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Research Article

Ethnobotany and Conservation Study of *Oxytenanthera abyssinica* in Mandura District, Northwest Ethiopia

Yohannes Dereso* and Ali Seid

Department of Biology, Assosa University, Ethiopia

***Corresponding author**
Yohannes Dereso, Department of Biology, Assosa University, Ethiopia

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Abstract

The present study is about ethnobotany and conservation issues of the multipurpose *Oxytenanthera abyssinica* in the Mandura Woreda. The Woreda has patchily distributed vegetation features characterized by *Combrutum molle* and *Entada abyssinica* growing in association with *O.abyssinica*, commonly known as lowland bamboo. The life of native people in Mandura Woreda is strongly dependant on law land bamboo for their socio-economic well binges. The lowland bamboo forest in the Woreda was flowered in 1998 E.C, but the current burning environmental issues in the Woreda is deforestation due to fuel-wood consumption, timber harvesting, farm expansion, and forest burning. *O.abyssinica* is multipurpose tree species in Mandura Woreda; about 20 local uses ofthe spices are identified. Pair wise ranking with 5 highly preferred woody species of different uses was conducted and *O. abyssinica* was first choice for construction and beehive making; and ranked fourth for pole and fire wood. The new shoots of the species also used as food during summer season, which is time of food shortage, and as "T'osha" (poison and alcohols antidotes). Lowland bamboo vegetation is threatened by cutting, decay of new shoots, mass flowering, agricultural expansion, over grazing, fire and cutting style of which fire is the most leading threat reported. Using a participatory method, five important methods of conservation were identified to conserve the species. They were: government measures, community forest protection, encouraging cultural by laws, cultivation and proper cutting style. Of these methods, government measure was thought central and decisive. Awareness creation is among the recommendations.

INTRODUCTION

Background of the study

Mandura Woreda of Benishangul Gumuz Regional State (BGRS) has the lowland bamboo forest which flowred during1998 E.C. Before flowering of the bamboo, the plant was used to grow almost everywhere in the Woreda, and covering 3 to 5 hectares in each kebeles that are located one to two hours walking distance in bamboo forest. But at present only few patches of bamboo are being seen as standing clumps [1,2].

In Mandura, the current burning issues on environment are deforestation due to fuel consumption, charcoal and timber production as income-generating activities, farm expansion (hill side farming), and mountain burning assuming good grass will grow after burning.

On the other hand the life of native people of Mandura Woreda is strongly dependant on law land bamboo (*O.abyssinica*) for their socio-economic benefits. But conservation management of this crucial plant is not well planed in the area and researches are not conducted in the area regarding conservation and management of the bamboo forest. This research paper is aimed to bring understanding of sustainable management of the bamboo and contribute understanding of livelihood benefits derived from this vital endowment in the Woreda.

Problem statement

Mandura has lowland bamboo which flowered since 1998 E.C. and all the flowered clumps are dried. The plant used to grow in almost everywhere in the Woreda. Few patches of lowland bamboo with limited numbers of clumps are left standing at present in the Woreda. Lowland bamboo is used for making traditional furniture, basketry, construction, firewood and fence.

In Mandura Woreda, forest protection issues are deforestation. Bamboo is diminishing for there is no conservation work so far. Fire is caused by humans for the purpose of hunting and people's thinking that bamboo regenerate better when burned.

The life of native people of Mandura Woreda is strongly dependant on law land bamboo (*O. abyssinica*) for its socio-economic benefits. But conservation management of this crucial plant is not well planed and researches are also not conducted in the area regarding conservation, reproductive ability of the species. In addition to this due to degradation of lowland bamboo people are using other plants instead of lowland bamboo in the same miss-managed way. Thus, this research paper aimed to

bring understanding of the sustainable management of bamboo; contribute to the understanding of livelihood benefits derived from this vital natural resource in the Woreda; and to bring proper way of using substitute plants [3].

Objectives

General objectives: This research attempts to explore the ethnobotanical and ways ofsustainable utilization of the resource potential for economic and environmental benefits.

Specific objectives: The specific objectives were to

1. document the various indigenous values (uses) of bamboo, substitute plants for its different uses and risk factors in Mandura Woreda;
2. identify plant species associated with *O. abyssinica*, and
3. Pinpoint major threats of lowland bamboo forest.

MATERIALS AND METHODS

Description of the study area

Location: The BGRS borders the Republic of Sudan in the west, Amhara region in the North, Oromiya in the South east and Gambella region in the South. Administratively, it is divided in to 3 zones (Metekele, Assosa, and Kemashi). Metekel zone is divided into 7 Woredas out of which Mandura Woreda, the study area is located North 10^0 55'-11^0 90' latitude North and 30^0 12'-30^0 36' longitude east, comprising 17 rural Kebeles and 3 town Kebeles. Gilgel Belese is the centere of Mandura Woreda and also the Zonal town. The Woreda has large topographic drops from east to west.

Climate: Agro-climatically, the study Woreda is grouped into Kola (lowland) 100%, and topography depict mountain 5%, Plain 55%, rugged 35% and valley 5%. The average temperature ranges 25°C-39°C, with altitude from 1050-1400 m.a.s.l and mean annual rain fall 900-1200mm (Pawie meteorological station).

Economic activities: In terms of economic activity, agriculture is the dominant economic sector in the Woreda from which nearly 92.5% of the total population derives its livelihood. The major source of income in the Woreda is crop farming with cattle rearing is also a sideline economic activitiy for much of the farming community. Furthermore, the Gumuz community members are engaged in selling fuel wood, mats of bamboo, bamboo calms and charcoal to supplement their income.

Sampling methods

Site selection: Five Kebeles (villages) were selected based on (1) availability of bamboo resources, (2) utilization potentials and significance to the surrounding community, (3) convenience to capturing as much socio-economic information as possible, and (4) the manufacturing and consumption of bamboo products.

Vegetation data: To describe the vegetation the stratified sampling method were used and vegetation data werecollected from10×10 m quadrats lied in homogeneous vegetation units. A total of 8 quadrats were considered. Two quadrates (6 and 7) were from cultivated bamboo forest, other two quadrats (5 and 8) were in protected bamboo forest, and the rest four quadrats (1-4) were laid in wild forest of bamboo (2 from Duanz baguna and 2 from Ajenta Villages). Community similarity among quadrats was quantified using Sørensen similarity coefficient. This coefficient of similarity (*Ss*) was defined using the formula:

$$Ss = \frac{2a}{(2a + b + c)}$$

Where Ss = SØrensen similarity coefficient

a = number of species common to both quadrat

b = number of species in quadrat 1

c = number of species in quadrat 2

Association among *O. Abyssinica* and other woody trees was calculated using Jaccard's index. The Jaccard index of species association (*IA*) is based on species presence (*p*):

IAP = [a/(*a* + *b* + *c*)] x 100.

Where IAP= Jaccard index

a = number of quadrat in which the two species under comparison occur together

b = number of quadrat in which one of the two species occur alone

c = the number of quadrat in which the other species is found alone

Ethnobotanical data collection

Direct observation: This was applied for the whole period of study, with the researcher taking field notes, photographs, counts and measurements of various aspects related to the subject of the study. Direct observation of important indicators was done to crosscheck findings with the facts that are going on. The indicators were used to generate on-the-spot questions to local people without formal questionnaires.

Structured and semi-structured interview: Semi-structured questionnaires were administered to Zonal Forest Catchment Officer (ZFCO), District Forest Officer (DFO), Zonal Environmental protection officers (ZEPO) and Developmental Agencies (DAs). Structured interviews were conducted with local people. More than 5% households of the study Kebele were considered for interview as recomanded by Kajembe [4]. The questionnaires were pre-tested before conducting realinterview for reliability test.

The sampling units were household heads and housewives. The selection of household to be interviewed was done using systematic sampling where every third house was interviewed in west-east direction; this was done with help of simple compass. The study tried to interview equal number of males and females but unfortunately due to tcheir cultural impact it was impossible to get the desired number of females.

A total of 99 informants were taken from different age groups, education level and sex from the five selected Villages (19 from Adida, 16 from Asitsa, 20 from Duanzbaguna, 21 from Ajenta and 23 from Gelegle Beles) were interviewed. Data were collected using quantitative ethnobotany (direct matrix ranking, preference ranking, and pair wise ranking and questionnaire survey), direct observation and focus group discussions. Information source persons including community elders and key

informants were identified and samples of bamboo cultivators (collectors) and consumers were randomly selected from the study areas to get qualitative and quantitative information on concepts related to the supply, manufacturing, consumption (use) and major factors affecting lowland bamboo. Further interviews with community during observation were conducted to identify how the surrounding communities use bamboo for construction, as source of income and household utensils.

Spider diagram representation: Spider diagram was used to identify the most important method to conserve and upgrade the availability of *O. abyssinica.* Individuals in the focus group discussion were asked to propose the best cultural five methods to protect and conserve the species. Then the groups were told to show the impact of the methods selected on one another. The one that has more influence on the other methods were taken as the central and most important method.

RESULT AND DISCUSSION

Analysis of vegetation feature

Vegetation feature of Mandura Woreda is made up of different patchy distribution of forests that contain plants like *Combrutum molle, Entada abyssinica, Lonchocarpus laxiflorus* and clumps of *O. abyssinica* associated among themselves. Based on the Sørensen coefficient, highest similarity of forest vegetation was found between quadrats 6 and 7 that were taken from cultivated forest. In these quadrants only *O. abyssinica* was seen. The second highest similarity of forest vegetation was found between quadrats 4 and 8. Some valuable vegetation such as *Combrutum molle*, *Entada abyssinica* and *Lonchocarpus laxiflorus* were found.

The lowest similarity of vegetation between quadrats was found among quadrats 3 and 6, and quadrats 3 and 7. Although both of the quadrats were classified as lowland bamboo forest, however vegetation in quadrat 6 and 7 was influenced by cultivation activity of humans and the other plants are removed as wild Figure 1,2.

In Mandura Woreda, *O. Abyssinica* grows mixed with several trees species. In the surveyed quadrats, it was clear that *Combrutum molle* and *Entada abyssinica* have high association with *O.abyssinica* (IAP= 62.5 %). Both of the plant species were found growing together with *O. abyssinica* in all of the quadrats except quadrants 6 and 7. Some species such as *Trilepisium madagascariense*, and *Lonchocarpus laxiflorus* have less association with *O. Abyssinica* (IAP= 12.5 %).

Disturbance to lowland bamboo population

Human disturbance by cutting in the three habitats, (protected forest, cultivated forest, and wild forest) was shown in Figure 3. Culms were highly cut (harvested) in cultivated forest (group C) and wild forest per clump (group W) and least number of culms cut (harvested) in protected bamboo forest per clump (group P). During the survey in all the three habitats there was no new shoots cut observed except rare damage of new shoots by animals and decay.

The establishment of newly emerging shoots was affected by crowdedness (shade) and litter mass. The number of new shoots decayed observed during the survey were shown in Figure 4. High number of shoots was decayed in protected forest and least number of bamboo shoot decayed in wild forest.

Current utilization of O. abyssinica in the community

Oxytenanthera abyssinica is highly involved in the daily life of the community of Mandura Woreda. From the survey result 27% of the respondents depend solely on selling of *Oxytenanthera abyssinica* culms and the products as source of income. The rest 73% depends on other different economic activities in addition to selling *O. abyssinica*.

All the respondents from the five study Kebeles responded that they get *O. Abyssinica* from wild forest. Regarding government involvement to the use and management of *O. abyssinica,* 83% of the respondents clamed that collection of *O.*

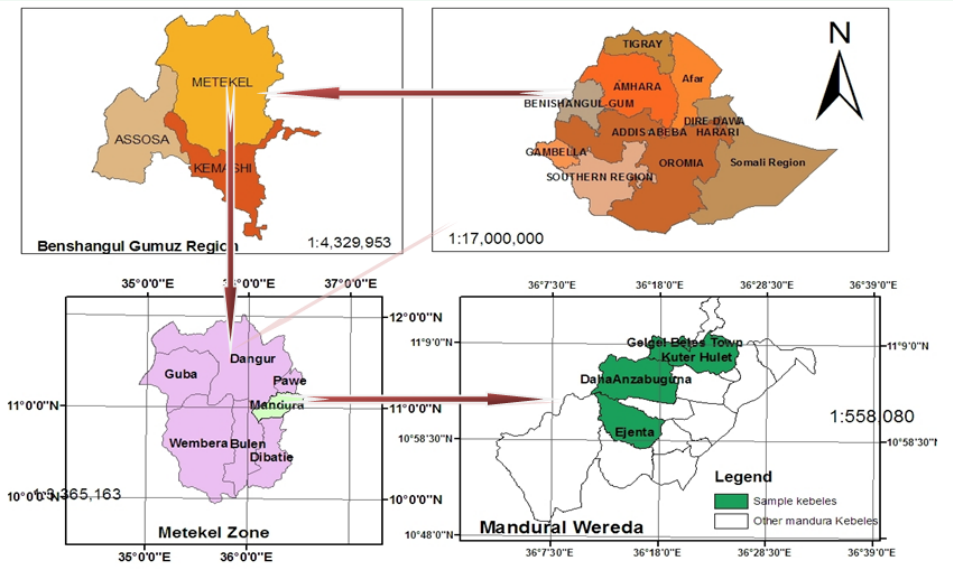

Figure 1 The location of study Kebeles in Mandura Woreda Metkel Zone, Ethiopia.

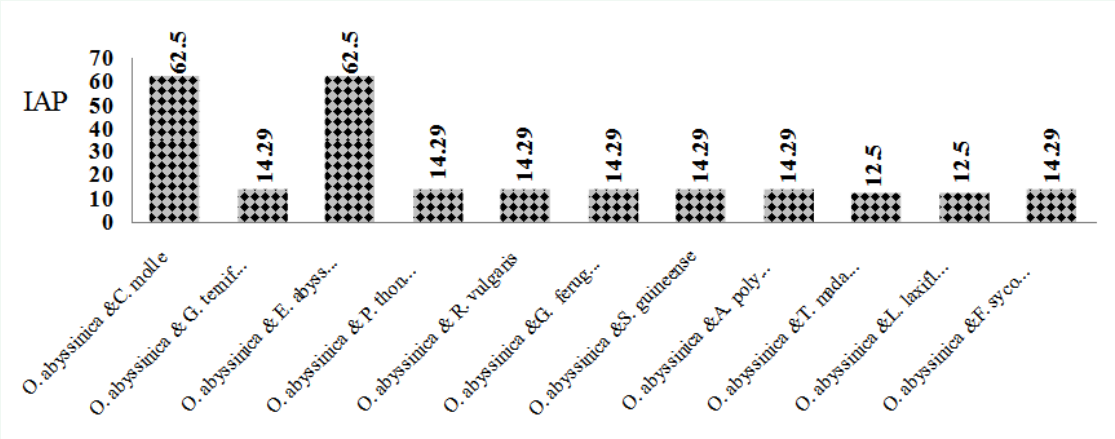

Figure 2 Graph showing IAP value of different plants associated with *O. abyssinica*.

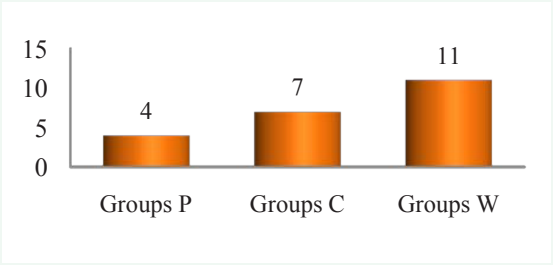

Figure 3 Number of culms cut (harvested) in the three habitats.

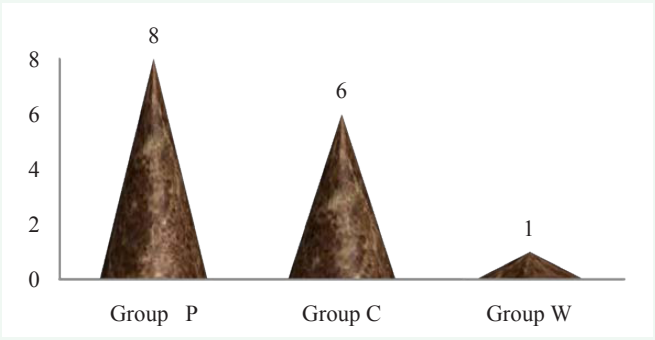

Figure 4 Number of new shoots decayed in the three habitats.

abyssinica is not permitted and they collect it illegally from the wild forest. Only 17% of the respondents which are from the new resettlement program Kebels responded that collection of *O. abyssinica* permitted for the new governmental village resettlement program.

The customers of *O. abyssinica* products are mostly (60%) local people and 40% of their customers come from other areas (Figure 5-8).

Local uses of lowland bamboo

Hundred percent of respondents in the studied villages responded that, *O. abyssinica* is popularly known and highly utilized. The statical test (Fishers' exact test) did not show significant gender based knowledge on use of *O. abyssinica.* In the study Kebeles 20 local uses of *O. abyssinica* were identified (Appendix: 4). According to Table 1 of pair wise ranking for five highly preferred woody species for fencing, *O. Abyssinica* was the first most preferred specie followed by *Vernonia spp.* and *Combrutum molle* respectively. The use of bamboo for fence conformed to the report of Bewketu Z [1], in which woven bamboo mats are commonly used to build fence throughout Ethiopia. In the same way, in pair wise ranking of 5 highly preferred woody species for beehive, *O. Abyssinica* was ranked the first. The next most preferred species for beehive are *Vernonia spp.* and *Cordia Africana* respectively. Villagers claimed that *O. abyssinica* to produces very durable beehive. The species come fourth in pole and fire wood. According to the report of INBAR [3], the ability

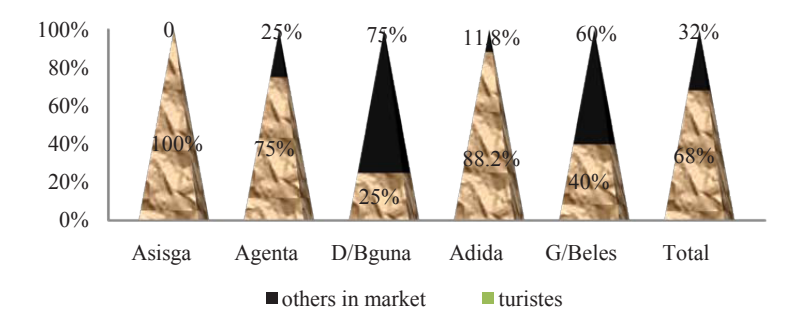

Figure 5 Percentage of customers of *O.abyssinica* products in the study Kebeles.

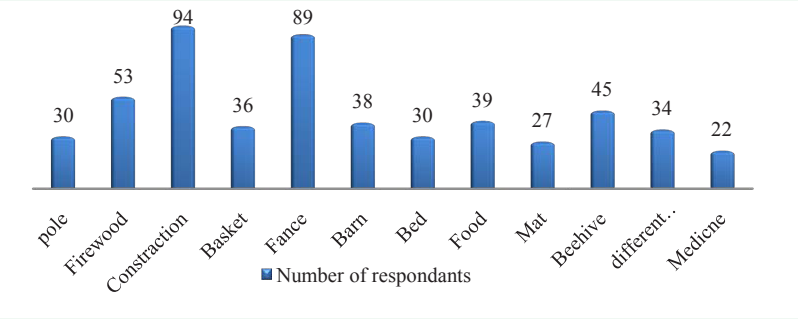

Figure 6 **Number of respondents that mentioned the 10 top uses of *O. Abyssinica.***

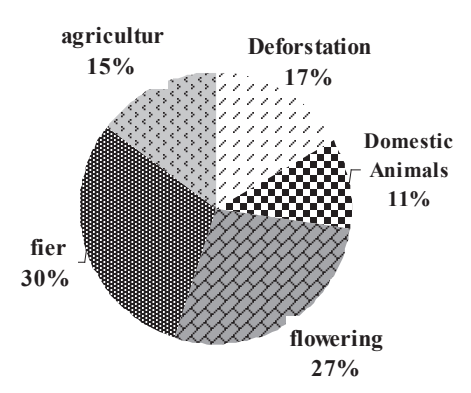

Figure 7 Percentages of factors that affect presence of *O. Abyssinica.*

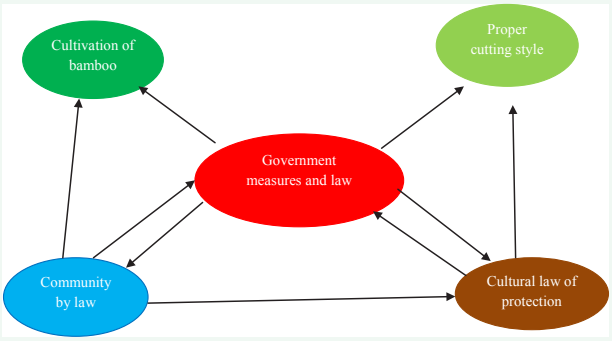

Figure 8 Spider diagram showing focus group preferred conservation methods.

of *O. abyssinica* to expand in large number, its tinsel strength and ability to resist effect of termite make the plant to be more preferred for construction and fence.

During the interview most of women forwarded that bamboo shoot was their immediate life saviour during summer food shortage (July and August). In addition to these both male and female respondents forwarded that the supernatant from ash of 1-2 moth shoot of *O. abyssinica* is used as oil to cook different vegetables. The respondents said that the supernatant from ash of bamboo shoot (t'osha) has the potential to detoxify any toxic material in any plant that they want to eat. Again they told that the supernatant (t'osha) is given to individuals that are highly poisoned by excessive alcohol drinking to get better.

Even though bamboo is as such very important all the respondents in the five Kebeles claimed that the plant is not found as wanted. The respondents forwarded that, the cases for unavailability of *O. abyssinica* were anthropogenic factors, effect of animals, wild fire and natural flowering of the plant. As to the source of bamboo 100% of the respondents in the five Kebele forwarded that they get bamboo from wild forest.

Paired comparison of local use of O. abyssinica

Construction: *Oxytenanthera abyssinica* was mentioned by 94.95% of the respondents as being used for construction, among them 94.6 % and 49.4% were males and females respectively. Fishers exact test showed no significant difference in proportion of males and females who mentioned *O. abyssinicause* for construction (p=0.56). Pair wise ranking for six (6) highly preferred woody species for construction is shown in (Table 2-4). *O.abyssinica* was the firstchoice. The other preferred woody species for construction were *Combrutum molle, Vernonia spp* and *Cordia africana.* People involved in thefocusd group discussion claimed *O.abyssinica* as the most preferred for construction because of its flexible culmfor curving, strengthand resistance to termites.

Fence: The use of *Oxytenanthera abyssinica* for fencing was mentioned by 89.9% of respondents. Among them 90.1 % and 89.3% were males and females respectively.

Beehive: Forty five percent of the respondents mentioned the use of *O. Abyssinica* for beehive. Among them 45% and 46.43% were males and females respectively. Fishers exact test showed no significant difference in proportion of males and females who mentioned the use of *O. Abyssinica* for beehive (p= 0.18).

Pole: *Oxytenanthera abyssinica* was mentioned by 30.3% of respondents as being used for poles. Among them 29.58% and 32% were males and females respectively. Fishers exact test showed no significant difference in proportion of males and females who mentioned the use of *O.abyssinica* for poles (p= 0.81). Pair wise ranking of 6 preferred woody species for building poles by focus group discussion. *Oxytenanthera abyssinica* was at 4th position. *C. molle* and *T.madagascariense* are 1st and 2nd respectively to be the most preferred wood species for poles. Both men and women in focus group discussion claimed that even though other species of plants are preferred for pole, *O.abyssinica* poles are durable and very resistant to termites. Some villagers call it "woody iron" as its service life can be more than 20 years.

Fire wood: *Oxytenanthera abyssinica* was mentioned by 53.54% of the respondents to be used for firewood; among them 54.93% and 67.86% of males and females respectively were involved. Fishers exact test showed no significant difference in proportion of males and females who use *O. abyssinica* for firewood (p=0.59). Pair wise ranking of focus group discussion for six highly preferred woody species for firewood in the study area is shown in (Table 5), *O. abyssinica* is ranked 4th. The most preferred woody species for firewood were *Combrutum molle*, *Cordia Africana* and *Trilepisium madagascariense* respectivly.

Table 1: Pair wise comparison of six commonly used plants for construction.

Scientific name	R1	R2	R3	R4	R5	R6	Total	Rank
Oxytenanthera abyssinica	4.6	4.8	4.8	5	4.6	4.6	28.4	1
Vernonia spp	3.4	4	4	4.6	4	4	24	3
Accacia polyacantha	4.2	3.2	3	4	4	4	22.4	5
Combrutum molle	3.6	4	4	4	4	5	24.6	2
Trilepisium madagascariense	5	3.4	3	2.8	3	3	20.2	6
Cordia africana	3	4	3.8	4	3.8	5	23.6	4

R: stands for respondents

Table 2: Pair wise comparison of five commonly used plants for fence.

Plants	R1	R2	R3	R4	R5	R6	Total	Rank
Oxytenanthera abyssinica	5	4.75	5	5	4.75	4.75	29.25	1
Vernonia spp	4	3	4	4	4	4	23	2
Accacia polyacantha	2	3	2	4	2	3	16	4
Combrutum molle	3	4	3	3	3	5	21	3
Trilepisium madagascariense	2	2	2	3	2	3	14	5

R: stands for respondents

Table 3: Pair wise comparison of five commonly used plants for beehive making

Plants	R1	R2	R3	R4	R5	R6	Total	Rank
O. abyssinica	5	5	5	5	5	5	30	1
Vernonia spp	4	3	5	3	4	4	23	2
C. molle	2	3	3	2	2	1	13	4
T.madagascariense	2	1	1	2	1	2	9	5
C. africa	3	4	2	3	4	2	18	3

R: stands for respondents

Table 4: Pair wise comparison of six commonly used plants for pole.

Plants	R1	R2	R3	R4	R5	R6	Total	Rank
O. abyssinica	4	2	3	2	3	3	17	4
Vernonia spp	1	1	2	1	2	1	8	6
A. polyacantha	3	3	3	4	3	3	19	3
C. molle	5	5	4	3	5	5	27	1
T.madagascariense	4	4	4	3	4	4	23	2
C. africa	2	2	3	2	2	2	13	5

R: stands for respondents

Table 5: Pair wise comparison of six commonly used plants for fire wood.

Plants	R1	R2	R3	R4	R5	R6	Total	Rank
O. abyssinica	3.6	3	3.4	3	3.8	5	21.8	4
Vernonia spp	2.8	2	1.8	2	2.4	3	14	6
A. polyacantha	4	3	3	4	3	4	21	5
C. molle	4.6	4	5	4.6	4	5	27.2	1
T.madagascariense	4	5	4.2	3	3	3.6	22.8	3
C. africa	4	4	4.8	4.6	4	3	24.4	2

R: stands for respondents

Relative importance value of six plant species for seven local uses

In pair wise ranking of six (6) preferred multipurpose woody species, *O. abyssinica* was ranked second with score of 29.85. *Cordia africana* was ranked first with score of 30.1 (Table 6).

Treats of *O. abyssinica* in mandura woreda

In the study several factors, both human and natural contributed to threat *O. abyssinica* in the study area. The serious factors reported include agricultural expansion, deforestation, mass flowering (Gewi), over grazing and fire. Fire was cited to be the first important factor that treated *O. abyssinica.* Natural flowering and deforestation by humans were the second and third factors respectively as seen in.

During interview, some respondents forwarded that the natural flowering of lowland bamboo may not directly cause decline and extinction of the plant. Mass flowering could increase the statues of lowland bamboo. The cause is that, mass flowering transformed the plant in to many seedlings that can't resist fire, so that fire burned all the sidling and the statues of *O. abyssinica* population extremely decreased.

The selected elders identified cutting period and cutting style are additional treats that cause the decline of *O. abyssinica*. Direct matrix ranking of factors showed that fire to be the first threat. Natural mass flowering and effect of humans were second and third respectively.

Woody species that substitute *O. abyssinica* for top selected uses

Preference ranking by selected focus group discussion *Vernonia spp.* was the best substitute of *O. abyssinica*. *C. molle* and *T.madagascariense* were the second and third substitutes of *O. abyssinica* respectively (Table 7,8).

Traditional management of *O. abyssinica*

According to respondents the coverage of *O. abyssinica* is highly decreased. Hundred percent of the respondents said that the community needs the presence of *O. abyssinica* in their area. The respondents want its presence for the cultural importance and as source of income. From the respondents 8% use *O. abyssinica* as source of income , 21% use for cultural importance and 71% clamed that the plant is used for both cultural importance and as source of income. All of the respondents in the study area rated *O. abyssinica* as very important plant. The Zonal and Woreda Environmental Officers (ZWEO) also forwarded that *O. abyssinica* is very important not only for cultural use and income of society but also it is very important for environmental balancing.

Even though *O. abyssinica* was very important many respondents said that there is very low status of conservation method used due to lack of education, so they do not know how and why the threshold threat *O. abyssinica*. In the same way the Zonal and Woreda Environmental Officers (ZWEO) explained that the community has low literacy about conservation, and/or the awareness creation program from the government body and NGOs were not satisfactory [5-7].

Table 6: Relative importance value of six commonly used trees common uses.

Plants	Construction	Fence	Beehive	Rope	Pole	Charcoal	Firewood	Total	Rank
O. abyssinica	4.94	4.94	4.94	4.94	4.94	1	4.15	29.85	2
Vernonia spp.	3.83	3.83	3.83	3.83	3.83	3.83	3.83	26.81	3
A. polyacantha	3.7	3.7	3.7	3.7	3.7	3.7	3.7	25.9	4
C. molle	4	4	4	4	4	4	4	28	6
T.madagascariense	3.2	3.2	3.2	3.2	3.2	3.2	3.2	22.4	5
C. africa	4.3	4.3	4.3	4.3	4.3	4.3	4.3	30.1	1

Table 7: Direct matrix ranking of treats that cause decline of *O. abyssinica.*

Threats	R1	R2	R3	R4	R5	R6	Total	Rank
Wild fire	4	5	5	5	5	5	29	1
Flowering	5	4	5	5	4	4	27	2
Animals	3	3	2	4	3	5	20	4
Humans	4	4	4	3	4	3	22	3
Cutting period	3	3	2	4	3	1	16	6
Cutting style	4	2	1	3	4	3	17	5

R: stands for respondents

Table 8: Preference ranking of five highly preferred woody species that can substitute lowland bamboo in top selected uses.

Plants	Construction	Fence	Pole	Beehive	Total	Rank
C. molle	4.2	3.8	3.3	1	12.3	2
Vernonia spp.	4.2	4.5	1	3.7	13.4	1
A. polyacantha	4.2	3	2.8	1	11	4
C. africana	3.7	3.2	1.5	2.3	10.7	5
T.madagas cariense	3.2	3.7	4.2	1	12.1	3

During focus group discussion groups identified four most important measures that should be used to conserve *O. abyssinica* and to up grade its availability in the area. The measures identified were Governmental measures, Community-Bylaws, cultivation and proper cutting style. The focus groups also identified government measures to be central and influential method to conserve the species by using spider diagram representation method.

Planting *O. abyssinica*

In two villages, Asisga and Ajenta: 100% of respondent clamed not to planting *O. abyssinica* in their homestead, farms and private wood lots. The most frequently mentioned reason for not planting is that the community considered the species as wild tree. In the rest villages; Duanzbaguna 50%, Adidda 56% and Gelegle Beles 83% of the respondents used to plant *O. abyssinica* in their home stead.

The respondents of villages that plant the species in their homestead, farms and privet woodlots said that the amount of land that they use for planting *O. abyssinica* is very small, less than half of their land.

The respondents said that planting seed and seedling is preferred for cultivating the plant. Seed and seedling are preferred for the reason that the plant growth success is high. This Concept is supported by Swaine MD [8]; who reported that seeds are very convenient for propagation, due to their small size and easily transportability.

CONCLUSION AND RECOMENDATION

Conclusion

Mandura Woreda has different patchily distributed vegetation features containing plants like *Combrutum molle*, *Entada abyssinica*, *Lonchocarpus laxiflorus* and *O. abyssinica*. In the study Woreda *O.abyssinica* grows mixed with different tree species. *Combrutum molle* and *Entada abyssinica* grows more associated with *O. abyssinica*.

In Mandura Woreda all people use *O. abyssinica* for different cultural and economic activities. About 20 local uses of the species are identified in the Woreda. According to pair wiseranking of 5 highly preferred woody species for different activities like fencing, beehive, fire wood, construction and pole. *O. abyssinica* is first in construction followed by *Vernonia spp.* and *Combrutum molle* respectively; it is also first for beehive followed by *Vernonia spp.* and *Cordia Africana* respectively. The species is ranked fourth in pole and fire wood. In general *O. abyssinica* is multipurpose tree species in the Woreda. The species is also used for food during summer season of new shoots and as 'T'osha' to detoxify poisonous and alcohols.

Lowland bamboo vegetation is threaten by different factors like cutting of culms, decay of new shoots, mass flowering, agricultural expansion, over grazing, fire and cutting style. Cutting of culms is highest in cultivated and wild forest and least in protected forest. As to new shoots decay it is highest in protected forest due to large number of culms and debris that form dense canopy preventing light reach to ground and favours inhibiting new shoots. But the decay of new shoots is low in cultivated and

wild forests of bamboo. From the threats ranked by direct matrix ranking fire is the leading threat reported followed by mass flowering.

Although lowland bamboo is very important for different activities of the society, it is declining and on the way of extinction. Now a day's people are using different plants that can substitute the species for different activities. The plant species that are used to substitute lowland bamboo are preferred based on their availability, strength and multipurpose value. *C. molle*, *Accacia polyacantha* and *Vernonia spp.* are the most preferred plant species to substitute *O. abyssinica*. These plants that are used as substitutes are not as effective as *O. abyssinica* in their reproduction (regeneration). So, care should be taken not to loos these species in near feature.

The community of Mandura Woreda is less literate to wards conservation management of *O. abyssinica*; they consider the plant as wild forest. Even though some awareness creation programs were planed and conducted in the Woreda, it couldn't bring that much understanding to the community how and why to conserve lowland bamboo. Five most important methods were identified to conserve the species. These are Government measures, community forest protection, cultural by law protection, cultivation and proper cutting style. From the methods Government measure is the central and more decisive method.

- Recommendati Since the seeds of *O. abyssinica* require good moisture content to germinate, the seeds should be sown in highly humid environment.
- The study recommends conservation education to villagers and encouraging villagers to establish privet woodlots to provide lowland bamboo for construction, fence, making beehive and building poles. This will minimize the daily walking routine of villagers into the wild forest and make individuals to cultivate *O. abyssinica* in their wood lots.
- Education on the adverse impact of fire should be done to villagers and the firebreaks (fire lines) constructed around lowland bamboo forest to protect the species from accidental fires from the farmlands and surrounding grasslands.
- Deliberate human intervention through further research is needed to restore normal recruitment and regeneration trend of *O. abyssinica* in the Woreda.
- *Oxytenanthera abyssinica* is used for many cultural and economical activities in the study Woreda, but less used as food and medicine, so more research and promotion activities should be done to improve the use value of the plant for food and medicine in the Woreda.
- The Governmental, NGOs and any concerned institutions should participate in teaching the community and distributing seedlings to the community to increase the status of lowland bamboo forest in the Woreda.
- Since species that are used as substitute of *O. abyssinica* like *C. molle*, *Accacia polyacantha* and *Vernonia spp.* are less effective to regenerate, so that care should be taken not to destroy them extremely.
- In partnership with cultivators, the Department of Agriculture/Forestry in the Woreda and NGOs operating at local level extension packages need to be developed and applied to improve cultural practices of lowland bamboo cultivation including timing, methods of harvesting and propagation.
- The establishment of bamboo seedling nurseries should be considered as a priority area of intervention. Apart from ensuring adequate local supply of seedlings for individual and community lowland bamboo plantations, the establishment of such nurseries would ease the pressure on natural bamboo stands which are currently used by lowland bamboo cultivators as the only source of planting material.

REFERENCES

1. Bewketu Z. Kassa. Bamboo: an alternative building material for urban Ethiopia. 2009.
2. INBAR - International Network for Bamboo and Rattan. Study on Utilization of Lowland Bamboo in Benishangul Gumuz Region, Ethiopia. 2010
3. INBAR. Bamboo for the environment. Development and trade International Bamboo Workshop. 2006.
4. Kajembe GC. Indigenous management systems as a basis for community forestry in Tanzania: A case study of Dodoma urban and Lushoto districts. Wageningen, Netherlands: Wageningen Agricultural University. 1994.
5. Kent M, Coker P. Vegetation Description and Analysis: A Practical Approach. 2nd Edn. US: John Wiley & Sons. 1992.
6. Liese W. Bamboos: Biology, Silvics, Properties and Utilization. 1985.
7. Mueller-Dombois D, Ellenberg H. Aims and Methods of Vegetation Ecology. 1974.
8. Swaine MD, Lieberman D, Hall JB. The effect of fire exclusion on savannah vegetation at Kpong, Ghana. Biotropica. 1992; 24: 166-172.

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