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Household Dependency and Constraints on Cultivation of Lowland Bamboo (*Oxytenanthera abyssinica*) in the Farm Land in Pawe District, Ethiopia

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Abstract

Study was conducted in Pawe district, Benishangul-Gumuz National Regional State, northwestern Ethiopia. The objective of this study was to evaluate Household dependency and Constraints on cultivation of lowland Bamboo (*Oxytenanthera abyssinica*). For this study, two kebeles were selected based on random sampling technique. Data were collected from a total of 136 households. Households were selected using simple random sampling technique. Statistical Package for Social Sciences (SPSS) which is chi square was used to analyze the data collected. The economic contribution of bamboo for local households is described in terms of raw-materials for house construction, fuel wood, farm tools, and also for animal fodder. Major constraints for cultivation and management of low land bamboo were lack of seed/ seedlings, small landholding, and animal damage. Government and NGOs should play great role in order to support and create awareness to local people. Moreover, there should be done to solve problems of shortage of seed/ seedlings by collecting seed from the seed sources areas and raising seedling in nursery and distributing to the farmer. The bamboo in natural forest is now affected by fire and free grazing and this should be controlled to provide better products with in short period of time.

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Keywords

Low Land Bamboo, household dependency, constraints.

Introduction

Bamboo is the fastest growing perennial grass species with a considerable potential to the socio-economic development and environmental protection (Baghel *et al.,* Kumar and sastry, 1999). There are more than 1,500 species and 75 genera bamboo found in the world, covering 14 million ha of the land. 67 % of the African and more than 7% of the world bamboo resource is found in Ethiopia (Luso Consult, 1997; Ensermu *et al.*, 2000; Kassahun, 2003). Bamboo is woody grass belonging to the sub family Bambusoideae of the family Poaceae. Bamboo is fast growing species and therefore, known as "Green Gold". This green gold is sufficiently cheap and plentiful to meet the vast needs of human populace from the "*child cradle to the dead man's bier*" (Nirmal, 2010) Ethiopia has two bamboo species namely the high land bamboo, *Yushina alpine* (K.Schum) and the low land bamboo *Oxytenanthera abyssinica* (A. Rich).

Coverage of an area about one million ha, out of in which the high land bamboo comprises about 150,000 ha and low land bamboo is over 850,000 ha (Ensermu *et al.*, 2000; Kassahun, 2003; EABP, 2009). Their permanent importance and multifaceted use in different parts of the country are reported (Ensermu *et al.*, 2000).

Bamboo has a considerable and numerous for day to day use for the local community where the species is growing. In addition its contribution in conservation of degraded areas (Tesfaye, 1998) its nature of prosperous in wide range and marginal lands makes bamboo and important the Millennium Green Gold of Ethiopia perennial grass species to be popularized in the country (EABP, 2009; INBAR, 2011). Although bamboo is not an integral part of the economy of Ethiopia, it plays a very important role socially, economically and ecologically in areas where it occurs naturally and where it is planted. Both the highland and lowland bamboos are such a versatile type of resources that they can be used in many ways. Their paramount importance and multifaceted use in different parts of the country are reported (Ensermu *et al.*, 2000). The lowland bamboo species is a clump forming, solid stemmed bamboo that is widely distributed in the dry regions in the western part of Ethiopia. Since ancient times, this plant has been a vital resource for communities living in the semi-arid regions of the country. It has traditionally been used as a raw material for building and it has also been used for making numerous household utensils, basketry, and handicrafts. It is also a plant with nutritional value: young bamboo shoots can be cooked and eaten as a vegetable, and the foliage can be used as animal fodder. In Ethiopia, the species grows on dry rocky hillsides where the mean annual temperature is above 30°C and where an annual rainfall of about 700-1000 mm is concentrated over a period of three to four months. The species occurs mainly in the western part of the country towards the savanna woodlands of Sudan at elevations between 1200-1800m. Stands of *O. abyssinica* thrive on poor soils and provide a buffer zone for desert areas (EABP, 2009; Kassahun, 2003)**.**

Statements of problem

The area of lowland bamboo forest cover of Ethiopia has been diminishing at an alarming rate due to a combination of anthropogenic and natural factors. Every year, bamboo forests are exposed to uncontrolled bush fire. In the study area there was 53,830 hectare of bamboo before2000 (Ensermu *et al.*, 2000). But this figure diminishes from time to time**.** In many cases, bush fires are started intentionally to clear land for shifting cultivation. In Ethiopia there is a planting experience of the highland bamboo by individual farmers and rural communities. But there is no information concerning the planting experience of the lowland bamboo. The majority of the community in Pawe districts possesses bamboo as a communal property (natural bamboo forest). The land allocated to private bamboo plantation in the lowland area is small compared to the highland bamboo which is planted in highland area. However, plantation of lowland bamboo as private holding in backyard has been an emerging activity. This could be attributed to the fact that access to lowland bamboo in natural forest is restricted as a result of reduction in area coverage because of over utilization (Yeshambel Mekuriaw *et al.*, 2011) and also uncontrolled fire. Even though it has been started to cultivate low land bamboo on farm land, it is not satisfied the need of the community. Which means there is a great gap in cultivation of this plant in the farm lands although many people livelihood is depending on the products of bamboo spp. Due to this the study was attributed to assess constraints on cultivation of bamboo and its significant in the farm land by the community.

Objectives

General objective

The general objective of this study was to assess household dependency and constraints on cultivation of low land bamboo (*Oxytenanthera abyssinica*) in the study area

Specific objectives

To assess the contribution of lowland bamboo to local community

To assess the preference of bamboo by local community

To assess the major constraints that limit cultivation of lowland bamboo on their farm land

Materials and Methods

Description of Study Area

Location

The study was conducted in Pawe district, Metekel Zone, Benishangul Gumuz National Regional State, North Westen Ethiopia at a distance of 560 km from Addis Ababa. The twon of the pawe district is Addis Alem town. The town was established as resettlement area by the military government of Ethiopia in the year of 1984 – 1986. The study kebeles were kebele 30 and kebele 23/45. And they are located 3 and 6 km from the town, respectively. The woreda lies between 36º15`E-36º34`E

longitude and 11º10`N-11º23`N latitude. The elevation of the Woreda ranges from 980 to 1200 meter above sea level.

Population

The Ethiopian authority planed the resettlement during the Dergue government, as the area was in habited virgin lands with agricultural potential. However, before the arrival of settlers, the area was habited by indigenous people (Gumuzu) who practice hunting of animal, gathering of fruit and leaves and shifting cultivation. Once the area become a conventional resettlement scheme site, it hosted resettles population of both famine victims from Wollo, Tigry, Gojam, Gonder and Show and those who came from over populated area (Wollo, Tigry, Gojam, Gonder and Show)(Abayneh Esayas, 2003).

The total population of the area is estimated about 49, 758 of which 25,320 are men and 24, 438 are women and more than 70% lives in rural areas (CSA, 2008). In the study area, the majority of the population practiced Ethiopian orthodox Christianity (64.4%), Muslim (20.4%) and protestant (9.6%). There are four largest ethnic groups in study area which is Amhara (75%), *Kambata, Wolayta and Hadiya* (14%), *Oromo* (3.6%) and *Tigray* (3.5%) and all others peoples of ethnic groups (1.3%) (Abayneh Esayas, 2003).

Agro climate

The climatic condition of the area is characterized by a semi-arid climate with an annual rainfall of 600-1450 mm, concentrating in one season, during the months of May- October and rainfall reaches its peak during July-September. Annual temperature of the area ranges from 18ºC to 40ºC with mean maximum and minimum temperature of 38ºC and 16ºC, respectively. The coolest period is July-August (12ºC) and the hottest period is March-April (40ºC). (Abayneh Esayas, 2003)

Topography and soil

The study area is characterized by 4% Mountainous, 22% undulating and 74% plain. The soil types in the study area are Black (*Vertisol*), Red (*Nitosol*) and Brown soil. Red and brown soils obtained higher agricultural production than Black soils. The study is covered by Vertisols (black clay soils), for (40-50%) of the area, Nitisols (red or reddish-brown laterite soils), which accounts for 25- 30% and intermediate soils of blackish brown color, which accounts for 25-30% (Abayneh Esayas, 2003).

Production system

The livelihoods of local farmers depend mainly on mixed farming of crops and livestock. (Pawe Agricultural and Rural Development Office, 2012). The dominant livelihoods of the study area are subsistence agriculture and traditional animal husbandry mainly cattle, goats, sheep etc. Livestock, crops and forest products are the main sources of income for the farmers in the study area. Farm size and number of livestock is the main factors which determine the wealth status of farmers. Farm holding size ranges from 0.75 to 3 ha with an average size of 1.5 ha (Abayneh Esayas, 2003). The livelihood of farmers depends upon diverse activities out of which agricultural production is the most dominant which includes crop production, and animal husbandry. The major crops grown in the area are sorghum, finger millet, maize, sesame, groundnut, rice chick pea, noug and pepper. However there are several other crops grown in the area with small scale that includes cowpea, tobacoo, cotton, sweet pota*to* and others. All farming households are entitled to land with a minimum 0.75 hectare of cultivable land and 0.01 hectare of back yard plot. The district has 43,316 animal populations, out of which 37,657 are cattle, 3,283 are goats, 3,388 are sheep and 788 (Abayneh Esayas, 2003).

Vegetation

The dominant vegetation cover of the area is characterized by different types of woodland which includes broadleaved deciduous woodland, *Acacia* woodland, and riparian woodland along the major river, Boswellia woodland and Bamboo thicket. Before 20 years, the whole village was covered with dense forest, Bamboo and other arboreal trees. However the forest cover has declined due to farmland expansion and other infrastructure buildings. As a result, the forest cover has been diminished and easy accessibility also becomes difficult (Demelash Alem, 2006).

Data Collection Methods and Sampling

Sampling method and procedure

Selection of the study area, respondents and sampling technique has been conducted in the following procedure. Two kebeles namely kebele 23/45 and kebele 30 were selected for the purposes of data collection.

There are 8,562 total households in the two study kebels 4,293 and 4,269 in kebele 23/45 and 30, respectively. The study kebeles were selected randomly as all areas of the study site have bamboo and the area is homogenous topographically. From a list of households' heads available in the respective kebele, 68 sample households from each of the villages were selected. A total of 136 household heads were selected following Cochran (1977).

$$no = \frac{z^2 pq}{d^2} \rightarrow n = \frac{no}{1+\frac{no-1}{N}}$$

Where: no = the desired sample size, if population is more than 10,000

n = number of sample size, if population is less than 10,000

z = 95% confident limit i.e. 1.96

p = proportion population to be included in the sample i.e. 10%

q = 1- 0.1

N = total number of population

d = margin of error (5%)

There are 8,562 total populations in the two study kebeles, 4,293 and 4,269 in kebele 23/45 and 30, respectively. From a list of households' heads available in the respective kebele office, 68 sample households from each of the kebele were selected. A total of 136 household heads were selected following Cochran (1977).

Data collection

Data was collected using questionnaires and supplemented by information obtained from making field checks at the time of survey and secondary data derived mainly from Office of Agriculture. Group discussions were held during the survey with key informants consisting of local community and local administrators.

During the group discussion, information was gathered on issues related to the current socio economic contribution, and farmers' indigenous knowledge about the production and utilization of bamboo, and constraints that affect bamboo cultivation. In the discussion process, an individual issue was raised by the researcher.

Socio economic data analysis

In ranking the importance of bamboo, the number of respondents who reported for each rank were summed up and taken as the proportion from the total interviewed farmers for each kebele. The collected raw data were systematically coded and analyzed using descriptive statistics like mean using Statistical Package for Social Sciences (SPSS). A chi square was used to analyze the socio-economic data (to identify major constraints on cultivation of lowland bamboo in farm lands. Over all respondents ranking based on their own criteria (cash income, house construction, fuel wood, charcoal, animal fodder, agricultural tools and furniture). The collected data was summarized and present in the form of table, chart and figure form.

Results and Discussion

Households' dependence on Low land bamboo

From the table 3.1, it is depicted that house construction, fuel wood, farm tools, for animal fodder, fencing, wind break, environmental amenity and erosion control had positive highly significant contribution of bamboo but others are not significant. The comparison for chi-square analysis is done between important and not important of bamboo for different purposes. Most of the respondents recognized that the economic contribution of lowland bamboo is vital for their livelihood. According to sampled households, 99.3% of them use it for house construction, fuel wood, farm tools, animal fodder and fencing (table 3.1). Moreover 94.9%, 69.9%, 66.2%, 43.4% of respondents used it for wind break, environmental amenity, erosion control, and cash income, respectively. While lowland bamboo used for charcoal production, Preventing land slide, protecting river bank, and moisture retention accounts 0.7%, 28.7%, 32.4 and 33.1%, respondents, respectively (Table 3.1).

In agreement with the result of some previous works like Yeshambel Mekuriaw *et al., (*2011), the use of bamboo for a cash income, house construction, as forage for livestock, fire wood, fences and environmental protection. Similarly, Ensermu Kelbessa *et al.,(*2000); Arsema Andargachew (2008) Explained the benefit of bamboo for income, animal fodder, fuel, food and raw material for house construction to over 2.2 billion people world-wide. Its leaves are important source of fodder for

livestock (Ensermu *et al.,* 2000; Yeshambel Mekuriaw *et al.,* 2011). And also INBAR, (2010) reported that bamboo provide for house construction, fence and fuel.

The majority of the interviewed rural families are entirely dependent on raw bamboo for construction, household furniture and as a source of domestic energy (Ensermu *et al.,* 2000). Low value of lowland bamboo as a raw material for furniture making was also reported by Arsema Andargachew (2008), who noted that the lowland bamboo is mainly used for income generation, construction and fences rather than furniture. Traditionally bamboo has been widely used for the construction of houses, fuel, feed, fodder, beehives, hats, mats, baskets, handicrafts, small furniture and other countless products (Seyoum Kelemwork, 2008)

Reason for the preferences of lowland bamboo

As the respondent said that the main reason why they prefer *Oxytenanthera abyssinica* next to *Mangifera indica* is: it is multipurpose tree that provide different products except food that used directly. But the products can substitute the food by selling its product and also preferred by its fast growing habit by the local respondents. From table 3.2, we can see that the reason why local respondents prefer lowland bamboo are bamboo provide multi-purpose products, bamboo is fast growing and bamboo can provide high economic return by accounting 50%, 24% and 15% of respondents, respectively.

The result is in supported by Nath *et al.,* 2009 reported, due to Bamboo strength, straightness, lightness combined with extraordinary hardness, range of size, abundance, short period in which they attain maturity, make them suitable for a variety of purposes and uses. The purposes are edible bamboo shoots, pulp & paper industry, charcoal, building and construction materials: bamboo house, shade house, construction frame, door-window frames, fencing, concrete reinforcement in highways and buildings partition walls etc. transportation, household & farm utilities, craft products (cottage industry), musical instruments, and soil conservation and carbon sequestration. In a fully developed bamboo root system, which occurs within 3-7 years after seeding, new bamboo shoots are produced every rainy season and attain full height and diameter in about 3 months (Kassahun Embaye, 2003; KEFRI, 2007). Bamboos get mature, strong and ready for utilization after 3-4 years (Kassahun Embaye, 2003; KEFRI, 2007).

Problems/Constraints in low Land bamboo cultivation on farmlands

The major problems that limit cultivation of lowland bamboo on the farm lands are lack of seed/seedlings, small landholding, animal damage and pest/ diseases. Majority of the farmers said that lack of seed/seedlings and small landholding are the major problems which accounted 80% and 70 % of the respondents, respectively and animal damage and pest/diseases are also other limiting factors on lowland bamboo production by responding 56% and 17% respectively. As the lowland bamboo flower and seed bearing takes long period of time, accessibility of the seed and seedlings is the major problem, majority of the farmers in surveyed households have less than 1 ha land which is also fragmented, with severe land degradation in dominantly crop-livestock mixed production system. The limited landholding is not enough to increase bamboo plantation in their private land. Hence, small land holding is another problem limiting bamboo production in the study area.

In the study area, there are 43,316 animal populations; 37657 cattle, 3283 goats, 3388 sheep. As in the study area, there is free grazing system the new growing bamboo is affected. More over as households responded, there are pest/ disease problems that affect the survival of the newly planted seedling and it is another problem that limits cultivation of bamboo in the study area. According to Kassahun Embaye (2003) report Bamboos have the following limitations: The gregarious flowering and eventual death of all bamboo trees in a forest is a characteristic that may seriously affect the sustainable supply of raw materials for bamboo-based industries

Bamboo can play a crucial role in rural economy and environmental protection to sustain the livelihoods of many rural households. Their economical contributions include used for house construction, fuel wood, animal fodder and fences. The study concludes that production of lowland bamboo is the major sources of fuel wood, house construction, farm tools, and animal fodder to those rural people. The major bottlenecks affecting cultivation of lowland bamboo in*pawe* District is lack of seed/seedlings, small landholding, and damage by animal. These problems affect plantation of bamboo by farmers in their farm lands.

Table.1 hi-square distribution of respondents' in their site and Functions of low land bamboo

purpose	Kebeles						chi square	p value
	23/45		30		Total			
	yes	No.	yes	No.	yes	No.		
Cash income	33	35	26	42	59	77	2.382	0.123 ns
Fuel wood	68	0	67	1	135	1	132.029	0.000 **
House construction	67	1	68	0	135	1	132.029	0.000 **
Farm tools	68	0	67	1	135	1	132.029	0.000 **
Animal fodder	68	0	67	1	135	1	132.029	0.000 **
Erosion control	46	22	44	24	90	46	14.132	0.000 **
Wind break	68	0	61	7	129	7	109.441	0.000 **
Fencing	67	1	68	0	135	1	132.029	0.000 **
Amenity	59	19	36	22	95	41	21.441	0.000 **
Increase fertility	17	51	32	36	49	87	10.618	0.001**
Furniture use	1	67	1	67	2	134	128.118	0.000 **
Gully rehabilitation	12	46	43	35	55	81	4.971	0.0026*
Charcoal	1	67	0	68	1	135	132.029	0.000 **
Preventing land slide	12	56	27	41	39	97	24.941	0.000 **
Protecting river bank	12	56	32	36	44	92	16.941	0.000 **
Moisture retention	12	56	33	35	45	91	15.559	0.000 **

ns = non-significant * Significant ** highly significant

Table.2 Reason that preferred bamboo by respondents

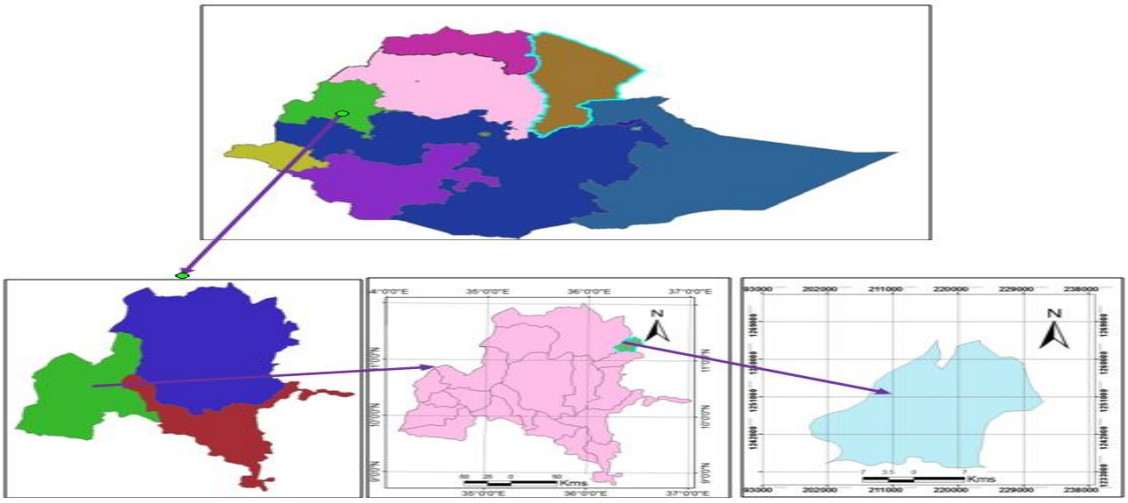
Reason of preferences	No. of respondents	%	Rank
Bamboo is fast growing	32	23.5	2nd
It can give high economic return	20	14.7	3rd
Bamboo has multi-purpose	68	50	1st
It occupy less space	0	0	-
Bamboo can rehabilitate marginal lands	10	7.4	4th
Bamboo can conserve soil	3	2.2	5th
It can stabilize land	1	0.7	7th
It can increase soil fertility	2	1.5	6th
Total	136		

Table.3 Major constraints that limit cultivation of bamboo by local farmers on their farm

constraints	Kebeles						chi square	p value
	23/45		30		Total			
	Yes	No.	Yes	No.	Yes	No.		
Infertile soil	1	67	0	68	1	135	132.029	0.000 **
Land shortage	45	21	46	22	91	46	14.235	0.000**
Animal damage	39	29	37	31	76	60	1.882	0.002ns
Pest/ diseases	19	49	4	64	23	113	59.559	0.000**
Lack of seed/ seedlings	50	18	56	12	106	30	42.471	0.000**
Lack of money	0	68	1	67	1	135	132.029	0.000 **
Theft	9	59	8	60	17	119	76.500	0.000**
Lack of skill/knowledge	7	61	5	63	12	124	92.235	0.000**

ns= non-significant * Significant ** highly significant

Fig.1 Map of the study area



Recommendation

Among many issues come across, it is suggested that the following are important areas that deserves future research and major areas of intervention. The contribution of lowland bamboo to the household income is often unseen in various economic and environmental conservation surveys. Therefore, it is recommended that policies and strategies that improve the welfare of rural people especially the poor and the land less households and use of bamboo for natural resource conservation should be given attention. Additionally, government and NGOs should support and encourage lowland bamboo and lowland bamboo based activities as part of the diversified livelihood strategies.

Most of the household practice traditional bamboo productions like baskets, mats, chairs, tables and traditional beehives. However, the traditional productions are very low in quality Therefore; it is recommended that strategies and interventions that aim at improve of value addition of bamboo and transformation of traditional production into modern. There should also need further research regarding to marketing system and creating marketing chain for farther implementation of bamboo cultivation.

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