

## Ecological and Socio-Economic Importance of Indigenous Multipurpose Fodder Trees in Three Districts of Wolayta Zone, Southern Ethiopia

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### Abstract

Indigenous multipurpose fodder trees have important social, economic and ecological functions such as controlling erosion, contribute to human quality of life, provide sinks for carbon dioxide and methane at the interface between the decaying fallen leaves and the soil and are a source of biodiversity. In this study, we assess ecological and socio-economic importance of the indigenous multi-purpose fodder tree (MPFT) species in three districts of Wolayta Zone of Southern Nations Nationalities and Peoples Regional State. Structured questionnaires were distributed to 270 respondents. The results indicated that indigenous MPFTs have important social, economic and ecological functions, such as food supply, shade, traditional medicines, and the preservation of milk, animal nutrition, social values and household income. For animal feeding, vegetation was cut, especially leaves, young tips, twigs and fruits. About 70% of the respondents were unaware of the benefits of the MPFTs. It is concluded that the indigenous MPFT have a strong social and ecological value, and a source of income supplementation.

**Keywords** Ecological; Social; Economic; Resources; Indigenous; Fodder tree; Traditional medicinal value

### Materials and Methods

#### Study location

The study was conducted in three districts of Wolayta Zone, Southern Nation Nationalities Regional State (Figures 1 and 2). The three districts were selected based on the potential of livestock production and were in different altitudinal ranges. The districts were Sodo Zuria (highland), Damot Woyde (mid altitude) and Humbo district (lowland) and were located at 330 km, 356 km and 347 km South of capital city, Addis Ababa, and at altitude between of 1950-2400, 1400-1750 and 750-1100 meters above sea level, respectively. Throughout this region, there are 8 to 10 months of variable rainfall and the main rainy season extends from May to September, with a shorter rainy season from February to April [11].

The Sodo Zuria is located approximately at 6°50'N-7°53'N and 37°36'E-37°53'E, Damot Woyde is located approximately at 6°43'N-7°03'N and 37°28'E-37°43'E and Humbo districts is located approximately at 6°34'N and 37°43'E latitude and longitude, respectively. The soil types of the three districts were vertisol and nitosol. The annual maximum rainfall of the study districts are 1300 mm, 1100 mm and 900 mm and the minimum rainfall are 1150 mm, 1000 mm, and 650 mm for Sodo Zuria, Damote Woyde and Humbo districts, respectively. Temperature range 13-26°C, 17-24°C and 18-30°C for Sodo Zuria, Damote Woyde and Humbo districts, respectively [12].

The agricultural production and land use systems are dominantly mixed crop-livestock farming system. Crops and livestock husbandry are common practices in the three districts where an extensive livestock production mainly depend on free grazing and cut and carry (in-door/out-door stall) feeding systems. Pastures and hay from hedgerows, pastureland, crop residues and crop left over on farm land, agro-industrial by-products like furishika and furishikelo, false banana

### Introduction

The social, economic and ecological functions of indigenous multipurpose fodder tree resources are important for human quality of life, national economic support, household income and environmental protection [1]. Multipurpose fodder trees (MPFTs) are woody perennials grown for several functions (for example, shelter, shade, land sustainability) within the land-use system [2]. Multipurpose fodder trees are also important for erosion control, carbon dioxide and methane sinks and biodiversity [3,4].

Indigenous MPFTs are grown as part of the farming system. Although most of the indigenous fodder tree species are not primarily grown for fodder but for other purposes, they are readily available for livestock feed.

Several studies on multi-purpose fodder trees (MPFTs) have been conducted in different parts of Ethiopia [5-10]. However, most deal with introduced or exotic fodder tree species and very little information is available on the socio-economic values of indigenous MPFTs, despite their importance as resources. It is, therefore, imperative to characterize and assess the socio economic values of the indigenous MPFTs in order to design management options for long term sustainable use in Wolayta zone and in areas with similar agro-ecologies. Therefore, the objective of this study was to assess ecological and socio-economic importance of the indigenous multipurpose tree species in the study districts.

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Subsistence production and rain fed agriculture are the main livelihood activities. The main economic sources for the districts were sale from crops, animals, animal products and off-farm activities like working around town, construction labourers, merchants and employed in government and non-governmental organizations (NGOs).

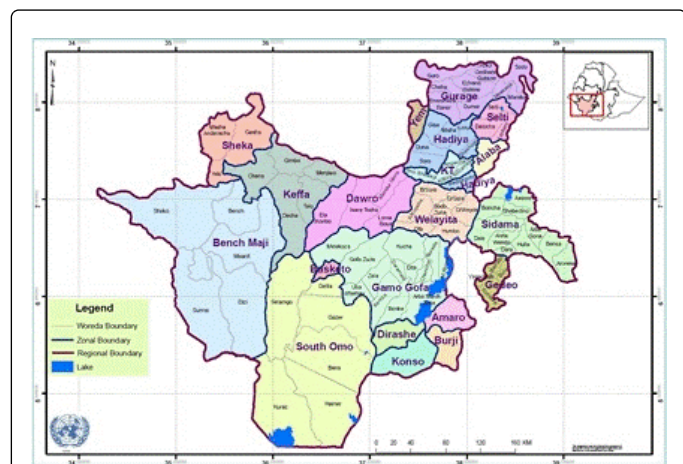


Figure 1: Map of Southern Nations and Nationalities Regional state (source: UN)

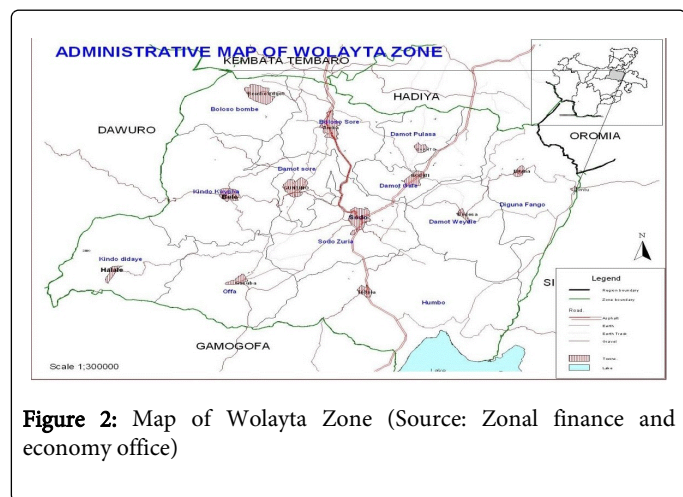


Figure 2: Map of Wolayta Zone (Source: Zonal finance and economy office)

**Socio-economic survey**

Nine kebeles (3 from each districts), and a total of 270 households (HHs) from the three districts were selected based on the availability of indigenous MPFTs for socio-economic values, and the utilization of these species for livestock feeding and livestock ownership. The HHs was used to collect the survey data. The socio economic survey was collected following the participatory rapid appraisal (PRA) procedure using questionnaire and interviews.

**Identification and selection of indigenous multipurpose trees**

Households were asked to identify and rank the different multipurpose trees (MPFTs) on the basis of their utilization as animal feed, fodder tree availability and other benefits. Based on their rank, the top five MPFTs were selected to investigate their social, economic and ecological importance. Data collected included HH structure, income source for households, uses and socio-economic importance of multipurpose fodder trees, utilization practices for multipurpose fodder trees, perceptions of people towards fodder trees, attitude and skill of utilization, their knowledge gap toward indigenous multipurpose fodder trees for multiple use strategies.

**Statistical analysis**

The socio economic survey data was analysed using descriptive statistics by the SPSS software [13].

**Results**

**Identification and selection of indigenous multipurpose trees**

The respondents include people of all age groups using indigenous multipurpose fodder trees for different socio economic uses. Respondents revealed that the indigenous MPFTs were used it ameliorate food scarcity during the annual dry season. Based on the interview result, 28 indigenous MPFT species were identified in the area (Table 1). The MPFT foliagees were good for fodder to reduce the food shortage and contribute to better animal productivity.

Scientific name	Family Name	Local (Wolaytegna)	Name
<i>Acanthus pubescens</i> (Oliv.) Engl.	Acanthaceae	Ohaa	
<i>Buddleja polystachya</i> Fresen	Loganiaceae	Shinkaa	
<i>Celtis africana</i> Burm. f	Ulmaceae	Shuwaa	
<i>Clausena anisata</i> (Willd.) Benth.	Rutaceae	Ciqottiyaa	
<i>Clutia lanceolata</i> Forssk	Euphorbiaceae	Higishsha meruwaa	
<i>Combretum molle</i> R. Br. ex G. Don	Combretaceae	Sobbuwaa	
<i>Erythrina brucei</i> Schwein	Fabaceae	Bortuwaa	
<i>Grewia ferruginea</i> Hochst.exA. Rich.	Tiliaceae	Gumariyaa	
<i>Ficus thonningii</i> Blume	Moraceae	Dambiyaa	
<i>Maytenus serrata</i> (A.Rich.) Wilczek	Celastraceae	Gershshuwaa	
<i>Maytenus</i> sp.	Celastraceae	Xuxuwaa	
<i>Maesa lanceolata</i> Forssk.	Myrsinaceae	Gergecuwaa	
<i>Millettia ferruginea</i> (Hochst.) Bak.	Fabaceae	Botta zagiyya	
<i>Nuxia congesta</i> R.Br. ex Fresen	Loganiaceae	Woraa shinkaa	
<i>Olea europaea</i> L.subsp.			

Cuspidate (Wall.ex G.Don) Cif	Oleaceae	Wogera
Pavetta oliveriana	Rubiaceae	Kana miqiyaa
Rhus glutinosa	Anacardiaceae	Xamuwaa
Rhus vulgaris Meikle	Anacardiaceae	Micekkuwaa
Rytigynia neglecta (Hiem) Robyns	Rubiaceae	Miqiyaa
Vangueria apiculata K. Schum.	Rubiaceae	Jijjuwaa
Vernonia adoensis Sch. Bip. ex Walp.	Asteraceae	Kanaa Hamakka
Vernonia amygdalina Del.	Asteraceae	Garaa
Vernonia sp.	Asteraceae	Yemenuwaa
Schrebera alata (Hochst.) Welw.	Oleaceae	Qaraa
Terminalia schimperiana Hochst.	Combretaceae	Ambiyaa

**Table 1:** List of identified multipurpose trees indigenous species commonly found collected from three study districts.

### Social and economic values of indigenous fodder trees

About 74% of the respondents of the three districts noted that the identified indigenous MPFTs are used for shade for animals and humans, while about 18% of the respondents said that the fodder trees are used to treat animal diseases. MPFTs also provide social acceptance for the owners in social meetings by serving as a shaded meeting place. In some districts, farmers use trees and shrubs to preserve livestock products such as milk. Wood from some species of trees was used to smoke milk, which increased both the preservation and flavour of the milk.

Scientific name	% of respondents (%)	Rank	Form of sale*_
C.molle	73.3	11	2
C.africana	91.8	1	1, 2
D.abysinnica	65.5	5	2
E.cymosa.	76.3	6	2
E.brucei	82.6	2	1, 2
F. thonningii	68.5	7	1, 2
M. ferruginea	78.2	8	1, 2
O.cuspidata	80.7	3	2
V.amygdalina	70	4	2
T.schimperiana	79.6	9	1, 2

**Table 2:** List of identified marketable indigenous fodder trees of the three districts (\*1 = timber; 2=whole sale)

Scientific name	Season of Maximum uses	Types of animal	Benefit expected
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In addition, sale of wood, fruits and other tree products bring economic benefits for local people (Table 2) and provide an opportunity to enhance household incomes in the study districts. The analysis result showed that 93.7% of respondents in the three districts use MPFTs as an income source. Income is generated from sale of whole trees or after processing. Timber production (e.g., *C. africana*) is particularly important to resource poor farmers for basic income.

The fruit of *O. cuspidata* is also used as raw materials for Zenith Cosmetics manufacturing industry in Addis Abeba, Ethiopia is known for production of Oliva Hair oil which is extra rich for dry hair.

### Utilization of indigenous multipurpose fodder trees for animal production

Indigenous MPFTs are used as supplementary feed for animal production, some being more valuable for this function than others, especially during the dry season, this believed to be important for livestock health and milk production. There are also some MPFTs that serve as medicinal value to treat certain ailments (Table 3). Data from this study revealed that out of 28 identified indigenous MPFTs, 23% were used for feed all year round, 27% were used from September to March, 10% were used from September to February, 17% were used from November to March, 13% were used from November to April, 3% were used from October to February, and 7% from November to February in three districts.

Utilization of indigenous MPFT species by animals depends on availability of fodder trees, selection by the animals, their effects after consumption and purposes to be obtained after consumption. Animals preferred some trees more than others. Among identified indigenous MPFTs, 33% were consumed by cattle, sheep and goats, 17% by cattle and goats, 13% by cattle and sheep, 23% by cattle only, and 13% were consumed by goats only. Regarding the benefit of indigenous MPFTs for animal production, about 17% were for both maintenance and to improve milk production, while 7% was for maintenance, improvement of milk production and traditional medicines, 13% was for both maintenance and traditional medicines, 43% for only maintenance, 17% for both maintenance and growth, and about 3% were for maintenance, growth and to improve milk production.

### Perception of Farmers toward Indigenous Multipurpose Fodder Trees

According to respondents of the study districts, indigenous MPFT species (Appendix Table 1) are believed to be nutritious and are important for livestock production in promoting not animal health but also growth and milk production. Butter-fat production in lactating animals and improvements in animal health were also mentioned by the respondents as good attributes of MPFTs. Indigenous MPFT species such as *V. amygdalina* and *E. cymosa* are believed to have traditional medicinal value and the leaves, tips and pods of such plants are ground mixed with Coffee arabica leaves and boiled and used as medicine to treat certain ailments.

<i>E. brucei</i>	All year round	Cattle, goat, sheep	Maintenance & milk production
<i>V. amygdalina</i>	All year round	Cattle, sheep goat	Maintenance, Milk production & Traditional medicine
<i>E. cymosa</i>	All year round	Cattle, Goat, Sheep	Maintenance, Milk production & Traditional medicine
<i>C. africana</i>	Sept. to Mar.	Cattle	Maintenance
<i>D. abyssinica.</i>	All year round	Cattle, Goat, sheep	Maintenance & Growth
<i>B. polystachya</i>	Sept. to Mar.	Cattle, Goat, sheep	Maintenance, Milk production
<i>G. ferruginea</i>	Sep. to Feb	Goat, Cattle, Sheep	Maintenance & milk production
<i>O. cuspidate</i>	Nov. to Apr.	Cattle, sheep & goat	Maintenance
<i>A. pubescens</i>	Nov. to Mar.	Goat	Maintenance
<i>F. thonningii</i>	Sept. to Mar.	Cattle, sheep & goat	Maintenance & traditional medicine
<i>T. schimperiana.</i>	Sept. to Mar.	Cattle, sheep & goat	Maintenance
<i>R. vulgaris</i>	All year round	Cattle & Goat	Maintenance, & milk production
<i>C. lanceolata</i>	Sept. to Feb.	Cattle	Maintenance & traditional medicine
<i>Vernonia sp.</i>	Nov. to Apr.	Cattle, sheep	Maintenance & traditional medicine
<i>S. alata</i>	Oct. to Feb	Cattle, sheep	Maintenance & Growth
<i>M. serrata</i>	Nov. to Feb.	Cattle	Maintenance
<i>V. adoensis</i>	Nov. to Apr.	Cattle	Maintenance & Traditional medicine
<i>Celtis Africana</i>	Sept. to Mar.	Cattle, sheep	Maintenance, Growth & Milk production
<i>M. ferruginea</i>	Nov. to Mar.	Cattle, sheep	Maintenance
<i>R. neglecta</i>	Nov. to Apr.	Goat, Cattle	Maintenance
<i>C. anisata</i>	Sept. to Mar.	Cattle, Goat	Maintenance, Growth
<i>V. apiculata</i>	All year round	Goat	Maintenance & Growth
<i>Maytenus sp.</i>	All year round	Goat	Maintenance, Growth
<i>N. congesta</i>	Sept. to Mar.	Cattle	Maintenance, Milk production
<i>M. lanceolata</i>	Nov. to Mar.	Cattle, Goat	Maintenance, Growth
<i>R. glutinosa</i>	Sept. to Feb.	Cattle	Maintenance
<i>P. oliveriana</i>	Nov. to Feb.	Goat, Cattle	Maintenance
<i>C. molle</i>	Nov. to Mar.	Cattle	Maintenance

**Table 3:** Utilization of indigenous multipurpose trees in the study districts

## Discussion

Indigenous multipurpose fodder tree resources can increase food supplies to supplement poor quality roughages, as the MPFTs are rich in CP, minerals and energy and can maintain their feeding value for extended period of time due to their deep root system [14-16]. This is supported by the findings of Komwihangilo et al. [17]. About 21.4% of identified indigenous MPFTs were used as honey bee forage. For example, the farmers use *O. cuspidata* trees leaves to smoke their traditional bee hives, thus attracting wild and foraging bees with its good smell (Appendix Table 2).

According to Abebe et al. [9] indigenous multipurpose trees provide many benefits including food, drink fruits, fuel wood, construction of hedges (fences), charcoal, furniture, resins or dyes, domestic uses or tools, honey from bees and also agro-ecological sustainability such as soil fertility, land improvement, erosion control and environmental air or atmosphere balance. They also serve as a storage material for grain (e.g. *E. brucei*, *O. cuspidata*). These social and livelihood benefits reinforce the importance of MPFTs in multiple use strategies. The research conducted in Southern part of Ethiopia [18] revealed that the sale of wild plants as fodder supplements contributes to farmer income sources.

The respondents revealed that indigenous MPFTs are miracle tree used as meeting under the tree shade, providing service like boundary demarcation or barrier. About 67% , 60% and 63% of respondents' in Sodo Zuria, Damot Woyde and Humbo district respectively, noted that indigenous MPFTs were used as social and cultural values relating to spiritual, aesthetic, symbolic, historical and primarily with the interaction and relationships among people these may be wide ranging and include for example belonging, status, friendship and identity (Appendix Table 1). The leaves of the most MPFT species are good sources of green roughage if free from or contain minimal anti-nutritional factors.

The edible parts of indigenous fodder trees are mostly leaves and in some species young tips, twigs and stem, fruit pods are consumed by animals. The dominance of leaves as part of MPFT used as feed has also been reported in previous studies [9,19-21]. About 70% of the respondents appeared to have a knowledge gap about the advantage indigenous MPFTs. Even if indigenous multipurpose trees have multiple advantages in social and livelihood, economic and ecological values, they were generally ignored in reforestation. Only 30% of respondents noted that of having some knowledge about the social and livelihood, economic and ecological values of indigenous MPFTs in three districts.

## Conclusion

The indigenous MPFTs have strong social and economic value to the people in general. These plants are particularly important for income sources, a benefit to livestock and shade. The five MPFT species identified as important in the study area based on their abundance and utilization as social and economic value and animal feed are *E. brucei*, *V. amygalina*, *E. cymosa*, *C. africana* and *D. abyssinica*. Further studies may examine the status of these plants in other regions and also include more species for evaluation.

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