0	0	0	0	0	0	0	0	3,616		
2	Farm implements	Freq.	1	9	69	65	20	10	3	124	13	6	0	0	320	0.1016	6
		Result	12	99	690	585	400	70	18	620	52	18	0	0	2,564		
3	Building materials	Freq.	88	84	33	8	5	51	14	35	2	0	0	0	320	0.1207	3
		Result	1,056	924	330	72	40	357	84	175	8	0	0	0	3,046		
4	Medicinal services	Freq.	0	0	0	0	0	1	5	7	1	83	170	50	317	0.0283	11
		Result	0	0	0	0	0	7	30	35	4	249	340	50	715		
5	Sources of food	Freq.	0	0	0	1	0	1	0	7	38	168	76	29	320	0.0352	10
		Result	0	0	0	9	0	7	0	35	152	504	152	29	888		
6	Sources of fodder	Freq.	66	66	125	5	5	25	4	23	0	1	0	0	320	0.1257	2
		Result	792	726	1,250	45	40	175	24	115	0	3	0	0	3,170		
7	Shade	Freq.	0	0	0	1	1	12	205	58	30	11	1	1	320	0.0704	8
		Result	0	0	0	9	8	84	1,230	290	120	33	2	1	1,777		
8	Stream flow improvement	Freq.	0	0	0	1	0	0	29	19	220	20	10	21	320	0.0511	9
		Result	0	0	0	9	0	0	203	95	880	60	20	21	1,288		
9	Rain fall increase	Freq.	0	0	2	175	65	49	22	6	0	1	0	0	320	0.1040	4
		Result	0	0	20	1,575	520	343	132	30	0	3	0	0	2,623		
10	Crop productivity enhancement	Freq.	0	1	4	31	210	35	28	7	3	0	1	0	320	0.0980	7
		Result	0	11	40	279	1,680	245	168	35	12	0	2	0	2,472		
11	Gum and incense source	Freq.	10	42	52	21	14	136	10	34	0	0	0	1	320	0.1025	5
		Result	120	462	520	189	112	952	60	170	0	0	0	1	2,586		
12	Recreational value	Freq.	0	0	0	0	0	0	0	0	13	30	62	215	320	0.0191	12
		Result	0	0	0	0	0	0	0	0	52	90	124	215	481		

Unbounded entrance of animals to the forest areas including from neighboring zones and countries of Sudan and Eritrea are the main problems of deforestation which score a result of 0.1288. Expansion of investment areas are taken at the expense of forest areas and smallholder farmers farms. According to the FGD participants, when authorities did these farmers were not asked to participate on the decision and on the way of implementation of these investment projects. Because of these inhabitants mentioned that they are ignored assuming that they have no power to do anything. This understanding is pushing for farmers not to actively participate in the management of the forests.

Sense of ownership. Discussants confirmed the degradation of social capital in conserving the natural resources especially the degradation of *B. papyrifera* dominated woodland forests in their communities. This loss of social capital that are features of social life particularly norms and trust caused the forest degradation especially *B. papyrifera* tree and the frankincense product. This social capital degradation has been recorded following absence of good governance particularly transparency in the political hierarchy of the government especially the local government. A critique from the focus group discussants on the way local authorities have been doing in the *B. papyrifera* dominated woodland covered land of the area is indicated below;

Considering as investment opportunity the government distributed the land covered with *Boswellia* without clear demarcated boundary. The respondents mentioned that boundary uncertainty is the main way to augment land by clearing of forest land which resulted in the deforestation of the forest area.

Considering the side effect of distributing land with unclear boundary demarcation the local people requested for their participating and to get permission from authorities to let them protect the forests based on their accumulated social capital, which the local government is not doing, the local governments did not allow the community members to participate in decision process. This made the population to feel that they have no power to influence the government in decision making related to the management and sustainability of the *B. papyrifera* dominated woodland forests.

However, there is still an opportunity at least to keep the existing once as the population is interested in the decision-making processes and the sustainable management of *B. papyrifera* and the forests in general. This finding is supported by the concept that Fennel and Cooper (2020) put in relation to the role that stakeholders and participation play in a success or failure of initiatives that are based at communities. Emanating from this, according to our target respondents, local communities have less ownership feeling on the *Boswellia* and the forest in general.

This was reflected during the focus group discussions we had with community representatives and public experts was relevant offices in the two Weredas and the zone. The core issue was discussant's discomfort with when the land covered with *Boswellia* being given to private companies and investors. This is described in detail under – governance problems. According to the interviewed households the most common challenge to the sustainability of forests is the lack of sense of ownership over forested area. Even the frequently asked question by farmers of the study area is 'how can we get pastureland for our livestock?'. Therefore, farmers start to search other option including clearing of forestlands for the purpose of crop production. They do not think of sustainability of forests, because they fear that the intact forests could be given to investors or other projects.

Table 3. Summary of challenges for sustainable forest management

S.N°	List of problems	Rank	1st	2	3	4	5	6	7	8	9	10	11	12	13	Total	Index	Rank
1	Lack of sense of ownership	Freq.	218	50	34	7	2	2	7	0	0	0	0	0	0	320	0.1367	1
		Result	2,834	600	374	70	18	16	49	0	0	0	0	0	0	3,961		
2	Lack of integration	Freq.	18	2	14	41	8	60	17	139	16	5	0	0	0	320	0.0841	6
		Result	234	24	154	410	72	480	119	834	90	20	0	0	0	2,437		
3	Forest fire	Freq.	2	0	9	2	4	26	0	10	15	22	72	142	2	306	0.0384	11
		Result	26	0	99	20	36	208	0	60	75	88	216	284	2	1,114		
4	Illegal mining	Freq.	2	2	0	4	0	0	0	0	2	11	24	46	187	278	0.0171	13
		Result	26	24	.	40	0	0	0	0	10	44	72	92	187	495		
5	Free grazing	Freq.	5	16	24	204	33	22	7	2	2	0	2	0	0	317	0.1074	4
		Result	65	192	264	2,040	297	176	49	12	10	0	6	0	0	3,111		
6	Absence of clear demarcation	Freq.	0	0	0	0	18	43	203	25	5	18	2	0	0	314	0.0752	7
		Result	0	0	0	0	162	344	1,421	150	25	72	6	0	0	2,180		
7	Poor land use management	Freq.	0	0	0	2	7	0	12	71	125	24	18	47	14	320	0.0509	10
		Result	0	0	0	20	63	0	84	426	625	96	54	94	14	1,476		
8	Low productivity	Freq.	0	0	0	5	197	17	18	25	29	13	10	4	2	320	0.0853	5
		Result	0	0	0	50	1,773	136	126	150	145	52	30	8	2	2,472		
9	Unemployment	Freq.	0	0	0	5	0	19	0	0	4	15	162	54	61	320	0.0323	12
		Result	0	0	0	50	0	152	0	0	20	60	486	108	61	937		
10	Illegal cultivators	Freq.	21	32	217	20	18	10	0	2	0	0	0	0	0	320	0.1207	3
		Result	273	384	2,387	200	162	80	0	12	0	0	0	0	0	3,498		
11	Seasonality of guarding	Freq.	0	0	0	16	10	27	30	26	29	17	7	0	0	320	0.0586	9
		Result	0	0	0	160	90	216	210	156	145	70	21	0	0	1,698		
12	Deforestation	Freq.	54	218	17	3	11	0	6	2	9	0	0	0	0	320	0.1288	2
		Result	702	2,616	187	30	99	0	42	12	45	0	0	0	0	3,733		
13	Climate change	Freq.	0	0	5	11	12	94	20	18	84	28	4	8	34	318	0.0644	8
		Result	0	0	55	110	108	752	140	108	420	11	12	16	34	1,867		

These problems lead to development of sense of lack of ownership .

Governance challenges and *Boswellia papyrifera* degradation. The frankincense extraction from *B. papyrifera* is done at large scale, i.e., covers large areas (almost all the areas covered by the tree) and is oriented towards export purposes only without industrial processing. This way of practice in natural resources is termed as extractivism. Extractivism is generally defined as a national, growth-oriented development pathway on rent-seeking activities, that is, the large-scale exploitation, production and exportation of raw materials. The trajectory in the extraction of *Boswellia papyrifera* in Ethiopia and in Tigray has been very destructive. This is because of the approaches followed. The practices in this regard are extensive and extraverterd that depend mainly on appropriation towards commodity export. This way of governance is not sustainable for natural resources. Recently, there is an initiative by the government to change the extraction process of frankincense. This is not on the way it is extracted but on who must extract it. For so many years frankincense in Tigray was extracted by political affiliated companies. But later some private companies including private, investors and farmers' multi-purpose cooperatives have also been participated in frankincense extraction. Recently the government introduced one scenario that would help unemployed youth to generate income from this tree through the introduction of shifting user rights.

The user right policy change is being exercised in Kafta Humera Woreda where two of the study Tabias are located. The reason behind the change in frankincense user right transfer is to create job opportunity for the landless - mainly youth and women. However, there are arguments from both the existing users and non users (who own land). The inhabitants of the area do not believe on the shifting in user right approach as it will not ensure the sustainability of the *B. papyrifera* dominated woodland forest rather it will result in further deforestation in their opinion. Similarly, those who got a use right currently do not expect a change in the management of the *B. papyrifera* dominated woodland forest with the existing approach of management. Instead focus group discussants believe that letting the people to solve the problem would bring a sustainable solution to the *B. papyrifera* dominated woodland forests in western Tigray.

Conclusion

The study identified fuelwood as the top prioritized benefit of *B. papyrifera* dominated woodland forest by local communities and the most challenging obstacles to the sustainable management of these forests. Most people surveyed appreciated the benefits of forests in their lives though there is difference in prioritizing of the forest benefits. At the same time the surveyed segments of the communities identified loss of sense of ownership as the main obstacle to the sustainable management of the forests. Though large-scale investment is good for development, it could also be devastating to the existing forests if the local people are not communicated to about the benefits of the large investments. Besides, it is crucial to communicate with local communities in changes in *B. papyrifera* product extraction policy such as the user right policy change that may affect the communities' lives and their environment.

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