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Native woody plants for livelihood in North Western Ethiopia: drivers of diversity and management constraints

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Abstract

RRA and PRA tools are used to understand drivers of land use practices and land allocation to different land use types with a special reference to remaining native woody plant communities in NW Ethiopia. A collaborative planning and implementation process shall lead to improved sustainability and productivity of land use. In a first step, a survey with questionnaire and semi-structured interviews were used to collect information on tree species preferences and tree niches and uses as well as selected socio-economic characteristics of farms of 100 households. Group discussion was carried out to prioritise woody plants against selected attributes. Floristic diversity differences between households were analysed by using species richness, Shannon and Simpson diversity and evenness indices. As a result, 60 plant species were identified. Diversity values differed markedly between farms. Multiple linear regression of diversity statistics on household characteristics showed significant relationship: much of the variation was explained by wealth, age, gender, educational level of the households, and size of land holding, explaining from 2 — 53% of the variation. From group discussions, eight attributes with which farmers value a tree species have been identified. Prioritisation of tree attributes showed major constraints and motivations for growing trees. Prioritisation of trees was based on their importance for fodder, compost and fuel wood. Poor survival due to moisture stress, propagule supply and free grazing has been mentioned as major constraints. Urgent needs for finding solutions leading to improved survival of seedlings were detected. Diversity and abundance of trees on farms might be increased by using household socio-economic characteristics as extension entry points. Recommendations on research priorities of native plant species and on how to maximise the species pools for future conservation and restoration efforts are provided.
Key words: farm trees, livelihood, diversity, productivity

Introduction

The north western highlands of Ethiopia have a long history of intensive land use and deforestation (Hurni, 1988). The major causes of deforestation have been land clearing for arable land and pasture; cutting trees for timber and fuel. The rapidly growing human population, civil un-rest as well as severe episodes of draught, have also stimulated the distress. In order to overcome this, farmers grow selected woody plant species on their own land in a definite spatial and temporal arrangement, and management regimes.

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According to (Warner 1995) pattern of trees grown on farm and the drivers of this pattern can only be examined in terms of farmer livelihood strategies and of the dynamics of rural change. For instance, trees may be grown on non-arable or fallow land, homestead areas, along boundaries, intercropping on arable land/multi-storied home garden, and homestead areas with different intensity of management. A pattern or a combination of patterns may exist in a given land use system depending on whether the farming system is extensive; protection against livestock is difficult, trees have beneficial positive impact with neighbouring crops or trees are cash crops.

On the other hand, with the emergence of the principles of landscape ecology and the parallel increase in interest for the human-shaped rural landscape, scientific attention for the composition, structure and functioning of the different types of farmland habitat constituting the rural landscape mosaic has been growing steadily. In the contemporary landscapes they often serve as a refuge for numerous species once widespread but now largely diminished (Hermy et al, 1999).

In Ethiopia little has been done to understand the basic organizing principle of woody plants in rural landscapes in the framework of farmers' livelihood strategy and dynamics of rural change in conjunction with the conservation of biodiversity in farmer managed habitats. Therefore, the objective of this study has been to understand drivers of woody plant diversity in and around farms, characterise niches of woody plants in and around farms, and also to characterise constraints of and opportunities for growing native trees.

Materials and methods

The study was carried out in Ambober-Wuzaba area in Gondar Zuria district of Semen Gondar in North Western Ethiopia between lat. 12°31'2.87"N long. 37°31'24.37"E. In this district, watersheds were selected based on the following criteria: Representativeness of much of the agroecology, location from the main road, being priority project area for the district office of agriculture to improve livelihood.

Inside the watershed 150 households have been selected. The selection of households was done with the help of local authorities, leaders and development agents.

Interview with questionnaire, group discussion, and transect walk have been carried out to collect data. For every tree species encountered on a farm, information was collected on the presence in particular on-farm niches by interviewing household members involving farm walks, and data recording using questionnaire.

On-farm niches in our case refer to the location on the farm and the establishment pattern of trees at the location. The niches that were distinguished were trees in the homestead area, trees mixed in cropland, trees on boundaries of the farm, live fence, trees in woodlots, and trees in degraded lands.

The survey was done by using pretested questionnaire and every sample household visited. In each visit, inventory of every woody plant was done. Interviewed individuals were made to name the main use of the species on the farm, the source of seedling or germplasm of each tree species. Origins of germplasm may be from natural regeneration, wildling, own nursery, government nursey, neighbour farmer, or from market.

We used species richness, Shannon and simpson diversity indices to estimate the divesirty of the ecosystem.

Group discussion was done to study major function and use of woody plants grown by farmers, and also to prioritize woody plants for different functions by criteria developed by the farmers.

Result and discussion

All in all 60 Native Woody Plants (NWP) have been indentified. The average land holding is 0.56 ha, and a given HH can have five fragmented plots. The average distance of plots is 2.1 km. Tree planting is practiced on the nearest plot of the HH and this plot is locally called "Wojed". There is no deliberate planting on the other plot, but tree can be maintained if it occurs on any of the boundaries or isolated stand in side the farm. The dominant farm forestry practice is growing tree around homesteads. The farm forestry system can be categorized as *Rahmins-Fics-Cordia*, which

is a typical local example for an agroforestry practice of tree growing around homesteads. Spatially, *Rahminus prinoides* is planted in rows of lines, *Cordia africana* scattered randomly, and *Ficus thonningii* surrounding the HH and also inside of the live fence.

Figure 1 the study area

Multiple linear regression analysis has been done to evaluate the importance of household characteristics in affecting the diversity of native woody plants grown by the farmer. The explanatory variables included in the analysis were gender and age of the household head, number of years farmer resided on present landholding, family size, size of landholding in hectares, size of livestock owned in tropical livestock unit. The dependent variable used in the analysis was diversity statistics of trees grown by the household as measured by Shannon diversity index.

Analysis of household and farm characteristics showed that those house holds with higher number of domestic animals and with bigger farm size grow diverse and higher number of trees than the other ones. In other words wealthy households grow and maintain diverse kinds of native trees than poor households. On the other hand age and gender of head of the household do not have any statistically significant effect on the tree growing behaviour of the household.

Table 1 coefficients of household characteristics as explanatory variables on diversity characteristics (Shannon))
Total explained variation is expressed by the multiple correlation coefficient R^2 (0.36), with probability P (0.00)

Independent variables	**Coefficients**	**P-value**
Intercept	-0,51	0,17
Male headed HH	0,03	0,87
Age of HH	1,01	0,15
Number of years land holding managed by the HH	-0,19	0,64
Schooling	-0,56	0,13
FamilySize	0,83	0,08
LandHolding size of HH	1,06	0,00
TLU	0,10	0,01

Analysis of species by the function it gives for a given HH showed that growing trees for fuel wood has the highest frequency. It has been mentioned 560 times. The other functions (fodder,

shade, beverage, construction, for market) were mentioned on average from 412-540. Low occurrence in the purpose of maintaining or growing native woody plants for fodder shows, farmers have little alternative woody plant that can be used as fodder. That means the average number of tree species that can be used as fodder on each household is low.

Analysis of species by HH by taking tree growing niche and the associated plant species showed, homestead areas being the most important tree growing niches followed by trees scattered inside own farm. Live fences and farm boundary is also moderately important tree growing niches. In terms of farm occurrence, number of households where the tree growing niche was mentioned also showed homesteads being the best and preferred niches followed by live fencing and scattering trees in side own farm. Note only are homesteads important tree growing niches, they are also diverse as they have higher species diversity result, that is the number of species per household and per niche.

The propagule source has been 90% from natural regeneration, 5% from wildling and the remaining planted by the household obtained either from neighbor or from market.

Pair wise ranking of tree growing niche by the use or function of the tree showed, homestead is the source of supply for 83% of construction, 92% of farm implement, 25% of fodder, 46%fuelwood, 75%medicine, and 2% for sale.

Homesteads are more diverse and important because they are under strong and secured ownership feeling of the household owner. Besides, they are near settlement and are always under the direct supervision of member of the household; again they will be managed well and easily as they are watched.

The most important limitations for tree growing were very low seedling survival, due to drought and free grazing, and limited availability of seedlings.

Conclusion and recommendation

The diversity & abundance of trees was determined by their virtue to have immediate impact on the HH such as direct market value, or fodder. The first possibility to increase native plants might be making more germplasm available with these values, or increasing less utilized tree growing niches such as gullies and degraded hill, or a combination of the two. Side by side, HH characteristics such as wealth and gender should be taken in to consideration in the form of subsidy or special program for the poor or female.

There is a need to decentralize the government nursery at the household and village level. This approach is important from two perspectives, first it gives flexibility to produce the desired woody species, and second quality seedlings will be produced. This can be achieved by giving training to farmers engaged in tree growing.

Research is needed to supply the farmers with germplasm and management package that can resist drought and mitigate impact of free grazing.

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