

Comparative Study of Forest under Participatory Forest Management: A Case of Belete Gera Forest, Southwest Ethiopia

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Abstract: Participatory forest management has attracted strong interest to improve forest condition and forest based livelihoods. The objective of the study was to assess the situation where participatory forest management works best. Data were collected from 137 households and 58 plots. The result showed that inverted J shape population structure based on diameter classes both for forest with and without coffee. More regeneration were recorded under forest without coffee. Shannon-Wiener diversity index of 2.98 in forest without coffee and 2.13 in the forest with coffee was calculated. Forest income to forest users on average on annual basis was calculated to be 8499 and 376 ETB to forest users with and without coffee respectively. An independent t-test shows forest coffee users obtain significant income compared to forest users without coffee. A chi square result showed that it is less probably the occurrence of forest income difference due to chance ($\chi^2(1) = 137.000$, $p > 0.05$). Further analysis indicates that 63% of forest users without coffee obtain less than 376 ETB per year. 47 % of forest users without coffee utilize forest only for consumption in a form of fuelwood, medicinal plants. The benefit of the forest to the member of forest users showed that 67% of forest users were obtain below average (4348 ETB per year), of which 75% were forest users without coffee. The relative contribution of forest income to forest users with coffee and without coffee was 40.6% and 2.3% respectively. The finding shows subsistence oriented forest dependency of forest users without coffee and cash oriented forest dependency of forest users with coffee. Improving forest condition and forest based livelihood requires taking into account the market value of forest products. The current human disturbance indication is the turning point to look options for livelihood improvement.

Key words: Forest income • Livelihood • Regeneration • Diversity • Forest coffee • Southwest Ethiopia

INTRODUCTION

Participatory forest management has attracted strong attention to manage the remaining natural forest of Ethiopia. The experience of forest management through participatory approach goes back to 1990s [1]. Belete-Gera forest is one of piloted forest under participatory forest management approach. With some experience from piloted projects, there is an interest of scaling up of participatory forest management to four regional states (Amhara, Oromia, Benshangul-Gumuz and Southern Nations, Nationalities and Peoples' Regional State (SNNPRS) and 94 forest sites. The ultimate objective

of participatory forest management is improving forest condition and forest based livelihoods (<https://www.google.com.et>). Non timber forest products are allowable forest products for utilization [2]. However, non timber forest products are wide array of forest products ranging from products with little integration to market like fuelwood to products with high integration to market like coffee [3, 4]. Two views distinguished from previous study about the contribution of participatory forest management towards addressing conservation and development. Some reports indicate participatory forest management is win-win approach, whereas; others' reports indicate the difficulty of addressing conservation

and development at the same time through participatory forest management [5].

Despite the notion of accepting participatory forest management in Ethiopia, scientific information about how forest condition determine the success of the approach is not sufficient. The previous studies have given much attention to forest income contribution and forest dependency [6,7, 2]. As a result, more scientific information is required to make participatory forest management successful. The study aims at comparing blocks of forest under the same management (participatory forest management) in context of forest condition and forest based livelihoods. The paper tries to answer the research question does all participatory forest management members get equal benefits from participatory forest management.

MATERIALS AND METHODS

The study was conducted at Belete forest part of Belete Gera National Forest Priority Area. The forest is located in Shebe Sombo district of Jimma Zone, southwestern Ethiopia. It is found along Jimma - Bonga main road at 45 km from Jimma town. Geographically, it is found between 7° 30' N and 7°45' N and 36° 15'E and

36°45'E. The forest reserve is categorized into Gera and Belete Branch. The total forest area of Belete branch is about 25,597.94 ha [8]. The forest management is under participatory forest management system since 2003. For the participatory forest management, there were 125 Forest Management Association units entitled to manage 63,828 hectares of forest [2]. There were 14 villages in total practicing participatory forest management and seven of the villages were bordering the forest coffee and the other seven villages were bordering the forest without coffee (Figure 1).

Data was collected between September 2012 and March 2013. The forest was divided into two blocks; forest with coffee and forest without coffee. Information was collected on current forest condition and the benefit of forest to forest users after participatory forest management has phased out. Household survey was used for socioeconomic information. Four forest users of participatory forest management members were selected (two from each). The total sample size of the study was calculated to be 137 households, 70 from forest without coffee users and 67 from forest with coffee users proportional to the total size of forest users. Household interview, focus group discussion and key informant interview were employed to collect the socioeconomic information. Structured and semi structured questionnaire was used to collect information during household interview.

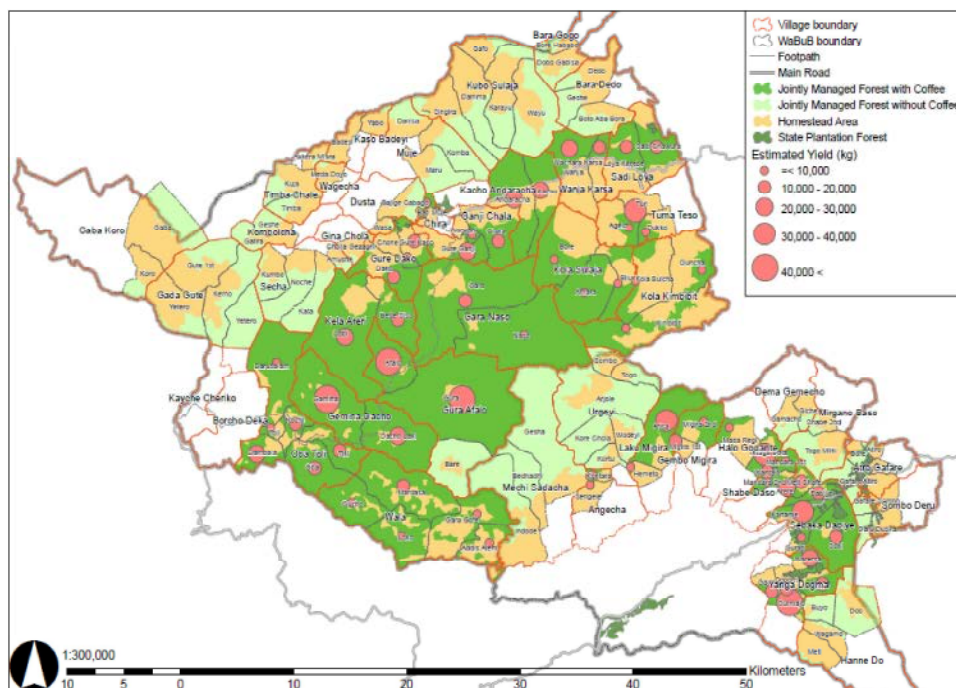


Fig. 1: Map of the forest with and without coffee

Field survey was carried out for forest condition assessment. Data was collected on forest status indicators such as regeneration, diversity of woody species and forest disturbance conditions. A plot of 20 m x 20 m along transect was used to collect data on forest condition following [9]. The total required plots at 10% sampling intensity were calculated to be 58 plots (29 plots from forest without coffee and 29 from forest with coffee). Data was analyzed descriptively and using independent t- test and chi square test. The collected data was coded, computerized and analyzed using Microsoft Excel and the Statistical Package for Social Sciences (SPSS version 20). Shannon-Weiner species diversity index was used to calculate species diversity following the formula:

$$H' = -\sum_{i=1}^s pi \ln(pi)$$

Where:

- H' = Shannon's diversity index
- S = Total number of species in the quadrat
- Pi = ni/N, the number of individuals found in the ith species as a proportion of the total number of individuals found in all species
- In = Natural logarithm to base e

RESULT AND DISCUSSION

Forest Regeneration Status: Regeneration is an indication of forest condition improvement [10]. Woody plants were categorized into seedlings, sapling and mature trees based on their height and diameter. Seedlings are woody plants with a maximum height of 1.5 meter. Saplings are woody plants with diameter less than 10 cm and height of 1.5 meter to 6 meter [1]. Woody plants at the stage of seedling and sapling were recorded both under forest with and without coffee (Table 1). More seedlings and species were recorded under forest without coffee. The number of seedlings under forest with coffee is greater than the previous report made by [11]. This is because the forest is certified for forest coffee by Rain Forest Alliance. The internal controlling system for forest coffee certification has contributed towards regeneration under forest with coffee.

The patterns of diameter class distribution indicates the recruitment processes of a given species [12]. Figure 3 and Figure 4 shows the population structure of the species under forest without coffee and with coffee respectively. The result showed inverted J shape both for

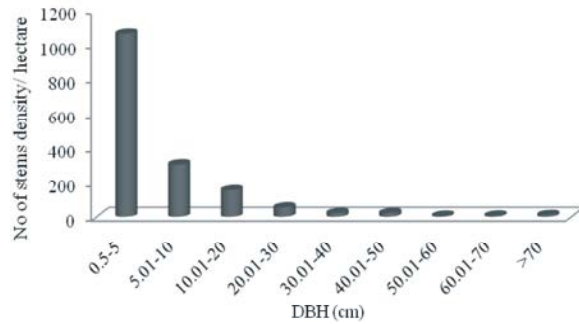


Fig. 2: Diameter classes of forest without coffee

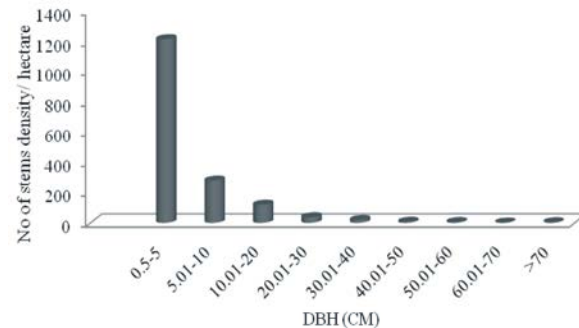


Fig. 3: Diameter classes of forest with coffee

forest with and without coffee indicating good species recruitment status. The previous study made by [11] states the suppression of regeneration that leads to disappearance of forest species due to coffee management. However, the present study shows the significance of participatory forest management towards enhancing regeneration of forest species. The finding agrees with study made by [1] at Bonga Southwest Ethiopia. Report by [14] has shown temporal forest condition improvement after participatory forest management from Tanzania.

Woody Species Diversity: Plant species diversity is mostly influenced by human impact. Forests with low levels of disturbance has high species diversity compared to disturbed forest [15]. Shannon-Wiener index was computed for the two forest categories. The result showed that the diversity of 2.98 in forest without coffee and 2.13 in the forest with coffee (Table 2). The finding is comparable to the previous report. Report by [11] has shown Shannon diversity of 2.82 and 2.6 at Bebeke forest coffee and Haranna forest coffee respectively.

Human Disturbance Indicators: Participatory forest management restricts illegal tree cutting, expansion of farm land into the forest and coffee expansion in the

Table 1: Regeneration under forest with and without coffee

No	Types	Forest without coffee		Forest with coffee	
		Stem density/ha	Species number	Stem density/ha	Species number
1	Seedlings	16000	31	4620	17
2	Saplings and shrubs	1337	33	521	19
3	Mature trees	274	45	187	41

Table 2: Diversity Index of forest with and without coffee

No	Index	Forest without coffee	Forest with coffee
1	Shannon Wiener diversity index (H')	2.98	2.13
2	Species richness (S)	55	45
3	Evenness (E)	0.74	0.56
4	H'max	4.0	3.8
5	Simpson index	13.9±0.93	4.2±0.70
6	Beta diversity	80%	



Fig. 4: Ringing tree and cutting inside forest with coffee

forest. Human disturbance indication was assessed in both forest with and without coffee. The result showed incidence of forest disturbance indication both in forest with and without coffee. New coffee plantation, charcoal making, cutting trees and tree ringing were observed in forest with coffee (Figure 4).

Out of 29 sampled plots in forest with coffee new coffee plantation, cutting trees and tree ringing were recorded in 8, 4 and 5 plots respectively. Forest without coffee had the incidences of farmland expansion into the forest and livestock grazing. Disturbance in the two blocks of forests were attributed to generating more income from the forest. The premium price for certified forest coffee has tempted some farmers to plant more coffee inside forest with coffee that violate the forest coffee certification itself. Similarly farmers in area where there is no coffee opt for expansion of farmland to improve their livelihoods. Study report [14] has shown incidence of human disturbance for joint forest management at Tanzania.

Forest Income: Participatory forest management is supposed to improve forest based livelihoods [16]. Forest income was estimated for forest users under forest with and without coffee. The two blocks of forest had quite different potential attributed to the nature of obtainable forest products. For forest users with coffee the major source of forest products were coffee and honey that have high integration to market whereas, for forest users without coffee the major source of forest products were fuelwood, medical plants and small construction materials meant for consumption. Table 3. shows an estimated forest income of forest users with and without coffee. An average forest income was calculated to be 8499 and 376 ETB on annual basis to forest users with and without coffee respectively. Forest coffee users obtain significant income compared to forest users without coffee. A chi square result showed that it is less probably the occurrence of forest income difference due to chance ($\chi^2(1) = 137.000, p>0.05$). Further analysis indicates that 63% of forest users without coffee obtain less than 376

Table 3: Estimated forest income of forest users with and without coffee (ETB)

Forest Income	Min.	Max.	Average	Users below average	Independent t-test		
					t	df	Sig.
Forest coffee users	1385	35000	8499	34%	10.090	35	.000
Forest without coffee users	0	5150	376	63%			

* ETB= Ethiopian Birr (1ETB =0.055 USD)

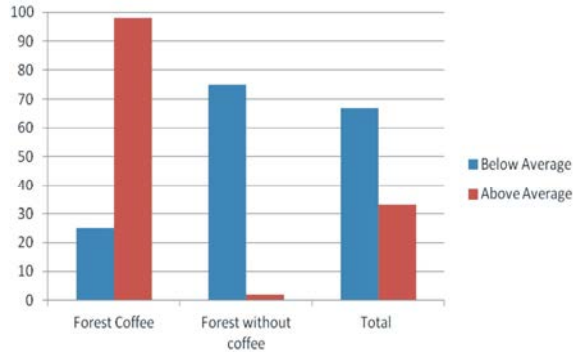


Fig. 5: Forest Income Contribution to Forest User

ETB per year. 47 % of forest users without coffee utilize forest only for consumption in a form of fuelwood, medicinal plants etc.

The benefit of the forest to the member of forest users was assessed. The result showed that 67% of forest users were obtain below average (4348 ETB per year), of which 75% were forest users without coffee due to less market integration of forest products from forest without coffee. The finding indicates unequal forest income potential between the two forest blocks (Figure 5).

Figure 6. shows source of income of forest users. The result showed that income from crop is the major source of income accounting about 89% for forest users without coffee. The relative contribution of forest income to forest users with coffee and without coffee was 40.6% and 2.3% respectively. The relative contribution of forest to forest users without is quite different from the previous report [17-19]. The previous study reports have shown larger number. For instance, [3, 11, 6] have reported 50%, 50% and 40% respectively. The present study considered the forest user access right with respect to the potential harvestable non timber forest products from the forest and associated market values to these products. The contribution of forest to household income to forest users with coffee agrees with the previous study report.

CONCLUSION

The study finding shows there is a difference between the two blocks of forests. Participatory forest management has contributed positively towards addressing forest condition. Improving forest based livelihoods is possible through market value of forest products. The results also shows subsistence oriented forest dependency of forest users without coffee and cash oriented forest dependency of forest users with coffee. Improving forest condition and forest based livelihood requires taking into account the market value of forest products. The current human disturbance indication is the turning point to look options for livelihood improvement.

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