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Full Length Research Paper

Indigenous knowledge on fuel wood (charcoal and/or firewood) plant species used by the local people in and around the semi-arid Awash National Park, Ethiopia

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Fuel wood (charcoal and/or firewood) species used by the Afar and Oromo (Kereyu and Ittu) Nations in and around the semi-arid Awash National Park (ANP), Ethiopia was conducted ethnobotanically. The study aimed to investigate and document various aspects of indigenous knowledge (IK) on fuel wood species and their associated threats. A total of 96 informants between the ages of 20 and 80 were selected using prior information. Data were collected using semi-structured interview, guided field walk, discussions and field observation. Preference ranking, paired comparison, Jaccard's coefficient of similarity and priority ranking were applied for data analysis. A total of 100 species belonging to 71 genera and 38 families were collected within the study area. Of these, 10 species were reported by the Afar Nation, 11 by the Oromo Nation and the rest by both of them. Family Fabaceae was represented by the highest number of fuel wood species, which accounted for 20%. From 27 species used for charcoal and firewood production, 11 species (40.7%) belonged to the genus Acacia. Preference ranking and paired comparison showed that Acacia tortilis is the most selected Acacia species as perceived by key informants within the park for charcoal production. Overgrazing, followed by deforestation were the major threats in the study area, which scored 21.7% and 19.9%, respectively.

Key words: Acacia species, Awash National Park (ANP), charcoal, Ethiopia, indigenous knowledge (IK).

INTRODUCTION

The most important sources of fuel, which are the necessities for human kind, are fuel wood (charcoal and firewood), petroleum and peat. Of these, wood makes an outstanding fuel as it is 99% flammable if completely dry (Hill, 1952; Kochhar, 1998). It is the cheapest, the most suitable and accessible energy source in many rural areas (Abbiw, 1990; Cotton, 1996). For example, Abbiw (1990) reported that 90% of the wood cut is used for fuel wood. However, an inefficient and wasteful method of traditional open fire cooking accounts mainly for the consumption of relatively a higher proportion of fuel wood. So, to combat the problem of deforestation designing fuel-saving stoves is one of the practical solutions in many developing countries. Although the majority of wild woody plant species can be used as a source of fuel for indigenous peoples, many species are recognized for particular burning qualities (Cotton, 1996).

Charcoal is a valuable and a chief domestic fuel in most tropical countries (Hill, 1952). Due to this reason, it is a common source of fuel wood in urban centers. In the absence of fossil fuel, charcoal is more advantageous and much preferred fuel wood than firewood due to being of lighter weight, less bulky and more compact, thereby easier to store indefinitely and cheaper to transport

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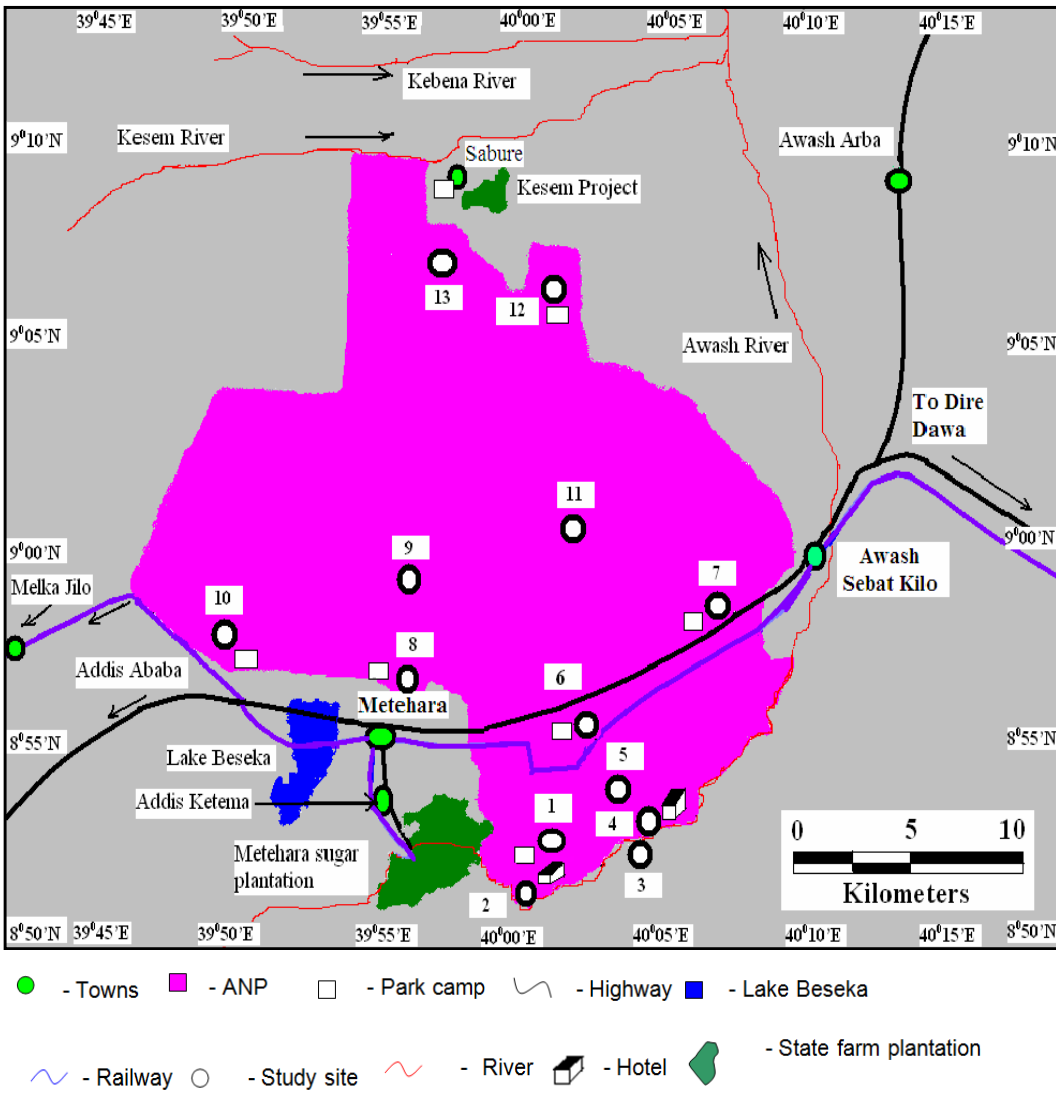

Figure 1. Map of ANP modified from EMA (1992), Jacobs and Schloeder (1993) and Berihun and Solomon (2005).

(Abbiw, 1990). It is more efficient and produces a steady heat with little or no smoke or soot (Hill, 1952; Abbiw, 1990; Cotton, 1996; Kochhar, 1998). On the contrary, the long distance transportation makes for its high cost as compared to firewood. During charcoal preparation, about half of the wood's energy is wastefully burned away (Abbiw, 1990). Consequently, extensive woodland has to be cleared to meet the high charcoal demand. Moreover, charcoal making causes many accidental fires on forests. Thus, both charcoal harvesting and accidental fire contribute to global warming, deforestation and land degradation (Silayo et al., 2008). Therefore, the present study aimed to conduct an ethnobotanical study of fuel wood species used by indigenous peoples of the Afar and the Oromo Nations in and around ANP and record, compile and document the associated IK to assist in the proper utilization, management and conservation of useful plants and the settings of the Park as a whole.

The study area

Geographical location

The study was conducted in ANP, Ethiopia, which is 225 km away from Addis Ababa and situated between latitudes 8°50' and 9°10' north and longitudes 39°45' and 40°10' east (EMA, 1992) (Figure 1). The Park covers approximately 756 km^2 and is bordered by the Sabober plain to the west, the Awash River to the south and southeast and Kesem River and Filwuha Hot Springs to the north (Jacobs and Schloeder, 1993). ANP is characterized by semi-arid climate or Qolla Zone and bimodal rainfall with the annual rainfall ranging between

400 and 700 mm (Jacobs and Schloeder, 1993). Out of the nine vegetation types of Ethiopia, the vegetation type of ANP is classified under *Acacia-Commiphora* woodland (Sebsebe and Friis, 2009) in the Somali-Masai Regional Center of endemism (White, 1983). Thirteen data collection sites in ANP were: 1. Gotu, 2. Awash River, 3. Awash Gorge, 4. Karreyu Lodge, 5. Ilala Sala plain, 6. Hamareti, 7. Geda, 8. Sogido, 9. Mt. Fentale, 10. Sabober, 11. Dunkuku (Kudu Valley), 12. Filwuha, and 13. Sabure (Figure 1).

MATERIALS AND METHODS

Ethnobotanical data collection

After a reconnaissance survey from August 15 to 30th, 2008, 13 study sites (Figure 1) were selected and established as data collection sites. Following this, ethnobotanical data were collected between September, 2008 and March, 2009, on three field trips that were carried out in each study site, following the methods by Martin (1995), Cotton (1996) and Cunningham (2001). Semi-structured interview, guided field walk, discussions and observation, with informants and key informants were applied based on a checklist of questions using the Afar and Oromo languages with the help of translators to obtain IK of the local people on fuel wood species in and around the ANP. Voucher specimens were collected, identified and kept at National Herbarium, Addis Ababa University. Consequently, informants were selected from the Afar and/or the Oromo Nations based on the vicinity of their Kebeles to the Park. Four Kebeles from the Afar Nation (Awash, Doho, Dudub and Sabure Kebeles), whereas five Kebeles from the Oromo Nation (Benti, Fate Leidy, Gelcha, Ilala and Kobo Kebeles) were taken. Of these, 96 informants 7 or 8 individuals for each study site (76 men and 20 women) between the ages of 20 and 80 were selected using prior information. Out of these, 36 key informants (32 men and 4 women) were selected. Basic information on fuel wood species including their local names, part (s) used, species used for charcoal and/or firewood and other additional uses was/were collected from informants.

Ethnobotanical data analysis

The data were analyzed and summarized using simple preference ranking, paired comparison and direct matrix ranking, following Martin (1995) and Cotton (1996). The Jaccard's Coefficient of Similarity (JCS) was also calculated and the similarity in fuel wood composition between the Afar and the Oromo Nations were compared as it was described in Kent and Coker (1992). Accordingly, JCS was calculated between paired habitat types (A and B) as follows:

$$JCS = \frac{c}{c + b + a}$$

Where **a** - is the number of species found only in habitat A,
b - is the number of species found only in habitat B and
c - is the number of common species found in habitat A and B.

Finally, JCS was multiplied by 100 in order to obtain the percentage similarity in species composition between the Afar and the Oromo Nations as applied by Kent and Coker (1992).

RESULTS AND DISCUSSION

Diversity and distribution of fuel wood species

Most of the local communities around the ANP directly or indirectly rely on the Park's resources for energy source. In this field study, a total of 100 fuel wood (charcoal and/or firewood) species were recorded, being distributed in 71 genera and 38 families. Of these, 10 species were reported by the Afar Nation, 11 by the Oromo Nation and the rest by both of them. About 80% of the species were reported with their vernacular (local) names, where 63% were reported by the Afar Nation and 80% by the Oromo Nation (Appendix 1). Firewood was the major source of energy which accounted for 73% and an income generating activity in the livelihoods of many rural dwellers. The majority of the local communities use fuel wood to cook their food and heat and light up their houses. The source of fuel wood was found to be from woodland reserve, bushland, shrubland and market areas. The urban dwellers in Awash Sebat Kilo, Metehara, Addis Ketema, Sabure and Melka Jilo towns buy sticks or splits/bundles of firewood or sacks of charcoal from the local markets. On the other hand, the rural peoples harvest firewood and/or charcoal from the study area. According to Zerihun and Mesfin (1990), the Rift Valley vegetation is an important source of charcoal making for the nearby towns and Addis Ababa. Informants during individual or group discussions revealed that selection of firewood mainly relied on availability, burning quality, little/no smoke/soot production and moisture content.

Accordingly, the most widely identified plant species for the source of firewood comprise *Acacia, Ziziphus* and *Grewia* species, *Balanites aegyptiaca*, *Olea europaea* subsp. *cuspidata*, *Tamarindus indica*, *Terminalia brownii*, *Manilkara butugi*, *Berchemia discolor*, *Trilepisium madagascariense*, *Dobera glabra* and so forth. In the same way, *Acacia* species such as *Acacia dolichocephala* and *Acacia brevispica* are the most preferred firewood species based on burning qualities in their respective orders (Hussien, 2004). Similarly, species like *Acacia nilotica*, *Balanites aegyptiaca* and *Acacia tortilis* are more preferable for both firewood and charcoal making. According to informants responses' *Lantana camara* and *Prosopis juliflora* are used as sources of firewood and firewood/charcoal making respectively. For instance, informants explained that the wood (stem) of *Prosopis juliflora* serve as an excellent source of fuel wood (firewood and charcoal making), house construction (timber, house posts) and dry fencing. This is a good practice in order to control and manage these noxious invasive alien plant species.

This was followed by both charcoal and firewood that come up with 27%. The informants stated that if the wood of a plant is used for charcoal making most of the time it also serves for firewood. Of these results, from 27 plant species used for charcoal and firewood production, 11

Table 1. Preference ranking for seven most preferred *Acacia* species used for charcoal production as perceived by key informants in the study area.

Major plants used for charcoal production	Key informants															Total score	Rank
	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}	R_{11}	R_{12}	R_{13}	R_{14}	R_{15}		
Acacia mellifera	4	1	2	4	1	1	5	7	1	2	4	1	2	7	3	45	5th
Acacia nilotica	3	6	7	6	5	7	4	4	4	6	7	6	4	5	4	78	2nd
Acacia oerfota	1	3	4	1	2	2	1	1	2	1	1	2	5	2	1	29	7th
Acacia prasinata	7	7	3	5	7	6	2	3	5	3	3	4	3	6	6	70	3rd
Acacia senegal	2	2	1	2	3	3	6	2	3	5	2	3	1	1	5	41	6th
Acacia seyal	5	4	6	3	4	4	3	5	6	4	5	5	6	3	2	65	4th
Acacia tortilis	6	5	5	7	6	5	7	6	7	7	6	7	7	4	7	92	1st

Table 2. Paired comparison of five major important *Acacia* species based on degree of tree cutting for charcoal production as perceived by key informants in the study area.

Acacia species used for charcoal production	Key informants										Total score	Rank
	R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	R_9	R_{10}		
Acacia mellifera	1	1	0	0	2	1	2	3	0	3	13	5th
Acacia nilotica	4	5	3	4	3	4	5	3	5	4	40	2nd
Acacia prasinata	4	0	2	4	4	3	5	2	3	4	31	3rd
Acacia seyal	3	2	1	2	0	4	4	5	1	3	25	4th
Acacia tortilis	5	4	5	5	5	5	3	4	5	4	45	1st

5= Series; 4=Very high; 3= High; 2= Medium; 1= Least.

species (40.7%) belonged to the genus *Acacia*. This indicated that charcoal production was one of the major factors responsible for cutting of trees within the Park. The family with the highest number of fuel wood was represented by Fabaceae with 20 species (20%), followed by Capparidaceae 7 (7%), Tiliaceae 6 (6%) and 21 families had only 1 species each. The most frequently reported plant parts used for firewood and both firewood and charcoal production were shrubs 47 species (47%), followed by trees 33 (33%) and Herbs 11 (11%).

Both preference ranking and paired comparison showed that *Acacia tortilis* is the most selected *Acacia* species within the park for charcoal production (Tables 1 and 2). This might be due to its high abundance in the study area as well as preference for high quality charcoal in the local towns or other distant towns like Walenchit, Adama and Addis Ababa. As a result, charcoal producers more selectively use this species. According to informants, Park's administrators and scouts, *Acacia nilotica*, *Acacia prasinata*, *Acacia seyal* and *Acacia mellifera* may be compared in terms of the production of high quality charcoal with that of *Acacia tortilis*. For example, in the Rift Valley area, *Acacia seyal* is extensively used for charcoal production due to its softer wood (Zerihun and Mesfin, 1990). Again, Hussien (2004) revealed that *Acacia nilotica* stood the 2nd rank for production of high quality charcoal in the study area. But, due to their scarcity in the study area charcoal producers are more inclined towards the harvesting of *Acacia tortilis*. Similar observation was also reported by Kebu et al. (2004) that *Acacia tortilis* was more commonly used for firewood and charcoal making instead of medicinal uses. Similarly, Makenya (2006) reported that *Acacia tortilis* was the best plant species for charcoal making in Tanzania. On the other hand, the paired comparisons showed that there was a deviation of R_1, R_3, R_4, R_6 and R_9 in their evaluation from the remaining key informants as they were older peoples, illiterate and charcoal producers and sellers. While, R_2, R_5, R_7, R_8 and

Table 3. The species similarity between the Afar and the Oromo Nations for fuel wood and the JCS in the study area

Total number of species	Total number of species reported			Jaccard's coefficient of similarity	Percentage similarity
	The Afar Nation	The Oromo Nation	Both Nations		
100	10	11	79	0.79	79

R_{10} were less experienced and less knowledgeable as compared to their counterparts due to literacy, younger ages and even older ages but different living professions (Table 2). This revealed that there was a difference in IK among key informants in evaluating each species for charcoal production due to their age, literacy, experience and profession. Such deviation could be attributed to the fact that older peoples, illiterate and charcoal producers and sellers are more experienced and knowledgeable as compared to younger ages, literate and even older ages, but different living professions. This is because most young informants particularly those who go to school were not interested to know and learn about plant resources from their parents. In general, socio-cultural factors such as age, whether literate or not and occupation affect the distribution of IK among individuals (Cotton, 1996).

In the present study, information from informants as well as field observation indicated that the commercial sale of firewood and charcoal from *Acacia* species and many other woody species is a common practice in the area. As a result, charcoal producers most frequently targeted by cutting the trees of *Acacia* species, which accounted the highest proportion and the least on shrubs. Hussien (2004) reported that trees are the most widely used life forms that accounted for about 69%. Widespread sale of firewood and charcoal in the area, in turn leads to threatening and gradual extinction of plant resources (Kebu et al., 2004). Widespread sale of firewood and charcoal also have environmental problems in the Rift Valley area (Zerihun and Mesfin, 1990; Ensermu et al., 1992). Furthermore, the cutting of *Acacia* trees and other plant resources for charcoal production leads to not only the destruction of wildlife habitats but also the complete disappearance of species from the Park (Andeberhan, 1982). Again, charcoal producers are major cause of accidental and deliberate forest fire in the ANP. This is because as they set the fire for making charcoal, the fire suddenly escapes and damages a large area of woodland resources.

Fuel wood species use diversity

Some of the surveyed fuel wood species in the study area were found to have multi-purpose values in various ways such as forage/fodder species, medicine, food, material culture and miscellaneous uses. Out of the total recorded fuel wood species, about 33% of the species were found to have 4 distinct uses, 14% with 5 uses and 13% with 6 uses to the local people (Appendix 1).

Variation of indigenous knowledge between the Afar and the Oromo Nations

Research findings during data collection showed that 10 fuel wood species were reported by the Afar Nation, 11 species by the Oromo Nation and 79 species were common to both Nations (Table 3). The percentage similarity (about 79%) for the species, in turn, indicated that since the two groups situated almost in close geographical settings, there is a cultural diffusion and sharing of experiences and knowledge between them. Thus, they commonly utilize the same species.

Threats to fuel wood species and associated indigenous knowledge

Since the local peoples have an intimate relationship towards their natural environment, they are familiar with the threats for fuel wood species. Therefore, during both group and individual discussions, key informants identified seven major threats by priority ranking in the ANP. Consequently, overgrazing/over browsing, followed by deforestation scored 21.7 and 19.9%, respectively. This was followed by deforestation for different purposes (for example, firewood and charcoal production, building and construction, household furniture and farm tools, fencing materials and others), human settlement and agricultural expansion as well as forest fire in their respective orders.

CONCLUSION AND RECOMMENDATIONS

The indigenous people mainly depend on fuel wood species for their house hold consumptions and income generation. As a result, high diversity

of species is recorded even if human-induced and natural factors influence the species. Overgrazing and deforestation are the major threats within the Park. Planting of fuel wood species around homesteads and farmlands for household supply and sale; conservation of threatened species such as *Acacia tortilis*, *Acacia nilotica*, *Acacia prasinata* and *Acacia negrii* to alleviate from threat; practical application of cooking with wood saving stoves and improved charcoal stove as well as enhancing the utilization of invasive alien plant species for various purposes to control further spread are recommended.

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Appendix 1. List of plant species used for fuel wood (firewood and/or charcoal) in the study area (ANP).

Scientific name	Family name	Ha	Vernacular name	U	MUC	CN
Acacia brevispica Harms	Fabaceae	S	HAMARESA (Or)	B	F, Fu, Fo, Mc	TB204
Acacia dolichocephala Harms	Fabaceae	T	-	B	F, Fu, Mc, Mi	TB058
Acacia mellifera (Vahl) Benth.	Fabaceae	S	MAKA'ARTO/MA'EGHERTO (Af); SEPENE GURO (Or)	B	F, Fu, M, Fo, Mc, Mi	TB011
Acacia negrii Pic.- Serm.	Fabaceae	S	KESEL-E (-TO) (Af); KESELE (Or)	B	F, Fu, Mc	TB051
Acacia nilotica (L.) Willd. ex Del.	Fabaceae	T	KESEL-E (-TO) (Af); BURKUKE (Or)	B	F, Fu, M, Fo, Mc, Mi	TB003
Acacia oerfota (Forssk.) Schweinf.	Fabaceae	S	GOMERTO (Af); AJO (Or)	B	F, Fu, M, Fo, Mc, Mi	TB045
Acacia prasinata Hunde	Fabaceae	T	SEKEKTO (Af); DODOTI (Or)	B	F, Fu, Mc	TB201
Acacia robusta Burch.	Fabaceae	T	GERE'INITO (Af); WANIGAYO (Or)	B	F, Fu, Mc	TB180
Acacia senegal (L.) Willd.	Fabaceae	S	ADADO (Af); SEPENSA DIMA/SEPESA (Or)	B	F, Fu, M, Fo, Mc, Mi	TB001
Acacia seyal Del.	Fabaceae	T	ADIGENTO/MAKANI (Af); WACHU (Or)	B	F, Fu, Fo, Mc	TB190
Acacia tortilis (Forssk.) Hayne	Fabaceae	T	E'IBITO/BEHBEY (Af); DEDECHA (Or)	B	F, Fu, M, Fo, Mc, Mi	TB026
Acalypha fruticosa Forssk. *	Euphorbiaceae	S	CHIRI (Or)	F	F, Fu, Mc, Mi	TB090
Azadirachta indica A. Juss.	Meliaceae	T	MIMI HARA (Af); KININI (Or)	F	F, Fu, M, Mi	TB207
Balanites aegyptiaca (L.) Del.	Balanitaceae	T	UDAYITO/ALA'ITO (Af); BEDENO (Or)	B	F, Fu, M, Fo, Mc, Mi	TB004
Barleria acanthoides Vahl **	Acanthaceae	S	BALI WERANITI (Or)	F	F, Fu	TB123
Berchemia discolor (Klotzsch) Hemsl.	Rhamnaceae	T	YEYEBITO (Af); JEJEBA (Or)	B	F, Fu, Fo, Mc	TB191
Bidens biternata (Lour.) Merr. & Sherff	Asteraceae	H	CHOGOGE (Or)	F	Fu, M	TB143
Boscia salicifolia Oliv.	Capparidaceae	S	-	F	F, Fu, Fo, Mc	TB107
Boswellia papyrifera (Del.) Hochst.	Burseraceae	T	LUBATEN (Af); MUKE ITANA (Or)	F	F, Fu, Fo, Mc	TB099
Cadaba farinosa Forssk.	Capparidaceae	S	FURA (-YITO)/NUMHELE (Af); KELIKNATIONHA (Or)	F	F, Fu, M, Fo, Mc, Mi	TB031
Cadaba rotundifolia Forssk.	Capparidaceae	S	ANAGALI/ADENGELITA (Af); ARANGILLE (Or)	F	F, Fu, Mi	TB052
Calotropis procera (Ait.) Ait.f.	Asclepiadaceae	S	GELE'ATO/GHULA'ENTO (Af); FELFELA ADAL (Or)	F	Fu, M, Mc, Mi	TB012
Capparis cartilaginea Decne.	Capparidaceae	S	DELENSISA (Or)	F	Fu, M, Fo	TB117
Capparis tomentosa Lam.	Capparidaceae	S	HARENIGEMA (Or)	F	F, Fu, M, Fo, Mc, Mi	TB084
Caucanthus auriculatus (Radlk.) Niedenzu	Malpighiaceae	C	GALE (Or)	F	F, Fu	TB005
Ceiba pentandra (L.) Gaertn. *	Bombacaceae	T	FERENJI TUTI (Af)	B	F, Fu, Fo, Mc, Mi	TB083
Celtis toka (Forssk.) Hepper & Wood	Ulmaceae	T	GUDIBI'ATO (Af); METEKOMA (Or)	F	F, Fu, Fo, Mc	TB192
Cleome brachycarpa Vahl ex DC. *	Capparidaceae	H	-	F	F, Fu	TB013
Combretum molle R. Br. ex G. Don	Combretaceae	T	WE'IBA'ITO (Af); RUKESA (Or)	B	F, Fu, Mc, Mi	TB197
Commiphora erythraea (Ehrenb.) Engl.	Burseraceae	T	YEYEBITO (Af); CHELANKA (Or)	F	F, Fu, Mc	TB187
Commiphora habessinica (Berg) Engl.	Burseraceae	S	HEDAYITO (Af); HAMESA (Or)	F	F, Fu, Fo, Mc, Mi	TB086
Cordia monoica Roxb.	Boraginaceae	S	MINE GURE/SUBULA (Af); MEDERO (Or)	F	F, Fu, Fo, Mc	TB025
Crotalaria incana L.	Fabaceae	H	IJISISE (Or)	F	Fu, M, Mc, Mi	TB101
Cryptostegia grandiflora Roxb. ex R. Br.	Asclepiadaceae	S	HALI MERO (Af); HAKONKOL (Or)	F	Fu, Mc, Mi	TB018
Cynanchum gerrardii (Harv.) Liede **	Asclepiadaceae	C	HIDA KELA/MUKA JINI (Or)	F	Fu, M	TB188
Cynanchum hastifolium N.E.Br. **	Asclepiadaceae	C	SARA KORPO (Or)	F	Fu	TB106

Appendix 1. Continues.

Dalbergia lactea Vatke	Fabaceae	S	DILO LELAFA (Or)	F	F, Fu, Mc	TB198
Dichrostachys cinerea (L.) Wight & Arn.	Fabaceae	S	JIRME (Or)	B	F, Fu, Mc, Mi	TB009
Dicoma tomentosa Cass. *	Asteraceae	H	-	F	F, Fu	TB131
Dobera glabra (Forssk.) Poir. **	Salvadoraceae	T	GHERSA (Af); ADE (Or)	F	F, Fu, Fo, Mc, Mi	TB195
Echinops pappii Chiov. **	Asteraceae	S	BILINGI (Or)	F	Fu	TB006
Ehretia cymosa Thonn.	Boraginaceae	S	MINE GURE (Af); ULAGA (Or)	F	F, Fu, M, Fo, Mc	TB097
Eucalyptus globulus Labill.	Myrtaceae	T	BAHIR ZAFI (Af & Or)	F	Fu, M, Mc	TB210
Euclea racemosa Murr. subsp. *schimperi* (A. DC.) White **	Ebenaceae	S	MIESSA (Or)	F	F, Fu, Fo, Mc	TB200
Euphorbia polyacantha Boiss.	Euphorbiaceae	S	-	F	Fu, Mi	TB142
Euphorbia tirucalli L.	Euphorbiaceae	T	LIHASO (Af); ANO (Or)	F	F, Fu, M, Mi	TB046
Ficus sycomorus L.	Moraceae	T	SUBULA (Af); ODA (Or)	F	Fu, M, Fo, Mc, Mi	TB043
Ficus vasta Forssk.	Moraceae	T	MARA'ITO (Af); KILTU (Or)	F	Fu, M, Fo, Mc, Mi	TB047
Flacourtia indica (Burm.f.) Merr. **	Flacourtiaceae	S	-	F	F, Fu, Fo, Mc	TB014
Forsskaolea viridis Webb. **	Urticaceae	H	-	F	F, Fu	TB030
Grewia bicolor Juss.	Tiliaceae	S	ADIBI'ATO (Af); HARORESA (Or)	B	F, Fu, Fo, Mc	TB185
Grewia ferruginea Hochst. ex A. Rich.	Tiliaceae	S	ADIBI'ATO/FO (Af); HARORESA (Or)	F	F, Fu, Fo, Mc	TB186
Grewia schweinfurthii Burret	Tiliaceae	S	ADIBI'ATO (Af); MUDHE GURE (Or)	B	F, Fu, Fo, Mc	TB181
Grewia tenax (Forssk.) Fiori	Tiliaceae	S	HEDAYITO/HUDA/MINE GURE (Af); DEKA TUNTUNA (Or)	F	F, Fu, Fo, Mc	TB038
Grewia velutina (Forssk.) Vahl	Tiliaceae	S	ADIBI'ATO (Af); HARORESA (Or)	F	F, Fu, Fo, Mc	TB054
Grewia villosa Willd.	Tiliaceae	S	GARIWA (Af); OGOMDI (Or)	F	F, Fu, M, Fo, Mc, Mi	TB024
Hagenia abyssinica (Bruce) J.F. Gmel.	Rosaceae	T	BEGALA (Af); HETO (Or)	F	Fu, M, Mc	TB209
Hibiscus micranthus L. f.	Malvaceae	H	AKILEHENA (Af)	F	F, Fu, Fo, Mc	TB145
Hippocratea africana (Willd.) Loes.	Celastraceae	C	MISI (Af); TERO (Or)	F	F, Fu, Mc	TB196
Hyphaene thebaica (L.) Mart. *	Arecaceae	T	UNGA/GARA'ITO (Af); METI (Or)	F	F, Fu, Fo, Mc	TB128
Indigofera arrecta Hochst. ex A. Rich.	Fabaceae	H	HERCHUMEN (Or)	F	Fu, M, Fo, Mc	TB008
Indigofera coerulea Roxb.	Fabaceae	H	ADULALA (Or)	F	Fu, M, Fo	TB120
Ipomoea carnea Jacq. *	Convolvulaceae	S	BIROLI (Af)	F	Fu	TB015
Jatropha curcas L.	Euphorbiaceae	S	ABETE BULK (Or)	F	Fu, Mi	TB102
Kleinia odora (Forssk.) DC.	Asteraceae	S	LUKO (Or)	F	F, Fu, Mc, Mi	TB206
Lantana camara L.	Verbenaceae	S	BADUWA HARA (Af); MIDAN DUBRA (Or)	F	F, Fu, Fo, Mc, Mi	TB050
Maerua angolensis DC. *	Capparidaceae	S	DUNIBIAYITO/SEKILELI'A (Af)	F	F, Fu, Fo, Mc	TB136
Manilkara butugi Chiov.	Sapotaceae	T	BUTUYE (Af); BUTUJI (Or)	F	F, Fu, Fo, Mc, Mi	TB194
Melhania ovata (Cav.) Spreng.	Sterculiaceae	S	HAMBOKITO (Af)	F	F	TB033
Moringa stenopetala (Bak.f.) Cuf.	Moringaceae	T	-	F	Fu, Fo, Mc	TB096

Appendix 1. Continues.

Morus mesozygia Stapf	Moraceae	S	-	F	F, Fu, Mc	TB105
Ocimum spicatum Deflers	Lamiaceae	S	MISE (Af); KORCHA MICHI (Or)	F	Fu, M, Fo	TB139
Ocimum stirbeyi Schweinf. & Volk. *	Lamiaceae	S	BIRITELI (Af)	F	Fu, Mc	TB021
Olea europaea L. subsp. *cuspidata* (Wall.ex G.Don) Cif.	Oleaceae	T	WEYIBO (Af); EJERSA (Or)	B	F, Fu, M, Mc, Mi	TB132
Oncocalyx schimperi (A. Rich.) M. Gilbert	Loranthaceae	P	HATOTE (Af); DERTU HARORESA (Or)	F	Fu, M, Mc	TB028
Otostegia integrifolia Benth.	Lamiaceae	S	TUNGIT (Af); TINJITI (Or)	F	Fu, M, Mi	TB215
Parkinsonia aculeata L.	Fabaceae	S	-	B	F, Fu, Fo, Mc	TB057
Plicosepalus sagittifolius (Engl.) Danser	Loranthaceae	P	HATOTE (Af); DERTU DEDACHA (Or)	F	Fu, M, Mc	TB087
Premna resinosa (Hochst.) Schauer	Lamiaceae	S	BOBA'O (Af); URGESA (Or)	F	F, Fu, Fo, Mi	TB035
Prosopis juliflora (Sw.) DC. *	Fabaceae	S	WEYANE (Af & Or)	B	F, Fu, M, Fo, Mc, Mi	TB020
Rhus vulgaris Meikle **	Anacardiaceae	S	DEBOBESA (Or)	F	F, Fu, M, Fo, Mc	TB103
Ricinus communis L.	Euphorbiaceae		SHERBETI (Af); KOBO (Or)	F	Fu, M, Fo, Mc	TB048
Salvadora persica L.	Salvadoraceae	S	HADAYITO/DADAHO (Af); ADE (Or)	F	F, Fu, M, Fo, Mc	TB039
Schinus molle L.	Anacardiaceae	T	KUNDO BERBERE (Or)	B	Fu, M, Mc, Mi	TB114
Sesbania sesban (L.) Merr.	Fabaceae	S	ENCHINI/HARCHA (Or)	F	F, Fu, Mc	TB135
Sida schimperiana Hochst. ex A. Rich.	Malvaceae	S	WELAYINEBA (Af); KORCHA IJOLE (Or)	F	F, Fu, M, Mc, Mi	TB094
Solanum coagulans Forssk.	Solanaceae	H	-	F	F, Fu	TB104
Solanum hastifolium Hochst. ex Dunal	Solanaceae	S	BURI BOLO (Or)	F	F, Fu	TB088
Solanum incanum L.	Solanaceae	S	AMBOKO ASO (Af); HIDI LONI (Or)	F	F, Fu, Mc, Mi	TB016
Steganotaenia araliacea Hochst. ex A. Rich. **	Apiaceae	T	-	F	Fu	TB055
Sterculia africana (Lour.) Fiori	Sterculiaceae	T	KERERI (Or)	F	F, Fu, Fo, Mc, Mi	TB022
Tamarindus indica L. *	Fabaceae	T	SEGENTU (Af); ROKA (Or)	B	F, Fu, M, Fo, Mc, Mi	TB126
Tamarix nilotica (Ehrenb.) Bunge	Tamaricaceae	S	SEGE'ITO (Af)	F	F, Fu	TB202
Terminalia brownii Fresen.	Combretaceae	T	WE'IBA'ITO (Af); BIR'ENSA (Or)	B	F, Fu, M, Mc, Mi	TB098
Trilepisium madagascariense DC. **	Moraceae	T	SELAWETA (Or)	F	Fu, Mc	TB189
Vernonia cinerascens Sch. Bip.	Asteraceae	S	FILE NEME'A (Af); KERTATUME (Or)	F	F, Fu, Mc	TB049
Vernonia uncinata Oliv. & Hiern	Asteraceae	H	FILE NEME'A (Af)	F	Fu	TB110
Ximenia americana L.	Olacaceae	T	HUDHA (Or)	B	F, Fu, Fo, Mc	TB199
Ziziphus mucronata Willd.	Rhamnaceae	T	KUSIR-A (-TO) (Af); KURKURA HADO (Or)	B	F, Fu, M, Fo, Mc, Mi	TB056
Ziziphus spina-christi (L.) Desf.	Rhamnaceae	T	KUSIR-A (-TO) (Af); KURKURA (Or)	B	F, Fu, M, Fo, Mc, Mi	TB041

Major use category (MUC) [F = Forage/fodder; Fu = Fuel wood; M = Medicine; Fo = Food; Mc = Material culture; Mi = Miscellaneous uses]; Uses (U) [F - Species used for firewood; B - Species used for both firewood and charcoal; Part (s) used in all species of fuel wood = Stem and branches]; Habit (Ha) [C-Climber; H-Herb; P - Semi-parasitic; S-Shrub; T-Tree]; [* Species used for fuel wood reported by the Afar Nation; ** Species used for fuel wood reported by the Oromo Nation; Species used for fuel wood without asterisks are reported by both Nations]; [Collection No. (CN)].