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Full Length Research

Woody Species Management and Utilization in Agroforestry Practices: Implication for the Conservation of Native Woody Species in Rift Valley Agricultural Landscape, Dugda District, East Shewa Zone, Oromia, Ethiopia

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Low management and over-utilization exacerbated the benefits farmers obtain from native woody species. The study was conducted to assess and evaluate existing silvicultural management practices rendering for woody species and assess management of natural regeneration and identify farmers use preference of the woody species in the area and rank them based on their use. Qualitative data collection methods; field observation, key informants interview and household survey were used to obtain necessary data. Within the district, three kebeles were purposively selected based on their livelihood dependency on selected agro- forestry practices, i.e., Parkland Agro-forestry practice and public managed patches of tree woodland. A total of 100 households were interviewed for responding on important variables. Pruning and pollarding were the major silvicultural management practices being applied to trees in park land practices while thinning was sometimes applied to young regeneration. While farmers are pruning or pollarding trees for different objectives, they are preparing to reduce competition between trees and crops for the next cropping season. Total removal of live woody species is not allowed in both practices unless they are dead because of different biophysical factors. But, sometimes it is applied in parkland to reduce competition. Seven purposes of management were recorded for communal woodland practice in the district. Overall the woodland serves the community as buffer zone during times of difficulty in a year. A total of 18 preferred uses were identified from 31 woody species recorded at the area. Acacia albida (Garbii), Acacia negrii (Doddota) and Acacia tortilis (Dhaddacha) were the three major tree species the respondents frequently raised during use preference and obtained the highest use value index, i.e., the first use rank. There is high dependency of local people on the uses that are obtained from native woody species in the area. Therefore, intensive improvements are important from individual species to the practice as whole to increase and sustain these native tree uses.

Key words: Agro-forestry practice, Silvicultural management, Use value index, Woody species.

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INTRODUCTION

Agro-forestry refers to land or farming system in which trees or shrubs are grown in association with agricultural crops, pastures or livestock and in which the positive interaction between trees and other components increase social, economic and environmental benefits for land users (World Agro-forestry, 2017). It is a dynamic, ecologically based natural resource management system, diversifies and

sustains production for increased social, economic and environmental benefits through the integration of trees on farm and in the landscape (Mukadasi&Nabalegwa, 2008).Its practices range from open parkland assemblages, to dense imitations of tropical rainforests such as agro-forestry home-gardens, to planted mixtures of only a few species, to trees planted in hedges or on boundaries with differing levels of human management of the various components (Dawson et al., 2013).

As natural vegetation is cleared for agriculture and other types of development, the benefits that trees provide are best sustained by integrating trees into agriculturally productive landscapes, agro-forestry. Agro-forestry focuses on the wide range of working trees grown on farms and in rural landscapes (McCabe, 2013). The trees which are available on farmer's fields are either isolated or exist in scattered manner as remnants of natural forest and naturally regenerated plants. These trees are part of agro-forestry systems that the farmers manage to obtain a wide array of agro-ecosystem services (FAO 2000; Kleinn 2000). Farmers intentionally introduce trees with multipurpose values to obtain a range of benefits from scarcely available land (McCabe, 2013). Indigenous trees from a mosaic agricultural landscape provide the four major ecosystem services such as; provisioning, regulating, cultural and supporting services (Schreckenberg et al, 2016; Roothaert and Franzel, 2001; Sinclair 2001).

Trees are an integral part of land resources that need careful management for sustainable utilization (Tukur et al., 2013). Farmers commonly apply different management types to trees they commonly grow depending on the aim they brought them to agricultural lands. The variation in tree management is emanated from the level/intensity of tree interaction with crops, tree structure such as branching behavior. As the main aim of agricultural land is to grow crops and obtain yield, tree management is commonly designed; to minimize competition but also prune the lower branches of trees to reduce shade, taking care not to affect tree development (Kowal 2000; Barranceet al., 2003).

AGP-II (2016) report stated that there is lack of forest management or silvicultural practices of indigenous tree species, management on newly regenerated seedlings and positive attitude on tree growing. Lack of positive attitude on tree growing needs detail studies on what makes them against tree growing, in which practices and mostly on which trees are also important points to be considered.

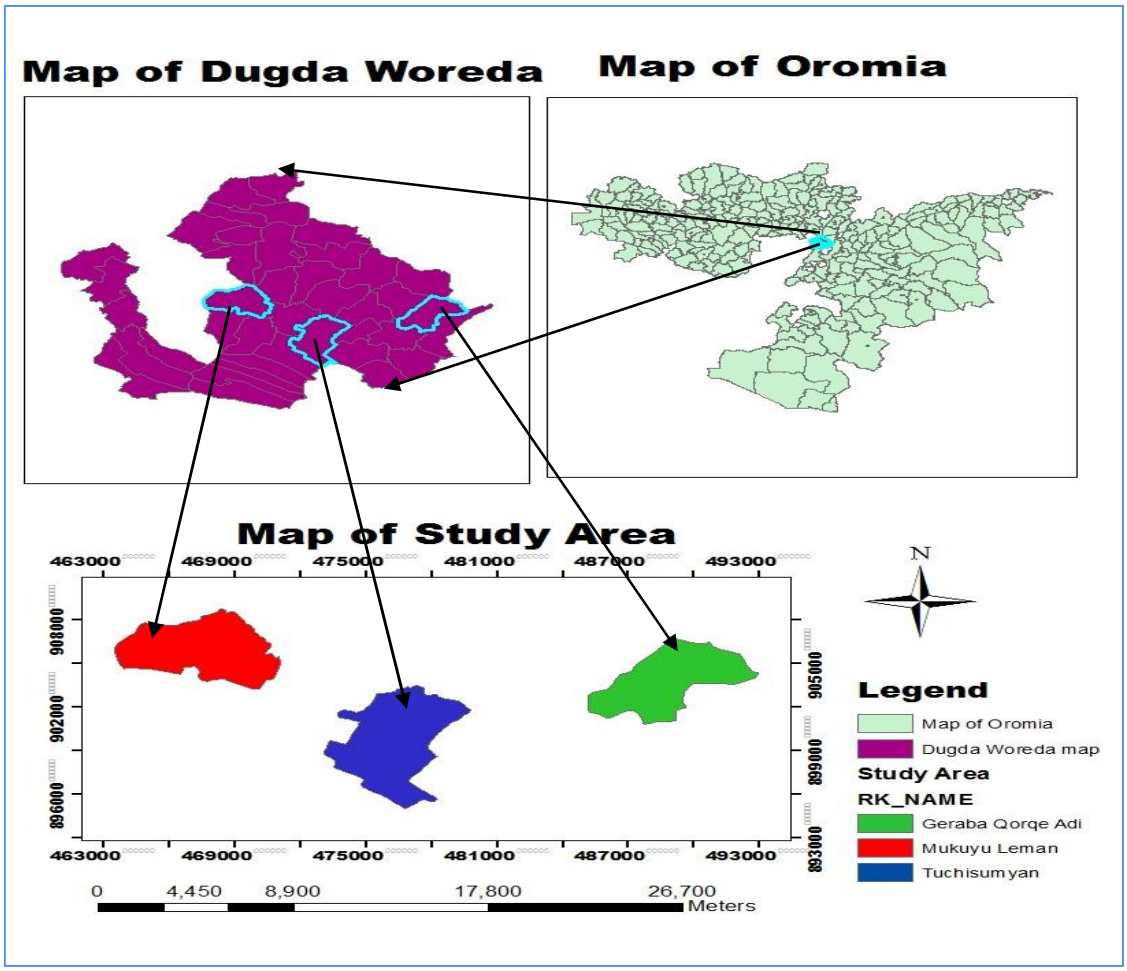
It is likely that the most important tree species will suffer the greatest harvesting pressure from local communities (Buyinza et al., 2015) and also some slow growing species and those that are lowly valued by farmers are declining in abundance (Kyarikunda et al., 2017). Over utilization of these trees and management practices that are not supporting their maintenance results in low performance to elimination of these trees which leads to ecosystem unfriendly bare agricultural lands.

There was also limited information exist regarding indigenous trees management and sustainability in the study area and similar environments. Accordingly, generation of information and recommending important management mechanisms and practices for the reproductive and regenerative capacities of priority species that allow natural or artificial regeneration is important to ensure that populations have a long-term future (Young et al. 1996; Heywood and Stuart 1992; Saunders et al. 1991). These all helps improve the management of the trees in the areas and gives information if there are some negative attitudes to be worked on. Continuous and appropriate management practices make these native trees to be conserved and continue growth in their environment.

Therefore, the objectives of the study were to assess and evaluate existing silvicultural managements rendering for the trees in the area, and assess management practices of natural regeneration and identify farmers use preference of the trees in the area and rank importance of these indigenous tree species based on their uses.

MATERIALS AND METHODS

Description of the Study Area



Dugda District is located at distance of 132km from Addis Ababa along the main road that leads through Modjo to Hawassa. The population of the district is 163, 099 (CSA, 2012).

Figure 1: Location map of the study area

Altitude ranges from 1600 to 2020 meters above sea level (Spielman et al., 2011). The mean annual temperature was about 22.80C, while mean annual rainfall was 750 mm (DWAO, 2015).
Land use: cultivated land (65.25%), forest (8.32%), pasture (3.55%), water bodies (12.54%), swampy and rocky mountain areas (0.31%) and 10.03% others and, the dominant types of crops are maize, wheat and teff (DWAO, 2015).
Vegetation and soil: Acacia tortilis, Balanitesaegyptiaca, Acacia seyal, Cordiaafricana, Faidherbiaalbida, Croton macrostachyus are dominantly found (OARI/AGP-II, 2016 please check the right reference). The soil textural class is clay loam (41%) and sandy loam (59%) (DWAO, 2015).

Practice Selection

Characterization of existing agro-forestry practices of the area is important before taking any action. Agro-forestry practices of the area were characterized based on the type of components and management practices being given. Methods used for characterization were field observation and key informants' interview. Based on the above criteria the agro-forestry practices of the area included:

1) Isolated trees on farm land: Mixed tree species at some places and Acacia tortilis was the dominant at most.
2) Parkland agro-forestry practice: Low to high dense of tree species and mixed tree species mostly. Faidherbia was the dominant at some places.
3) Patches of tree woodland

Characteristics

Silvo-pastoral - direct interference of livestock in-to the woodland during dry season times, cut and carry system and Entomoforestry - Production of honey also exists here. Trees are naturally established/regeneration and some are under enrichment at the border with mixed species of woodlot.

Management

Management practices were under cooperative, church (Orthodox) and communal. Huxley (1999) categorized managed tree plots as one of agro-forestry practices and put some specific types as fodder banks using woody species, fuel wood lots, mixed orchards (especially several products, e.g., fruits and honey).

4) Other practices: Livestock with trees on some open areas and buffer zone around lake with mix of different species (from grass to woody shrubs) mostly with animals.

Finally, practices important for the study objectives were purposively selected. These were parkland agro-forestry practice, patches of tree woodland which were the dominant practices contributing to the livelihoods of the community. Tree management was applied where trees were available.

Site Selection

Sites/kebeles which had two dominant practices were purposively selected. The kebeles were GirabaQorkeAdi (945 households), TuchiSumayan (524 households) and MukiyeLaman (467 households) (Dugda District Agriculture and NR Office, 2018).

Household Survey

Key informant interview was conducted before household interview to develop necessary variables. Households were randomly selected for interview from the selected kebeles. 5% of the population of selected kebeles (total of 100 HH) was interviewed to obtain trees utilization and management aspects information data. SPSS statistical package (Version 20) was used for variables analyses.

Species use ranking

Use value index technique was used to rank and prioritize the most important trees (Phillips and Gentry, 1993).
$UV = \Sigma Ui/n$

Where Ui is the number of uses mentioned by each respondent for a given species, n is the total number of respondents. The species was then ranked based on the overall use value.

RESULTS AND DISCUSSION

Socio economic description of farm households

The respondents' sex category of the area was male 73% and female 27%. Their education status included illiterate (37%), read & write (13%), elementary education (44%) and high school education (6%). This shows that the education status of the households is not as such as obstacle for required extension message. Average size of household was 7 persons with minimum 1 person and maximum 16 persons. Average number of trees recorded on plots (40x40 m) taken from farmer field was 6, with maximum 9 and minimum 3. When converted to hectare basis on average 38 trees per hectare, while 56 and 19 maximum and minimum trees per hectare, respectively.

Table 1. Farm land holdings of the area

Categories of land owned	Percent
< 1 ha	39
1 up to < 2 ha	19
2 up to < 3 ha	27
3 up to < 4 ha	10
≥ 4 ha	3

Trees utilization

A total of 18 woody species uses were recorded during key informant's interview as below,

1. Shade
2. Fodder
3. Fence
4. Charcoal
5. Farm implements
6. House materials
7. Firewood
8. Cultural value
9. Medicinal
10. Rope (temporary)
11. Tooth brush
12. Smoke (for house and equipment's like milk and local beer)
13. Edible (fruits)
14. Cleaner (during crop threshing)
15. Construction purposes (lumber, split wood and direct uses)
16. House utensils
17. Moisture conservation
18. Fertility improvement

Fruits of trees mostly not edible by humans are used as fodder for animals. Most of the species met these services raised by the respondents included Acacia albida, Cordiaafricana, Acacia tortilis, Balanitesaegyptiaca, Erythrinabrucei and Ziziphnusspina-christi. Other species also could give this service.

Farmers' species use preference and ranking

Table 2. Farmers tree species use preference

Tree species	Uses (from high to low)
Acacia abyssinica (Laaftoo)	Fence; Charcoal; Shade; Firewood, Fodder and House tool; Farm implement and Lumber
Acacia albida (Garbii)	Fence; Firewood; Shade; Fodder; House tools; Lumber; Charcoal; Farm implements; Split wood (House construction); Moisture conservation and Local rope
Acacia nilotica (Burquqqee)	Shade; Firewood, Fence and Farm implement; Fodder and Charcoal
Acacia negrii(Doddota)	FirewoodandFence;Charcoal;HouseConstruction(asSplit wood);FodderandShade;Lumber;Housetools;Medicinal; Farm implement
Acacia senegal/Acacia asak (Saphansa)	Fence; Firewood; Charcoal and Fodder; Shade; House construction (as Split wood)
Acacia seyal (Waaccuu)	FenceandFirewood;Charcoal;Fodder;Farmimplement; ShadeandMedicinal;HouseConstruction(asSplitwood)
Acacia tortilis (Dhaddacha)	Fence;Firewood;Shade;Charcoal;Fodder;Housetools; Farmimplement;Splitwood;Lumber;Culturalvalue; Medicinal value; Localrope
Acokantheraschimperi (Qaraaruu)	Shade;FirewoodandFodder;Fence;Charcoal,Medicinaland Farm implement
Balanitesaegyptiaca (Baddannoo)	Firewood and fence; Shade; Fodder; Charcoal; House tools; Farm implement
Capparistomentosa (Arangama)	Fence; Firewood, Split wood and Fodder; Charcoal
Celtic africana (Ceekaa)	Firewood; Charcoal, Shade, Fodder, Medicinal, Farm implement, Lumber, House Construction (Direct use) and Fence (as Split wood)
Cordiaafricana (Waddeessa)	Lumber; House tools and Shade; Firewood; Fence; Farm implement; Fodder; Firewood
Croton macrostachyus (Bakkanniisa)	Lumber; Firewood; House tools; Fence and Shade; Farm implement; Medicinal; Charcoal; Local rope
Dichrostachyscineria (Jirimee/ Haxxee)	Fence; Firewood and Fodder; Charcoal; Shade
Dodonaeaviscosa (Itacha)	Charcoal, Firewood, Farm implement and House tools
Ehretiacymosa(Ulaagaa)	Farm implement; Firewood; Shade and Fence; Charcoal
Erythrinaabyssinica (Walensu)	Fence, Farm implement, Fodder and House tools
Ficussycomorus (Odaa)	Shade, Farm implement, Cultural value (Boku tree) and Lumber
Ficusvasta (Qilxu)	Shade, Farm implement and House tool
Grewiabicolour (Harooressa)	Firewood, Fodder and Farm implement; Charcoal, Medicinal and Fence
Juniperusprocera (Gaattiraa)	Lumber and House tools; Farm implement
Maytenusarbutifolia (Kombolcha)	Fence; Firewood; Charcoal; Fodder, Shade, Split wood, and House construction
Oleaeuropaea (Ejersa)	Smoke (for materials); Farm implement; Firewood; House tools; Charcoal and Lumber; Fodder, Shade, Medicinal, Fence, Local rope, and Cultural value
Podocarpusfalcatus (Birbirsa)	Lumber, House tools and Farm implement
Rhus vulgaris (Daboobessaa)	Farm implement; Charcoal, Firewood, Fodder and Shade
Ziziphusspina-christi(Qurqura)	Firewood; Fodder; Farm implement; Shade and House tool; Charcoal and Fence; Lumber; House Construction (as Spilit wood)

The uses recorded above are almost in line with what MeseleNegash (2007) reported on livelihood contribution of trees for farmers.

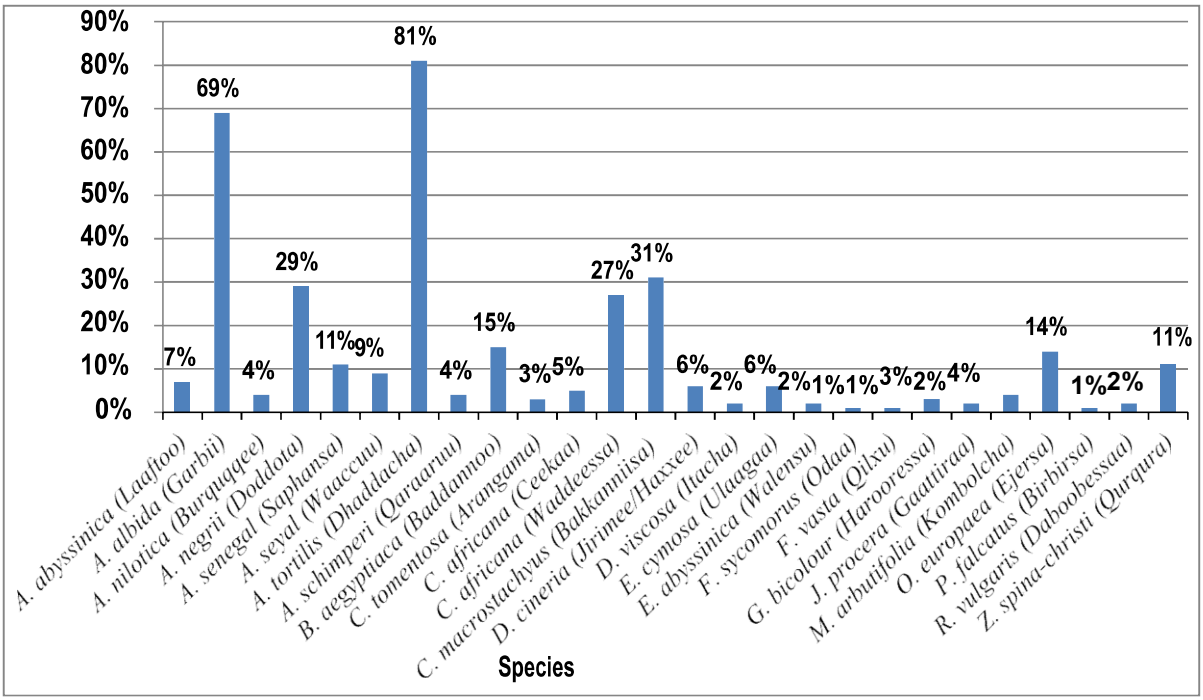


Figure 2. Frequency of respondents on tree species preferred uses

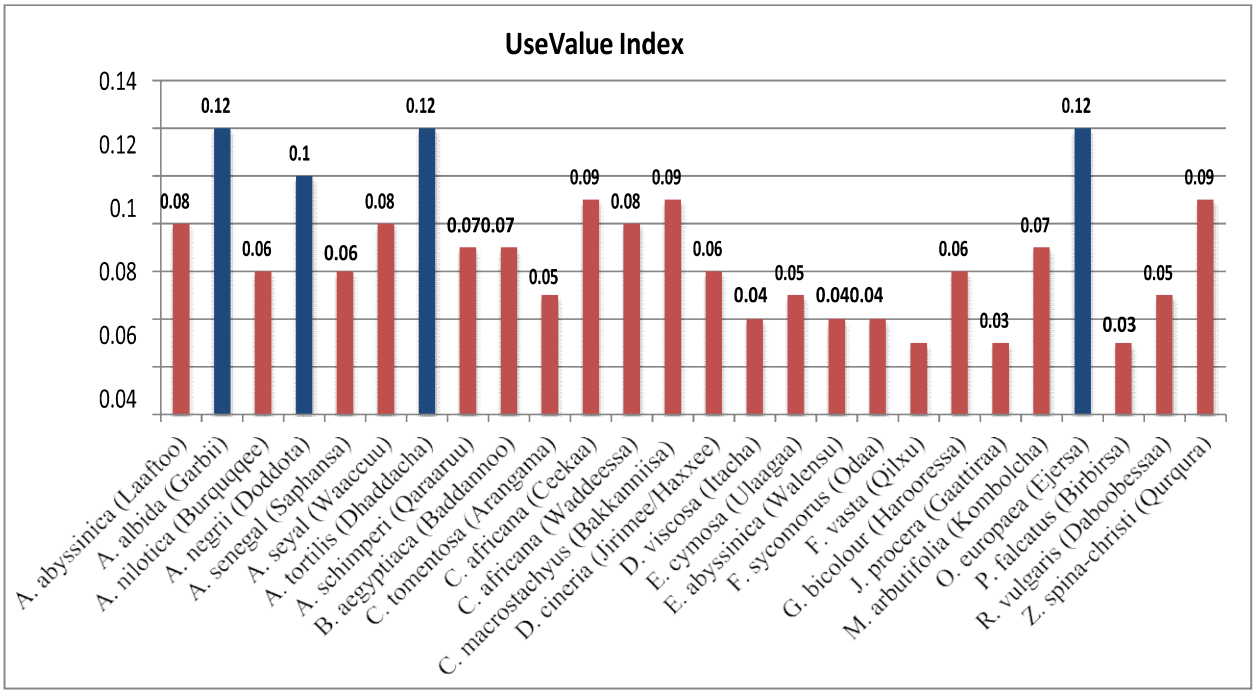


Figure 3. Species use value index

Based on species use value index above, the species use ranking are as follows,

Table 3. Species use ranking

Tree species	Rank	Tree species	Rank
A. abyssinica (Laaftoo)	5	*D. cineria (Jirimee/Haxxee)*	9
A. albida (Garbii)	1	*D. viscosa (Itacha)*	13
A. nilotica(Burquqqee)	9	*E. cymosa (Ulaagaa)*	11
A. negrii (Doddota)	1	*E. abyssinica (Walensu)*	13
A. senegal (Saphansa)	9	*F. sycomorus(Odaa)*	13
A. seyal (Waaccuu)	3	*F. vasta (Qilxu)*	15
A. tortilis (Dhaddacha)	1	*G. bicolour (Harooressa)*	9
A. schimperi (Qaraaruu)	5	*J. procera (Gaattiraa)*	15
B. aegyptiaca (Baddannoo)	7	*M.arbutifolia(Kombolcha)*	7
C. tomentosa(Arangama)	9	*O. europaea(Ejersa)*	1
C. africana (Ceekaa)	3	*P. falcatus(Birbirsa)*	15
C. africana(Waddeessa)	3	*R. vulgaris (Daboobessaa)*	11
C. macrostachyus (Bakkanniisa)	3	*Z. spina-christi (Qurqura)*	2

Ranking gave information for the priority trees to be conserved and worked on to make utilization ease of access. But this is not to mean that all valuable and important trees have completely included here. The preferred species use frequently rose by the respondents did not mean that the species got first use rank based on the species use value index. Croton macrostachyus (Bakkanniisa) didn't get first use rank compared to Acacia negrii (Doddota); however, its uses got high frequency of respondents (Figures 1 & 2).

Silvicultural Management Parkland agro-forestry practice

Pruning

From the total respondents, 63% pruned lower tree branches, while only 10% pruned both lower and middle tree branches at the same time. The reason for pruning included; fencing (55%), fuelwood (13%), to support growth of upper branches (10%), to make cultivation easy for short trees (25%), firewood (37%), house construction(3%) and to reduce shade effect on crops (29%). Pruning frequency of tree species is described in Table 4.

Table 4. Frequency of pruning per tree species

Species	Frequency of pruning
Acacia albida(Garbii)	Oneyear(17%),Twoyear(23%),Threeyear(1%),Five year (2 %)
Acacia abyssinica(Laaftoo)	One year (4 %), Two year (2 %)
Acacia negrii (Doddota)	One year (8 %), Two year (8 %), Three year (5 %)
Balanitesaegyptiaca(Baddannoo)	Oneyear(4%),Twoyear(4%),Threeyear(2%),Fouryear (1 %)
Croton macrostachyus(Bakkanniisa)	Oneyear(8%),Twoyear(6%),Atanytimeofimportance(1 %)
Cordiaafricana (Waddeessa)	One year (4 %), Two year (4 %)
Acacia tortilis (Dhaddacha)	Oneyear(18%),Twoyear(21%),Threeyear(4%),Fiveyear (1%)
Acacia senegal (Saphansa)	Two year (4 %), Three year (2 %)
Dichrostachyscineria(Jirimee/Haxxee)	One year (1 %), Three year (1 %)
Zizphusspina-christi(Qurqura)	One year (1 %), Two year (3 %)

Table 4.continues

Acokantheraschimperi(Qaraaruu)	One year (1 %), Two year (1 %)
Acacia seyal(Waaccuu)	One year (2 %), Two year (1 %)

Table 5. Pruning season of tree species

Pruning season	Percent
During cropping phase	16
During crop harvest	16
After crop harvest	11
Onsetofcroppingorrainyseason	38
At any season of importance	6

Pollarding

About 87 % of the respondents pollarded trees on their farm land. The purpose of total branch removal (pollarding) included; for fencing (80 %), to reduce light competition (shade effect) on underlying crops (79 %), weakens the development of lower tree branches (32 %), disease incidence (3 %), firewood (61 %), fuelwood (19 %), charcoal (4 %), construction purpose (10 %) and to obtain new flash of branches(4 %).

As to farmers knowledge if the objective was new flash of branches or sprout of branches, total branch removal was important otherwise there were different biophysical impacts of upper branch on the remaining bottom branches.

Table 6. Pollarding season of tree species

Pollarding season	Percent
During cropping phase	6
During crop harvest	40
After crop harvest	9
Onsetofcroppingorrainyseason	62
At any season of importance	6

The way of applying pollarding was that few farmers pollarded all trees at the same time (13 %), while the majority of them (74 %) applied through shifting or not pollarding all trees at the same time. The reason behind pollard shifting was that no trend of applying pollard on trees with less and immature branch biomass (21 %), to get sustainable branch biomass production (16 %) for different wood services, or both (37 %).

Table 8. Frequency of pollarding tree species

Species	Frequency of pollarding
Acacia albida (Garbii)	Oneyear(21%),Twoyear(39%),Threeyear(11%),Four year(1%),Fiveyear(2%),Atanytimeofimportance(1%)
Acacia abyssinica (Laaftoo)	One year (4 %), Two year (2 %), Three year (3 %),
Acacia negrii (Doddota)	One year (2 %), Two year (8 %), Three year (9 %)
Balanitesaegyptiaca (Baddannoo)	Two year (6 %), Three year (6 %), Four year (1 %)
Croton macrostachyus (Bakkanniisa)	One year (7 %), Two year (10 %)
Cordiaafricana (Waddeessa)	Oneyear(21%),Twoyear(39%),Threeyear(1%),Five year (1 %)
Acacia tortilis (Dhaddacha)	Oneyear(12%),Twoyear(38%),Threeyear(18%),Four year(1%),Fiveyear(1%),Atanytimeofimportance(1%)
Acacia senegal (Saphansa)	Two year (6 %), Three year (5 %)
Dichrostachyscineria (Jirimee/Haxxee)	Three year (1 %)

Table 8.continues

Z. spina-christi (Qurqura)	Two year (4 %), Three year (1 %)
Acokantheraschimperi (Qaraaruu)	Two year (1 %)
Acacia seyal	Two year (4 %), Five year (1 %)
(Waaccuu)	
Erythrinaabyssinica (Walensu)	Five year (1 %)

Note: Pollarding is practiced at any time of importance, mostly when branches mature for the desired objective of utilization.

Table 7. Over all pollarding frequency of trees species in the areas

Pollarding frequency	Percent
One year	33
Two year	61
Three year	27
Four year	1
Five year	7

Total tree removal

About 26 % of the respondents applied total tree removal. Purpose of total tree removal included; to avoid shade effect on underlying crop (9 %), to avoid disease incidence (4 %), removal for different uses (12 %), removal only when dried (3 %), for charcoal (1 %) and removal when became barrier for ploughing (2 %).

Regenerations management

The ways farmers establish trees on their farm lands were almost fully (99 %) through natural regeneration. Mesele (2007) also reported farmers used natural regeneration for tree seedlings. This finding is also in line with FAO (2000) and Kleinn (2000) reporting. 81 % of the respondents observed regeneration of new seedlings on their farm, while 19 % not. Regeneration was grown as group of seedlings (39 %), single growth (28 %) and both (13 %). For groups of seedlings grown together or bunch of seedlings, 46 % of them operated thinning for continual growth of one stand, 1 % transplant inside other part of farm land, 3 % transplant on the boarder of farmland, and 8 % removed at all. For single grown regeneration, 29 % managed as it was for continual growth, 7 % transplanted inside other part of farmland, 2 % transplanted on the border of farmland and 10 % removed at all. The majority of the respondents, 60 % had no knowledge of transplanting, while 36 % had knowledge. Based on these results, only 26 % of the respondents transplanted new regeneration yet while 68 % did not. For those transplanted regenerated seedlings, 20 % responded successful seedlings.

Disease and pest management

From total farmers, 52 % saw disease and pest incidence, while 46 % did not see on trees in their farmlands. Symptoms that made farmers consider disease occurrence were leaf color change (26%), leaf and branch death (12 %), total tree dying (23 %), fruit pod blackness (1%) and pest incidence (3%). They also argued pest incidence happened when trees cut off during rainy season. So they were careful in cutting trees during rainy time.

Table 9. Age of trees when susceptible to disease

Age category	Age of trees susceptible to disease (%)	Age of trees withstand disease (%)
Up to 5 year	16	11
Above 5 year	8	11
Up to 7 year	1	6
Above 7 year	16	9
Up to 1 year	2	2

Table 9.continues

Above 1 year	1	1
Up to 3 year	1	
Above 3 year		1
All age	2	2.
Not know	12	16

This is to show farmers knowledge and assumption on how they detect and manage diseases on trees on their farmland. However, they assured that in the occurrence of disease incidence, the situation is not as much serious among them. The ages they assumed trees were susceptible and withstand disease were varied among respondents.

Communal tree woodland practice

The purpose of managing the communal woodland as a general included income from dried trees/for fire wood (35 %) and grass through cut and carrying for house construction and livestock feed (100 %) as well as grazing during dry season by renting limited area with low cost (100 %). The income obtained from it supported the protection of woodland from illegal harvest and animal browsing. Total removal of dried trees was also a common practice almost in all woodlands. Over all there was no replacement planting (35 %) for tree removed from the practice, but, removing the live tree was prohibited. Environmental purpose/good climate especially attracting rainfall (32 %), branches for firewood and house construction during ceremonies/wedding and funerals (40 %), honey production (12 %) and Habitat for wild animals (39 %) were also some of the purposes of managing woodland. FAO (2010) confirmed the biological and socio-economic importance of woodlands in African dry lands. Bluffstone et al. (2007) also reported that in rural areas of low-income developing countries such kind of natural resources benefited households for fuels, animal feed, building materials, fruits and medicines.

From total respondents, 72 % confirmed as the protection have been applied to the practice. Biological soil and water conservation (70 %) with some exotic and few native trees (13 %) was also one of the management practices being given in some woodland, while in most cases with only exotic trees (59 %). Other kinds of management being given to the practice included, protection from animals (100 %), protection from harvest (87 %) and enrichment planting (5 %) mostly at the borders.

Pollarding (40 %) was one of the silvicultural management practices applied on some tree woodlands. It was applied mostly during different ceremonies (funeral, wedding, etc.) to get wood products. Permission from public leaders was a must for any activities undertaken in the woodlands.

CONCLUSIONS AND RECOMMENDATIONS

CONCLUSIONS

The benefits communities are obtaining from native-woody species are not undermined. However, the area is known for its wood shortage mostly for energy purpose, Parkland agro-forestry is the most common practice accessing community with different wood uses.

In parkland practice farmers manage trees based on the benefit they obtain from them. Except few of them established trees through both natural and artificial planting, tree establishment at the area was at most through natural regeneration. Pollarding was the most tree management operation under use compared to pruning and total tree removal. The pollarding frequency of the trees was at most every two years. It rewarded farmers with enough amount of biomass for different uses or wood services. Mostly in the area any pollarding or pruning was after crop harvest or at the onset of cropping/rainy season. Some winter months closer to arfasa got rains. Conducting it at the onset of cropping season was for crops, field fencing and reducing competition between trees and crops while after crop harvest was mostly for fencing crop residue.

The purposes of management of woodland were the same among kebeles unless some differences were found regarding the management practices. Woodland mostly served community for environmental purposes while also conserving biodiversity. Whether the management was under cooperatives, church or public there was at least one tree woodland practice in kebeles which had a prominent role for sustainable agro- ecosystem and related services. The management of woodlands was different between kebeles. There was a huge livestock intervention to the practice which communities were considering as managed and protected, i.e., woodland. The multiple uses obtained from it for the community was positive until it had not hurt the current and future vegetation habitat.

Total removal of live tree was a prohibited act in both practices and no substitute for a single tree use.

RECOMMENDATIONS

Most of the trees preferred by farmers were not easily available around their locality which needed future intervention through in-situ conservation. The patch of tree woodlands was a good option for re-planting those trees in the area and increase community use from it.

Tree planting on individual land holdings could be based on farmer's preference under different management and utilization regimes. It could be arranged as trees in cropland (mostly as parkland practice), as boundary planting and/or by planting as woodlot on parcel of land adjacent to crop fields.

Technical solutions like agro-forestry component arrangement are important for increasing advantages obtain from those trees on crop lands. Farmer's tree compatibility selection with crops especially in practices like tree intercropping or integration should also take into account. Research and development intervention through extension advices and provision of materials increases the quantity and quality of honey production (api-forestry) in woodland. For current woodland practice, silvicultural management practices are important to increase trees ability of standing against changing climatic environment. Communal tree woodland practice should be scaled up to other areas at least one per kebele where there is open communal land. It has no easy role in overall biophysical resources enhancement in the area including biodiversity development and conservation. Working on individual household based woodlot mostly composed of native trees (mixed species woodlot) can alleviate the problem of wood energy in such area while saving the environment.

Finally, to the area and other farmland practices, tree management and utilization policy should be encouraged at local level; because, at every locality there have been different management and utilization practices. Farmlands should not stay bare and for every cutting there should be a replacement planting.

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