Wild edible trees and shrubs in the semi-arid lowlands of Southern Ethiopia

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Abstract

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The study was conducted in Benna Tsemay district, South Omo Zone of the Southern Nations', Nationalities' and Peoples' Region (SNNPR) of Ethiopia, to identify and document wild edible trees and shrubs and to assess their role in household food security. Ethno-botanical data were collected using a semi-structured questionnaire, key informant interview, group discussion and vegetation inventory. A total of 30 wild edible trees and shrubs were identified and documented, of which 15 species (50%) have a supplementary role in household food security, three species (10%) are used to fill the seasonal food shortage and 12 species (40%) have an emergency role. In addition to food, four species are used to generate income for households. The density of wild edible trees and shrubs varied with altitude, the average number being 25 trees or shrubs ha^{-1} in the lower altitudinal zones (500–600 m a.s.l.) and 312 in mid-altitudinal zones (1200–1500 m a.s.l.). The harvestable edible materials also varied from site to site, with average quantities of 85 and 382 kg ha^{-1} for the lowlands and mid-altitudinal zones, respectively. Expansion of agriculture (25%), fire hazards (21.7%) and overgrazing (18%) were the major threats to the existence of wild edible trees and shrubs in the study area. The study indicated that wild edible plants are valuable resources for improving food and nutritional security and income of households living in dryland areas. Thus, more research is needed to assess their nutritional value and economic as well as ecological contributions.

Keywords: Ethno-botany, Food security, Indigenous knowledge, Benna, Tsemay, South Omo

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Introduction

Rural people derive a significant proportion of their food and energy requirements from various indigenous trees and shrubs, which are not cultivated (Nair, 1989). Wild food plants are plants with edible parts that grow naturally on farmland, fallow or uncultivated land (Ruffo *et al*., 2002; Zemede Asfaw & Mesfin Tadesse, 2005; Getachew Addis,

2009; Demel Teketay *et al*., 2010). They are relevant to household food security and nutrition in some rural areas, particularly in the drylands, to supplement the staple food, to fill seasonal food shortages, and as emergency food during famine (Amare Getahun, 1974; FAO, 1989; 2003; Guinand & Dechassa Lemessa, 2000; Teshome Soromessa & Sebsebe Demissew, 2002).

These wild plants can supplement nutritional requirements, especially vitamins and micronutrients. Analysis of some wild food plants demonstrates that, in many cases, their nutritional quality is comparable to— and may be superior to— domesticated varieties (Getachew Addis *et al*., 2005; Kebu Balemie & Fassil Kebebew, 2006). Income and employment can be obtained from the sale or exchange of their fruits, leaves, juice and local drinks. Moreover, the indigenous species are adapted to the local culture and environment, and therefore propagate and grow easily, with few requirements for external inputs such as fertiliser and pesticides. Thus they can easily be integrated into sustainable farming systems (Ruffo *et al*., 2002).

For many years, the importance of wild edible plants in the subsistence agriculture of developing countries, as a food supplement or a means of survival during drought and famine, has been overlooked. Although many wild food plants are used by the majority of the rural population, they are still not as appreciated or valued as are some cultivated food plants, such as mango, orange, cabbage and banana (Bell, 1995; Guinand & Dechassa Lemessa, 2000; Ruffo *et al*., 2002; Demel Teketay *et al*., 2010).

Traditional knowledge of wild plants in Africa is in danger of being lost, as habits, value systems and the natural environment change. There is a widespread decline in knowledge about wild food plants, especially among young people and urban dwellers. Therefore, to preserve this knowledge, which potentially is highly valuable for future generations, it needs to be recorded systematically (FAO, 1996; Zemede Asfaw & Mesfin Tadesse, 2005; Tigist Wondimu *et al*., 2006; Demel Teketay *et al*., 2010).

In Ethiopia, where more than 80% of the population is rural, people have depended on their traditional knowledge for the utilisation of plants in their surroundings. Despite the wider role of wild edible plants in rural communities, their contribution, management and utilisation are not exhaustively documented. This is particularly true of the drylands of Benna Tsemay district in Southern Ethiopia.

The present study was, therefore, designed to answer the following research questions: *(a)* what wild edible trees and shrubs are there in the area, *(b)* what part do wild edible trees and shrubs play in household food security, *(c)* what traditional knowledge and skill is there regarding the management and utilisation of wild edible trees and shrubs, and *(d)* what is the production potential of those edible trees and shrubs?

The aims of this study were to document indigenous knowledge related to the use and management of wild edible trees and shrubs and to assess the constraints and potentials for their better exploitation in the future.

Materials and Methods

The study area

The study was conducted in Benna Tsemay District of the South Omo Administrative Zone, in the Southern Nations', Nationalities' and Peoples' Regional State (SNNPRS) of Ethiopia (Figure 1). The District is situated

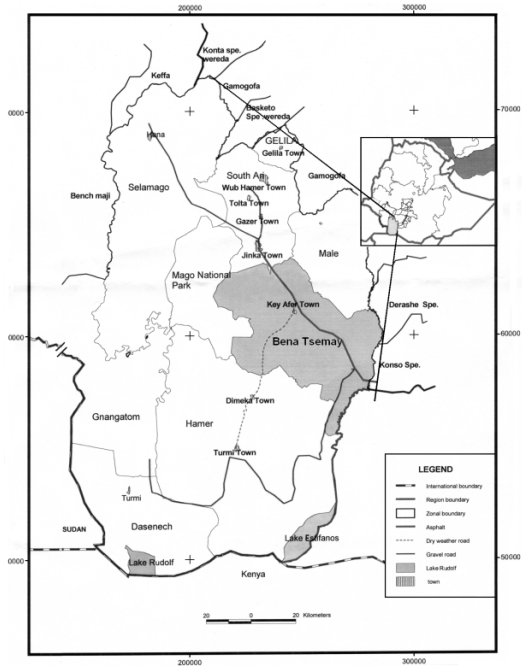

Figure 1. Geographical location of Benna Tsemay District, South Omo Zone, Southern Ethiopia (Source: BOFED, 2008).

between 5.11º–5.70º N latitude and 36.20º–37.04º E longitude (BOFED, 2007). The area receives bimodal rainfall; the first peak, from mid-March to the end of April, is important for crop production, and the second peak, from mid-October to the beginning of November, is short and important only for pasture. The altitude ranges between 500–1500 m a.s.l. The lower altitude, below 700 m a.s.l., is inhabited by the Tsemay ethnic group, while the area above 1000 m a.s.l. is predominantly inhabited by the Benna ethnic group. The annual average rainfall varies between 400–920 mm. The mean annual temperature ranges between 17.6–27.5 ºC. The diurnal maximum temperature in the plains of Weyto in the Tsemay area can exceed 42 ºC (SIM-Alduba, unpublished report). The major soil types of the area are Eutric fluvisols (in the flat lands of the Tsemay), and Eutric and Chromic cambisols (in the rolling plateau of the Benna area). According to Teshome Soromessa *et al*. (2004), the district has substantial vegetation resources, particularly the *Combretum-Terminalia* and *Acacia-Commiphora* woodlands, which are also used as rangelands and common property resources of the whole community.

The human population of the district is 55,590, of whom 28,087 are male and 27,503 female (CSA, 2007). The two dominant ethnic groups, Benna and Tsemay, comprise 27,022 (48.6%) and 20,046 (36.1%) of the population, respectively, while the remaining 8,522 (15.3%) are from other ethnic groups. As regards the livestock population, there are *ca.* 179,918 head of cattle, 82,178 goats, 28,494 sheep, 18,885 donkeys and 80,000 traditional beehives (CSA, 2007).

Methods of data collection

Socio-economic survey

The socio-economic survey involved various data collection techniques, such as semi-structured questionnaires, focus-group discussions and field observations. For the questionnaire survey, six *Kebeles* or Peasant Association (PAs) were selected out of 28, on the basis of vegetation cover, altitudinal range and ethnic composition (Table 1). Ten households from each *Kebele* were randomly selected for the survey, in total 60 sample households. The sample households constitute about 10% of the total population in the *Kebeles.*

In addition to the household interviews, information was collected from 30 key informants (five per *Kebele*) and six group discussions (one per *Kebele*). This information provided an overview of the socio-economic and biophysical environment of the sites, and served to cross-check the data collected from households.

Table 1. *Selected kebeles, their vegetation type, altitude and dominant ethnic groups*

Kebele	Vegetation type	Mean altitude, m	Ethnic group
Shalla-kyyuo	Desert and semi-desert scrubland	500	Tsemay
Luka	*Acacia–Commiphora* woodland	600	Tsemay
Alduba	*Combretum–Terminalia* woodland	1250	Benna
Shabba	*Combretum–Terminalia* woodland	1400	Benna
Olka-kibo	*Combretum–Terminalia* woodland	1500	Benna
Kako	*Combretum–Terminalia* woodland	1300	Benna

A semi-structured questionnaire was developed, and interviews were conducted with the selected households. Data were collected on the role of wild edible trees and shrubs in food security, production potential per tree and utilisation practices, and on plant parts. Other uses of the trees and shrubs, traditional management practices and major threats to these wild edible species, were identified through interviews and field observations.

Vegetation inventory

An inventory was made of the wild edible trees and shrubs, to obtain information on the type of trees and shrubs, their density per hectare and the production potential of edible materials per tree and per hectare. The term 'shrub' in this paper is used to describe woody perennial plants that remain low and produce multiple shoots from the base, while 'trees' refers to woody perennial plants that produce one main trunk or bole and a more or less distinct and elevated crown (Huxley & van Houten, 1997). The inventory was conducted by systematic transect sampling. In each *kebele*, two parallel transect lines were laid out 500 m apart, with quadrats at an interval of 600 m. Each transect had two 40×40 m (1600 m^2) or 20×20 m (400 m^2) quadrats, depending on the vegetation cover, i.e., 40×40 m for the sparse vegetation of the lower altitudes (< 700 m a.s.l.) and 20×20 m for the dense vegetation in the mid-altitudes (>1000 m a.s.l.). Therefore, four quadrats were laid out in each *kebele*, in total 24 quadrats for the whole study. Of these, eight quadrats had an area of 1600 m^2 each, and the remaining 16 were each of 400 m^2.

On each plot, all trees and shrubs were documented by their vernacular name, later converted to the scientific name by means of a tree identification manual. Unfortunately, some species were not identified at field level: For such species, plant specimens were collected, mounted, labelled and submitted to the National Herbarium at Addis Ababa University for identification.

The density of wild edible trees and shrubs on each plot was expressed by counting stems and converting the number to a per hectare basis. Data on the estimated quantity of edible products expected from each plant were collected by interviewing the harvesters. According to Pancel (1993), the quantity of edible parts expected from each plant species of a certain size class can be estimated by asking the same question of a number of harvesters. Following this method, 15 harvesters in total were interviewed, to obtain a reasonable estimate of the yield of edible parts of the various trees and shrubs on each plot. The result obtained was then averaged and converted to a per hectare basis.

Data analysis

The data collected were analyzed by means of descriptive statistics, with Microsoft Excel and SPSS (Statistical Package for Social Sciences, version 13).

Results and discussion

Wild edible trees and shrubs in Benna Tsemay district

The plant species of the study area are generally diverse and serve different purposes to the communities. Among them, a total of 30 wild edible trees and shrubs, belonging to 25 genera and 19 families, were identified (Table 2, overleaf). The Capparidaceae and Tiliaceae families had the highest proportion of edible wild trees and shrubs, with four and three species, respectively. A study conducted in the Kara and Kwego area of Southern Ethiopia (Tilahun Teklehaimanot & Mirutse Giday, 2010) has also indicated that these families had the highest number of edible plants. The diversity of edible trees and shrubs was higher in the altitudinal range 1200–1550 m a.s.l., as compared to the lower altitudes (500–700 m a.s.l.). The difference in species diversity is mainly due to differences in agroecological zones, which in turn depend on the soil, temperature, and rainfall that are determining factors for survival and growth of species.

Most of the identified trees and shrubs are reported to be edible elsewhere in Ethiopia and other parts of Africa. In an ethnobotanical study in Derashe and Kucha district of Southern Ethiopia, Kebu Balemie & Fasil Kebebew (2006) recorded 10 of the wild edible plant species reported in the present study, while a study undertaken in Tanzania (Ruffo *et al*., 2002), indicated the use of 16 of the wild edible trees and shrubs (see also Amare Getahun, 1974; Teshome Soromessa & Sebsebe Demissew, 2002; Zemede Asfaw & Mesfin Tadesse, 2005; Getachew Addis *et al*., 2005; Tigist Wondimu *et al*., 2006; Getachew Addis, 2009; Tilahun Teklehaimanot & Mirutse Giday, 2010).

Role of wild edible trees and shrubs in household food security

Wild food plants could be grouped into three categories on the basis of their consumption pattern. These include those consumed: *(a)* during periods of ample food production to supplement the staple food, *(b)* to fill the gap of seasonal food shortage and *(c)* during famine. In addition to their food value, some species of wild edible plants have other economic values.

(a) Supplementary role of wild edible trees and shrubs

This study showed that, of the 30 identified wild edible tree and shrub species, 15 (50%) are used to supplement the regular food supply (Table 2; Appendix 1). The majority of these species are found in the Benna area. According to the informants, the selection of these edible plants is based on simplicity of processing, good taste, time of availability and low labour requirement. This is in agreement with earlier studies, which indicated that wild food usually is considered as an addition to farmers' daily food consumption pattern (UP, 2000; Guinand & Dechassa Lemessa, 2000). Bell (1995) also noted that wild plants are incorporated in the normal livelihood strategies of many rural people who are pastoralists, shifting cultivators, sedentary farmers or hunter-gatherers.

(b) Seasonal role of wild edible trees and shrubs

Wild edible trees and shrubs are used by many agropastoralists in the study area to fill the food gap. Of the 30 edible trees and shrubs, three (10%) are used to fill the gap of seasonal food shortage (Table 2; Appendix 2). These trees and shrubs regenerate their leaves after the first shower of rain. The survey

Table 2. *List of wild edible trees & shrubs in the two altitudinal zones of the study area*

Scientific name	Family	Edible part	Role in food security	Degree of distribution	
				500–850 m a.s.l.	850–1550 m a.s.l.
Balanites aegyptiaca (L.) Del.	Balanitaceae	Fr, Lf	SS	xx	xx
Balanites rotundifolia (van Tilghem) Blatter	Balanitaceae	Fr	SP	xxx	x
Borassum aethiopum Mart.	Arecaceae	Fr	EM	x	0
Boscia angustiifolia A. Rich.	Capparidaceae	Se	EM	0	x
Canthium pseudosetiflorum Bridson	Rubiaceae	Fr	SP	x	xxx
Carissa spinarum L.	Apocynaceae	Fr	SP	0	xx
Cleome monophylla L.	Capparidaceae	Lf	SS	0	xxx
Crateva adansonii DC.	Capparidaceae	Fr	SP	0	x
Diospyros mespiliformis Hochst. ex A. DC.	Ebenaceae	Fr	EM	0	x
Euclea divinorum Hiern.	Ebenaceae	Fr	EM	x	x
Ficus sur Forssk.	Moraceae	Fr	EM	x	x
Ficus vasta Forssk.	Moraceae	Fr	EM	x	x
Flacourtia indica (Burm.f.) Merr.	Flacourtiaceae	Fr	EM	x	xxx
Grewia tenax (Forssk.) Fiori	Tiliaceae	Fr	SP	0	x
Grewia velutina (Forssk.) Vahl.	Tiliaceae	Fr	EM	0	x
Grewia villosa Willd.	Tiliaceae	Se	SP	0	x
Lannea schimperi (Hochst. ex A. Rich.)	Anacardiaceae	Fr	EM	0	xx
Leucas glabrata (Vahl) Sm in Rees.	Lamiaceae	Fr	EM	0	xx
Meyna tetraphylla (Schweinf. ex Hiern) Robyns	Rubiaceae	Fr	SP	xx	x
Opuntia ficus-indica (L.) Miller	Cactaceae	Fr	SP	0	x
Piliostigma thonningii (Schum.) Milne-Redh.	Fabaceae	Se	EM	0	xx
Psydrax schimperiana (A. Rich.) Bridson	Rubiaceae	Fr	SP	0	xx
Rhus quartiniana A. Rich.	Anacardiaceae	Se	SP	0	xx
Salvadora persica L.	Salvadoraceae	Fr	SP	0	x
Sclerocarya birrea (A. Rich.) Hochst	Anacardiaceae	Fr	SP	x	xx
Securidaca longepedunculata Fresen	Polygalaceae	Lf	SS	0	xx
Senna singueana (Del.) Lock	Fabaceae	Fr	EM	0	xx
Tamarindus indica L.	Fabaceae	Fr	SP	x	xx
Ximenia americana L.	Olacaceae	Fr	SP	xx	xx
Ziziphus mucronata Willd.	Rhamnaceae	Fr	SP	o	xx

Key: a) *Edible parts:* Fr=Fruit; Lf=Leaf; Se=Seed
b) *Degree of distribution:* 0=none; x=rare; xx=Intermediate; xxx=large-scale
c) *Role in food security* SP=Supplementary; SS=Seasonal EM=Emergency

showed that the Benna ethnic group predominantly use *Cleome monophylla* L. and *Securidaca longepedunculata* Fresen, but the Tsemay consume *Balanites aegyptiaca* (L.) Del. and some herbaceous weeds to fill the gap of seasonal food shortage. This difference between ethnic groups is mainly due to the wider distribution of the species in their respective localities.

Wild plants play a critical part in food security in arid and semi-arid environments. Since dry and rainy seasons are sharply separated in these areas, agriculture is restricted to specific periods of the year, thus leaving wide intervals with limited options for food

production. In such periods, food reserves are reduced or may be exhausted, and wild food plants then become a critical food security resource. Wild food plants represent an untapped resource, with the potential to improve nutrition in arid and semi-arid lands. They play a role analogous to that of vegetable crops in humid and sub-humid areas (FAO, 2003; Getachew Addis *et al*., 2005). According to UP (2000), wild leafy vegetables, cabbage and tuberous plants are consumed to fill the gap after the first rain, when farmers prepare their fields.

(c) Emergency role of wild edible trees and shrubs.

Of the recorded wild edible trees and shrubs, 12 species (40%) are consumed during famine (Table 2; Appendix 3). Famine foods are used only when preferred alternatives are not available, and in situations where chronic food shortage prevails (Amare Getahun, 1974; Guinand & Dechassa Lemessa, 2000; Kebu Balemie & Fassil Kebebew, 2006). The agropastoralists of both ethnic groups reported that shortage of food is the major problem in the area, and that the consumption of wild food plants ranked second as a coping mechanism for surviving during famine (Table 3). Famine occurs in the area because of recurrent drought; thus, most of the annual food plants die off, while only perennial plants survive. Since most non-cultivated plants are perennial, they form the most important diet for starving people in the area.

Income-generating role of wild edible trees and shrubs

In addition to their use for household consumption, the identified wild edible trees and shrubs are marketable, and provide an opportunity to supplement household incomes in the study area. According to Kebu Balemie & Fassil Kebebew (2006), income derived

Table 3. Respondents' ranking of disaster-coping mechanisms (n = 60)

Disaster-coping mechanism	*Kebele* (Site)							Rank
	Luka	Shalla Kyayo	Alduba	Shaba	Olika Kibo	Kako	Total	
Sale of small ruminants (goats & sheep) to purchase grain	4	2	3	4	3	2	18	**1**
Consumption of wild edible plants	3	4	2	1	1	2	13	**2**
Slaughtering small ruminants for meat	1	2	2	1	2	1	9	**3**
Collection and sale of firewood and charcoal	0	0	1	2	1	3	7	**4**
Migration to other areas to look for water and grass for animals	1	1	1	1	1	0	5	**5**
Begging food from relatives and friends	0	0	1	1	1	1	4	**6**
Collection and sale of incense	1	1	0	0	0	0	2	**7**
Slaughtering male cattle for consumption	0	0	0	0	1	0	1	**8**
Migration to other areas to look for employment as day-labourers	0	0	0	0	0	1	1	**8**
Total	**10**	**10**	**10**	**10**	**10**	**10**	**60**	

N.B. Each respondent was asked to mention only one of the most important coping mechanisms the household exercises

from the sale of wild plant is of particular importance to the poorer households, which must supplement food production with cash in order to meet their basic needs. This was truly observed in the study area, where some of the wild edible plants were sold in the local market to support household incomes (Table 4). A study conducted in Tanzania (Ruffo *et al*., 2002) and other parts of Ethiopia (Getachew Addis *et al*., 2005) also revealed that the sale of wild food plants supplements low farm returns, and contributes additional income to households.

Table 4. *List of marketable, wild edible trees and shrubs*

Scientific name	No. of respondents	Rank
Menya tetraphylla (Schweinf. ex Hiern) Robyns	26	1
Balanites rotundifolia (Van Tilghem) Blatter	19	2
Opuntia ficus-indica (L.) Miller	8	3
Sclerocarya birrea (A. Rich.) Hochst	7	4

Density of wild edible trees and shrubs

The density of wild edible trees and shrubs in the study area varied from site to site. In the mid-altitude woodlands of Alduba *kebele*, the density of edible trees and shrubs was 312 stems ha^{-1}, whereas it was only 25 stems ha^{-1} in the lowlands of Shalla *kebele* (Table 5). The density of wild edible trees and shrubs increased with altitude, as did that of the other trees and shrubs.

Production potential of wild edible trees and shrubs

The total harvestable yield per hectare of edible materials varied from site to site, with values ranging between 85–382 kg ha^{-1} (Table 5). The yield of edible materials also varied with the type and age of the species. According to respondents, the quantity of harvestable material per tree is generally small. For instance, the species *Crateva adansonii* DC. does not produce more than seven fruits (1.5 kg) per production cycle, and *Salvadora persica* L. also does not produce more than 3 kg per production cycle. According to the community, this low production potential is the major limitation of some wild edible trees and shrubs, as has also been reported elsewhere (Guinand & Dechassa Lemessa, 2000). It is, therefore, advisable to initiate selection and breeding programmes for such species, to increase production. The harvestable yield increased with altitude. This is attributed to the high density of edible trees and shrubs, which increases with altitude, resulting in a higher yield of harvestable material per unit area of land, as was also reported by Becker (1983).

Table 5. *Density and estimated yield of wild, edible trees and shrubs*

Kebele	Altitude (m a.s.l.)	Total no. of trees and shrubs/plot	No. of edible trees and shrubs/plot	Density of edible trees and shrubs ha^{-1}	Total prod/ha (kg)
Shalla	500	45	16	25	85.00
Luka	600	89	43	67	155.00
Alduba	1250	130	50	312	173.00
Shaba	1400	171	28	175	219.18
Olka kibo	1500	183	45	281	381.79
Kako	1300	165	29	181	193.03

Utilisation practices of wild edible trees and shrubs by the Benna and Tsemay community

Of the collected wild edible trees and shrubs, trees comprised 18 species (60%), and the remaining 12 species (40%) were shrubs. This result as regards growth form is in agreement with the ethnobotanical study of wild edible plants in Kara and Kwego (Tilahun Teklehaimanot & Mirutse Giday, 2010), but disagrees with the report from Derashe and Kucha District (Kebu Balemie & Fassil Kebebew, 2006), which revealed that wild edible materials are largely collected from shrubs. These differences could be attributed to the composition of the dominant species in the respective localities. The proportional abundance of wild edible trees and shrubs in the landuse system was, in decreasing order, open woodland (40%), dense woodland (33%) and cultivated land (17%) (Appendix 4). In some cases, these plants are semi-domesticated, because the local people manage them in ways that ensure their conservation and regular availability, even occasionally cultivating them.

The parts of wild edible trees and shrubs consumed include fruit, seed and leaf. Fruits are the dominant edible parts (80%) consumed by both ethnic groups (Table 2; Appendix 4). The dominance of fruits as edible parts has also been reported in most previous studies undertaken in Ethiopia (see Zemede Asfaw & Mesfin Tadesse, 2005; Getachew Addis *et al*., 2005; Kebu Balemie & Fassil Kebebew, 2006; Tilahun Teklehaymanot & Mirutse Giday, 2010). Contrary to this finding, Mohammed Ali *et al*. (2008) reported that leaves and stems are the most widely used parts of wild edible trees and shrubs in the West Bank of Palestine. This difference might be due to variation in the available species, and culture of the communities with respect to food preference and preparation.

As regards the mode of consumption, 23 species (76.7%) are consumed raw or without further processing, five species (16.7%) are consumed cooked or roasted and two species (6.7%) are consumed either fresh or cooked (Appendix 4). This result is in agreement with the findings of previous studies conducted in Southern Ethiopia (Guinand & Dechassa Lemessa, 2000; Kebu Balemie & Fassil Kebebew, 2006). Most of the wild edible trees and shrubs that require further processing are consumed as emergency food, at a time of chronic food shortage. On the other hand, the respondents indicated that some of these edible plants are poisonous if consumed raw. One such example is the edible fruit of *Boscia angustifolia* A. Rich., which must be cooked for a long time, because it is poisonous if eaten raw (Appendix 4).

Traditional management practices and threats to wild edible trees and shrubs

The woodlands and their resources are the common property of the community in the study area. However, there are certain restrictions on their use, which is controlled by the council of elders. For instance, the cutting for firewood of big trees, as well as edible and medicinal trees and shrubs, is forbidden. On the other hand, the keeping of individual beehive-hanging trees, which pass from father to son, is a common tradition and management practice of both ethnic groups (Table 6).

The Tsemay ethnic group protect their resources against the collection of edible materials by other tribes. They collect these wild edible materials first from communal land, then from their farmland. This is because there are few alternative ways of obtaining food in the area, owing to the harsh climate. This result is consistent with the finding of Wubalem Tadesse *et al*. (2007), who reported that the

Table 6. *Traditional management practices for wild edible plants*

Traditional management	Number of respondents	
	Benna (n = 40)	Tsemay (n = 20)
Retain trees and shrubs when opening up new farmland	16	4
Prevent the use of trees and shrubs by other tribes	0	6
Collect from communal land before farmland	0	3
No cutting of wild edible and medicinal trees	24	5
Clearing the ground under the canopy to facilitate collection of fallen fruits	0	2

development of non-timber forest products (NTFPs) is a key to the sustained management and development of drylands which, owing to their harsh climate, have few alternative means of livelihood.

Wild edible trees and shrubs in the study area face some challenges that threaten their existence. According to the respondents, the expansion of agriculture is the major threat, followed by the fire hazard (Table 7). Over time, the community is changing from a pastoral, to an agropastoral way of life. The major form of agriculture practised by the community is shifting cultivation, which requires the clearing of natural vegetation to open up new farmland. Also, agropastoralists set fire to the woodlands to create fresh grazing and to eliminate parasites and pests. These practices adversely affect wild edible trees and shrubs, leading to a reduced food supply. The challenges facing wild edible plants have also been reported in previous studies (Guinand & Dechassa Lemessa, 2000; Tigist Wondimu *et al*., 2006). Hence, strategies should be designed to protect and domesticate these plants for future use.

Conclusions

The Benna Tsemay community of Southern Ethiopia faces chronic food shortages because of the harsh environment of the area. These food shortages are partly compensated for by the collection of wild edible materials from communal woodlands, and farms. Little is known about these wild edible trees and shrubs, their nutritional value, their production level, the possibility of storage or possible long-term side effects, such as toxicity.

The analysis of household interviews showed that wild edible materials collected

Table 7. *Threats to wild edible and medicinal trees and shrubs*

Threats	No. of respondents		Respondents (%)	Rank
	Benna	Tsemay		
Expansion of agriculture	12	3	25.0	1
Fire hazards	7	6	21.7	2
Overgrazing	7	4	18.3	3
Construction of new road	6	2	13.3	4
Drought	2	5	11.7	5
Collection of firewood and construction materials	6	-	10.0	6
Total	40	20	100	

from trees and shrubs make a major contribution to the dietary intake of the community, either in times of seasonal food shortage, to fill a gap and supplement staple food in normal times, and for use as emergency food during famine. In addition to the household food supply, edible parts are collected from some species of trees and shrubs, and sold in the local market to generate income. In general, these results indicate that wild edible trees and shrubs should be given due consideration when strategies are developed to fight food insecurity and to improve rural livelihood. The following suggestions and recommendations are presented for the better utilisation and conservation of wild edible trees and shrubs in the study area:

• Promote wild edible plants as valuable resources to improve household food security, nutrition and income, especially for households living in the study area or other dry or marginal areas.

• Incorporate wild food plants in agricultural development programmes, placing special emphasis on their nutritional value and production potential.

• More research should be carried out on the nutritional value of wild edible plants.

• Propagation and domestication of wild food plants should be started through the efforts of governmental and non-governmental organisations.

• *In-situ* conservation of edible trees and shrubs should be enhanced through the participation of the local community.

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***Appendix* 1.** Rank of edible trees and shrubs having a supplementary role in household food security

Scientific name	Ethnic group		Proportion (%)	Rank
	Benna (*n* = 40)	**Tsemay** (*n* = 20)		
Balanites rotundifolia (Van Tilghem) Blatter	4	8	20.0	1
Meyna teterphylla (Schweinf. ex Hiern) Robyns	8	3	18.3	2
Canthium pseudosetiflorum Bridson	5	1	10.0	3
Sclerocarya birrea (A. Rich.) Hochst	4	2	10.0	3
Rhus quartiniana A. Rich.	4	-	6.7	4
Tamarindus indica L.	3	1	6.7	4
Ziziphus mucronata Willd.	3	-	5.0	5
Salvadora persica L.	1	2	5.0	5
Crateva adansonii DC.	2	-	3.3	6
Grewia villosa Willd.	1	1	3.3	6
Ximenia americana L.	1	1	3.3	6
Grewia tenax (Forssk.) Fiori	1	1	3.3	6
Opuntia ficus-indica (L.) Miller	1	-	1.7	7
Psydrax schimperiana (A. Rich.) Bridson	1	-	1.7	7
Carsia spinarum L.	1	-	1.7	7

***Appendix* 2.** Major trees and shrubs having a seasonal role in household food security

Scientific name	Benna (*n* = 40)		Tsemay (*n* = 20)	
	No. of respondents	Proportion (%)	No. of respondents	Proportion (%)
Cleome monophylla L.	21	52.5	-	-
Securidaca longepedunculata Fresen	14	35.0	-	-
Balanites aegyptiaca (L.) Del.	5	12.5	20	100

Appendix 3. Rank of trees and shrubs used in emergency in the study area

Scientific name	No. of respondents		Total	Rank
	Benna (*n* = 40)	**Tsemay** (*n* = 20)		
Flacourtia indica (Burm.f.) Merr.	6	6	12	**1**
Ficus vasta Forssk.	5	1	6	**2**
Ficus sur Forssk.	6	0	6	**2**
Euclea divinorum Hiern.	1	4	5	**3**
Piliostigma thonningii (Schum.) Milne-Redh.	2	3	5	**3**
Diospyros mespiliformis Hochst. ex A. DC.	4	1	5	**3**
Grewia velutina (Forssk.) Vahl.	5	0	5	**3**
Senna singueana (Del.) Lock	5	0	5	**3**
Leucas glabrata (Vahl) Sm in Rees.	2	2	4	**4**
Borassus aethiopum Mart.	3	0	3	**5**
Boscia angustifolia A. Rich.	0	2	2	**6**
Lannea schimperi (Hochst. ex A. Rich.)	1	1	2	**6**

***Appendix* 4.** Utilisation practices of wild edible trees and shrubs

Scientific name	Growth form	Parts used	Utilisation practices	Habitat	Other uses
Balanites aegyptiaca (L.) Del.	tree	fruit and leaf	The ripe fruits are collected and the pulp eaten; the seeds are discarded. The newly grown leaves are also collected and cooked then consumed with other food, like vegetables	Open woodland	Shade
Balanites rotundifolia (Van Tilghem) Blatter	tree	fruit	The ripe fruits are collected either from the ground or picked from the tree and the pulps of the fruits eaten and the seed dried and stored. The dry seeds are cooked and mixed with cooked maize seed and consumed, or the fruit is cooked and used as juice. The seed is sold at local markets	Open woodland	Shade
Borassus aethiopum Mart.	tree	fruit	The fruit is collected from the ground or tree; the flour is consumed	Dense woodland	Construction
Boscia angustifolia A. Rich.	shrub	seed	The seeds are collected and cooked for a long time, then eaten	Farmland	Shade
Canthium pseudosentiflorum Bridson	shrub	fruit	Ripe red fruit are collected from the shrub and eaten raw. The fruits are very sweet, people collect in competition with wild animals	Dense woodland	Bee forage
Carissa spinarum L.	shrub	fruit	The fruits are collected directly and the pulp eaten fresh	Dense woodland	Medicine
Cleome monophylla L.	tree	leaf	The small leaves are collected and cooked and consumed like cabbage together with other food	Farmland	Bee forage
Crateva adansonii DC.	shrub	fruit	The ripe fruits are collected and consumed raw	Open woodland	Shade
Diospyros mespilifomis Hochst. ex A. DC.	shrub	fruit	The fruits are collected and eaten raw	Open woodland	Shade
Euclea divinorum Hiern.	shrub	fruit	The ripe fruit is collected and consumed raw	Open woodland	Medicine
Ficus sur Forssk.	tree	fruit	Ripe fruits are collected either from the tree or the ground, dried and ground and the flour is consumed in various dishes	Open woodland	Bee forage
Ficus vasta Forssk.	tree	fruit	The ripe fruits are collected from the ground or tree and consumed raw or the flour of the seeds is cooked and consumed	Open woodland	Bee forage

Appendix **4.** *continued*

Scientific name	Growth form	Parts used	Utilisation practices	Ecological niches	Other uses
Flacourtia indica (Burm.f.) Merr.	tree	fruit	Ripe fruit are collected from the tree and eaten raw	Dense woodland	Bee forage
Grewia tenax (Forssk.) Fiori	tree	fruit	The red ripe fruits are collected and eaten fresh. It is very sweet, but unripe fruit creates stomach dryness	Shrubland	Fodder
Grewia velutina (Forssk.) Vahl.	tree	fruit	The ripe reddish brown fruit are collected and the pulp is eaten raw	Dense woodland	Bee forage
Grewia villosa Willd.	tree	seed	The dry pod is collected, the pod is removed and the seed consumed raw	Dense woodland	Bee forage
Lannea schimperi (Hochst. ex A. Rich.)	tree	fruit	The ripe red fruits are collected from the tree and consumed directly fresh	Farmland	Construction
Lecus glabrata (Vahl) Sm in Rees.	shrub	fruit	Ripe fruits are collected and eaten raw	Open woodland	Firewood
Meyna tetraphylla (Schweinf. ex Hiern) Robyns	shrub	fruit	Fruits are collected from the shrub and the pulps consumed. The fruits are also marketable	Farmland	Firewood
Opuntia ficus-indica (L.) Miller	shrub	fruit	The yellow fruits are collected and consumed raw by removing the pulp	Farmland	Fence
Piliostigma thonningii (Schum.) Milne-Redh.	tree	seed	The brown pod is collected, the pod is removed and the seed consumed raw	Open woodland	Shade
Psydrax schimperiana (A. Rich.) Bridson	tree	fruit	The ripe black fruits are collected directly from the tree and consumed raw	Dense woodland	Firewood
Rhus quartiniana A. Rich.	shrub	seed	The seeds are eaten raw after removing the pulp	Open woodland	Bee forage
Salvadora persica L.	shrub	fruit	Ripe red fruit are collected by hand squeezed in water and drunk as juice	Shrubland	Medicine
Sclerocarya birrea (A. Rich.) Hochst	tree	fruit	The yellow ripe fruit are collected and consumed raw	Dense woodland	For hanging beehives
Securidaca longepedunculata Fresen	tree	leaf	Leaves are cooked and eaten together with any food.	Dense woodland	For hanging beehives
Senna singueana (Del.) Lock	shrub	fruit	Ripe red fruits are collected and eaten fresh	Open woodland	Fodder
Tamarindus indica L.	tree	fruit	Ripe dark brown pods are collected from the tree and the pulp is consumed. The pulp is also squeezed in water and drunk as juice	Open woodland	Medicine
Ximenia americana L.	shrub	fruit	The ripe fruits are collected and consumed raw	Shrubland	Medicine
Ziziphus mucronata Willd.	tree	fruit	Ripe fruits are collected from the tree and consumed raw	Open woodland	Fodder