

Gender and Socioeconomic Factors Influencing Domestication of Medicinal Plants in North West of Ethiopia

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Abstract

This paper examines the influence of gender and socio-economic factors on domestication of medicinal plants in Assosa Zone of Western Ethiopia. Participatory wealth ranking, structured and semi-structured interviews, botanical surveys and participant observations were the main methods employed in data collection. The results showed that the domestication has played a fundamental role in conserving medicinal plants in the study area. Forty (89 percent) and 12 (27 percent) out of 45 indigenous plant species were domesticated on farms and around homesteads, respectively. About 89 percent of the respondents (n = 173) had domesticated medicinal plants on their farms and around homesteads. Gender featured as important factor that had influence on this practice, with male-headed households shown to outdo the female-headed households in the domestication effort. This can be attributed to social and cultural reasons that besides dispossessing women of the tenure rights over resources and land, they also subject them to heavy workloads and, therefore, diminish the time required for domestication. The number of domesticated medicinal plants also depended on age, affluence, farm size, household size and ethnicity. In conclusion, the paper urges that since domestication - an important strategy for conserving threatened medicinal plants in farmlands and around homesteads - is being influenced by gender and socio-economic factors, agroforestry research should focus, not only on integrating forest plants in farmlands, but also on socio-cultural, socio-economic and institutional aspects affecting the whole system of domestication.

Keywords: biodiversity conservation, cultural values, medicinal plants, livelihoods.

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INTRODUCTION

The potential role of medicinal plants

Medicinal plants are essential components of primary health care, especially for the rural communities, who by geographical and economic reasons cannot access the modern western medical services. Literature has cited World Health Organization (WHO) estimating world population relying on traditional medicines for their primary health care to be four billion people, 80% of them coming from developing countries (Augustino and Gillah 2005; Schippmann *et al* 2006). The high reliance on traditional medicines is mainly caused by a low ratio of the university trained doctor to rural populations. For example, the ratios of traditional healers and that of medical doctors to patients in Ethiopia were 1:1100 and 1: 33,000 1:708 and 1:25,000 (World Bank 1993); Malawi - 1:138 and 1:50,000 (Msonthi and Seyani 1986) and; Mozambique - 1:200 and 1:50,000 (Green 1994). The population growth and worsening economic situation is exacerbating this imbalance and there is no hope to reverse this trend in the near future (Ishengoma and Gillah 2002; Augustino and Gillah 2005). In Ethiopia, for example, the ratio of doctors to patients had decreased from 1:33,000 in 1993 to 1:17,000 in 2016 [Abdallah *et al* 2007].

Prominence of traditional medicines, manifested by a high imbalance ratio between traditional healers and modern medical doctors, are caused by - among other factors - inadequate medical facilities, poor accessibility to western medical services, low purchasing power among the rural people and the trust that people have over the efficacy of medicinal plants (Green 1994; Thomas 2002; Hamilton 2003; Abdallah *et al.* 2007). The reality that the world is experiencing an increasing rate of resistance by pathogens to some of the synthetic drugs and that some of the diseases such as cancer, diabetes and AIDS have not found treatments from modern medicine has also increased the popularity of the traditional medicines (Msuya, 1998; Otieno, 2000; Augustino and Gillah 2005; Msuya and Kideghesho 2009). The western health care system has been criticized for divorcing treatment from the patient's culture; failure to tell the patients the nature and cause of their illness; tendency of removing the patients from the family and community, stripping of their identity and forcing them into a sterile hospital setting and; tendency of the treatment to address patient's biological manifestation of the illness rather than healing the spiritual aspects of the illness (Lashari 1984; LeBeau 1998).

Medicinal plants are popular, not only locally but also globally. Statistics indicate that between 1991 and 1998 the 12 leading countries of import of medicinal plants material paid over US\$1bn to import about 343,000 tonnes while 12 leading countries of export earned over 640 million from export of about 282,000 tonnes (Lange 2002). The top three countries of export of medicinal plants in the world were China, India and Germany which exported 139,750; 36,750 and 15,050 tonnes, respectively. The three leading countries for import with tonnes in brackets included Hong Kong (73,650), Japan (56,759) and USA 56,000 (*ibid*). The US National Cancer

Institute has identified over 1,400 tropical forest plants with the potential to fight cancer (WCMC 1992.). *Catharanthus roseus*, native to Madagascar, is one of such plants. This species that has been used for generations by traditional healers is now an important raw material for drugs effective against Hodgkins disease and other forms of cancer (ibid.).

Threats facing the medicinal plants

The WHO (1998) estimates of the number of plant species used medicinally worldwide stood at 72,000. This is about 17.1% of the total number of flowering plant species i.e. 422,000 (Govaerts 2001). The world trends such as market forces, population growth and high demand of these species – not only for primary health care, but also for commercial and several other purposes such as fuelwood, timber and poles - have subjected them to overexploitation. About 21% of medicinal plant species (i.e. 15,000 species) are threatened worldwide (Bramwell 2003). Furthermore, their habitats are increasingly being destroyed through land clearing for agriculture, settlements and other developments as well as accidental and deliberate fires (Millenium Ecosystem Assessment 2005; IUCN 2006; IUCN 2008).

Susceptibility of medicinal plants to excessive harvesting is a function of various biological factors such as narrow geographic distribution, habitat specificity, slow growth rates and destructive harvest for their roots, bark or the entire plant (Schippmann *et al* 2006). Excessive harvesting implies exploiting the species at a rate that exceeds the annual sustained yield. This leads to genetic erosion of species that are not in cultivation as exemplified by *Curcuma* spp. and *Parkia roxburghii* in East Java and *Dioscorea deltoidea* in the Himalayan foothills of northern India (WCMC 1992). The later is a major source of diosgenin used in the manufacture of contraceptive pills (ibid.). On the other hand, destructive harvest involves extraction of medicinal plants that involves ring debarking and root cutting and, therefore, killing of the entire plants. This is epitomized by *Prunus africana* in West Africa and *Warbugia salutaris* in Kenya (Kokwaro 1991) and South Africa (Schippmann *et al* 2006).

Trade is one of the leading factors threatening medicinal plants worldwide. Many species are earmarked as raw materials by over 1,000 drug manufacturing companies and in export as crude extracts (WCMC 1992). A demand for many popular and effective medicinal plant species in Europe, North America and Asia is growing between 8% and 15% per annum (Grünwald and Büttel 1996). Iqbal, (1993) and Leaman (2002) attribute the following eight factors to the increased demand for medicinal plants and herbal remedies in the developed countries: increasing costs of institutional, pharmaceutical-based health care; interest of individuals, communities and national governments in greater self-reliance in health care; interest of communities and national governments in small-and large-scale industrial development based on local/national biodiversity resources; increasing success in validating the safety and efficacy of herbal remedies; legislation improving the status of herbal medicine industry; renewed interest of companies in isolating useful compounds from plants; search for new drugs and treatments of serious and drug-resistant diseases and; marketing strategies by the companies dealing in herbal medicine.

The impact of increased international demand for medicinal plants has increasingly been acknowledged in literature. For example, loss of valuable plant genetic resources in some countries of Asia has been documented following overexploitation of medicinal plants such as *Curcuma* spp., *Voacanga gradifolia*, *Orthosiphon aristatus*, and *Rauvolfia serpentine* (WCMC 1992). In Tanzania about nine medicinal plants that were reported to be traded locally and internationally were identified by the Wildlife Trade Monitoring Network (TRAFFIC) as the most in need of conservation, management and research due to their endangered status caused by excessive harvesting. These species were: *Dioscorea dumetorum*, *Cadaba farinosa*, *Milicia excelsa*, *Acalypha fruticosa*, *Harrisionia abyssinica*, *Steganotaenia araliacea*, *Acacia melifera*, *Ehretia amoena*, and *Wedelia mossambicensis* [Marshall 1998]. Similar impact of trade is reported for *Prunus africana* in West Africa and Madagascar, *Warbugia salutaris* in South Africa and *Saussurea costus* in the Himalayas (Schippmann *et al* 2006). Threat of extinction prompted addition of the following 17 medicinal plants into CITES (Convention on International Trade of Endangered Species of Wild Fauna and Flora) Appendices: *Adonis vernalis*, *Aquilaria malaccensis*, *Cistanche deserticola*, *Dioscorea deltoidea*, *Guaiacum officinale*, *Guaiacum sanctum*, *Hydrastis Canadensis*, *Nardostachys grandiflora*, *Panax ginseng*, *Panax quinquefolius*, *Picrorhiza kurroo*, *Podophyllum hexandrum*, *Prunus Africana*, *Pterocarpus santalinus*, *Rauvolfia serpentine*, *Saussurea costus* and *Taxus wallichiana* (Schippmann *et al* 2006). It is because of the threats facing medicinal plants, that the Medicinal Plant Specialist Group was founded in 1994, under the auspices of the Species Survival Commission of the IUCN – the World Conservation Union-to increase global awareness of conservation threats to medicinal plants and to promote conservation actions. One of such actions is domestication.

Domestication of medicinal plants

Domestication has been defined as an indigenous agroforestry practice that involves retaining plant species of forest origin in the farms during the process of clearing land for cultivation and/or bringing forest plants to the

farms or homesteads for the purpose of reducing the exploitation pressure of wild stocks (Shepherd 1992; Wiersum 1997; Kessy and Temu 2000). The practice is regarded as one of the conservation options that can relieve a pressure for medicinal species which are most susceptible to threat of extinction due to rarity and slow-growth rates (WCMC 1992; Augustino and Gillah 2005; Uniyal *et al* 2000; Schippmann *et al* 2006; Msuya and Kideghesho 2009).

Besides relieving pressure of overexploitation, domestication of medicinal plants has other numerous advantages over wild collection. According to Schippmann *et al.* (2006) domestication: guarantees continuing supply of raw material; makes reliable botanical identification possible; secures steady supply of herbal medicines (home gardens); makes the quality standards easy to maintain; makes controlled post-harvest handling possible and provides in-country value-adding. Furthermore, with domestication wholesalers and pharmaceutical companies can agree on volumes and prices over time with the grower; resource price remains relatively stable over time; certification as organic production is possible and; the selection and development of genotypes with commercially desirable traits from the wild or managed populations may offer opportunities for the economic development of the medicinal plant species as a crop.

Influence of gender and socioeconomic factors on domestication of medicinal plants

Domestication of medicinal plants has been practiced in Ethiopia since prehistoric times (Wiersum *et al.*, 1985; Kajembe, 1994; Kaoneka and Solberg, 1997; Moshi, 1997, Msuya, 1998). Although it is unlikely that the situation will change in the near future, there are a number of factors affecting domestication of medicinal plants in this area, which need to be examined critically and documented for sustainable use and management purposes. The focus of this paper is gender and other socio-economic factors. Knowledge of these factors is essential as it may provide a framework for prioritization of management actions and allocation of resources available for management.

Gender, one of the important factors that can influence resource conservation, has been defined as the relations between men and women, both perceptual and material (FAO 1997). The main focus of gender issues entail women and relations with men, their roles, access to and control over resources, division of labour, interests and needs (Augustino and Gillah 2005; Kingazi *et al* 2008). In almost all communities worldwide, women and men have different gender-based roles, responsibilities, needs as well as local knowledge pertaining to access to and control over their environment. Women's capacities and willingness to conserve resources differ from those of men. Similarly, the way women are affected by environmental degradation and declining biodiversity resources and their coping strategies against these effects are quite different from those of men. However, there is a tendency of overlooking these aspects (Talhok *et al.* 2001). Augustino and Gillah (2005:45) put it correctly by arguing that "Women are not more important than men, but they deserve special attention as their roles and needs are often overlooked." They urge that because of women's marginal economic status and special interest they have in plants, domestication should be accorded a priority to them. The reality that in rural societies, women are responsible for the health of children and spend more time in caring for the sick, prompts a meticulous analysis of the influence of gender on domestication of medicinal plants as one of the important coping strategies against decline of these resources.

Besides gender, other socio-economic factors such as age, education, wealth, ethnicity, farm and household size can influence the domestication efforts. These factors also need to be critically analysed to understand how they enhance or impede domestication of medicinal plants. This paper seeks to show how gender and socio-economic factors can influence the domestication of medicinal plants in Western Ethiopia. It is framed around two main questions: (1) which medicinal plants are domesticated in farms and around homesteads and (2) how does gender and socio-economic factors influence domestication of medicinal plants.

STUDY AREA AND METHODOLOGY

Assosa Zone is one of the three Zones in Benishangul-Gumuz Region west of Ethiopia. Assosa Zone is bordered on the south by the Mao-Komo special woreda, on the west by Sudan, and on the northeast by the Kamashi Zone (Fig. 1). Based on the 2007 Census conducted by the Central Statistical Agency of Ethiopia (CSA), this Zone has a total population of 310,822, of whom 158,932 are men and 151,890 women. 39,957 or 87.14% of population are rural inhabitants. The four largest ethnic groups reported in the Assosa Zone were the Berta (59.95%), the Amhara (23.86%), the Oromo (10.31%), and the Tigraways (1.5%), 1.48% of the population was from Sudan; all other ethnic groups made up 2.9% of the population. Main languages are the Rutana/Berta (59.31%), Amharic (25.7%), Oromo (10.68%), and Tigrigna (1.07%). The majority of the inhabitants were Muslim, with 74.08% of the population reporting that they held that belief, while 16.51% practiced Ethiopian Orthodox Christianity, and 8.57% were Protestant (CSA, 2007).

The people of the study area which belongs to the Rutana, Amharic, Arabic and Oromiffaa speaking community are mainly subsistence farmers predominantly living in rural communities, which informed their dependence on plants for their healthcare needs. For the purpose of the survey, 190 traditional healers from

twelve kebeles were purposively selected and visited in their homes for inventory and identification of plants cultivated in their home gardens.

The process of data collection includes identification and specimen collection of the medicinal plants cultivated in the home gardens of the local communities. Information concerning the frequency of collection, distribution, mode of propagation, conservation strategies, uses and local names of the plant were obtained from traditional healers. The resulting data was analyzed using simple percentages (frequencies) analysis using Excel 2016. The plants were scientifically identified using floras and comparison of plant specimen collected with voucher specimens at the herbarium of Ethiopian Biodiversity Institute. A semi structured questionnaire was administered by interpreting it into Amharic, Rutana/Arabic and Oromiffaa languages which was mostly understood by the local communities under the study. Informed consent of the THs was obtained to make the information public before they were interviewed. Stipends were offered in appreciation of the time spent in taking us round their homesteads and responding to our questions.

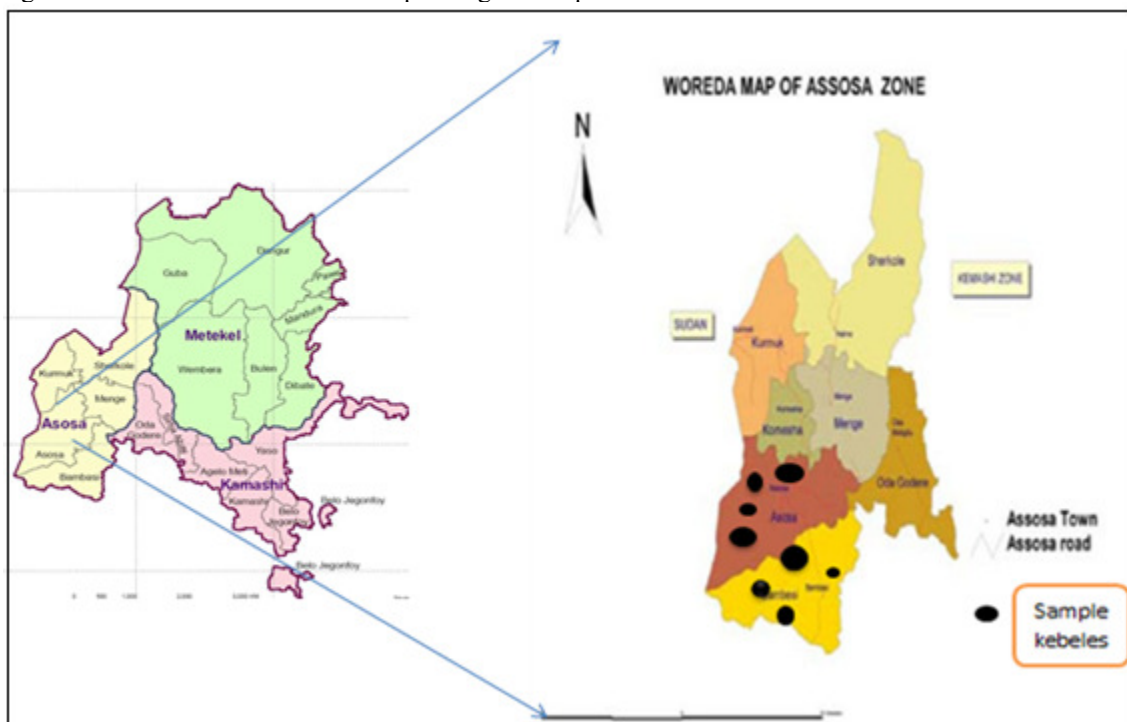


Figure 1: Map of the study area

Data analysis

Data collected in phase 1 were analysed with the help of the communities, and results were communicated back to them. The results were triangulated with data from the second and third phases. Data collected in the phases 2 and 3 were analyzed using both qualitative and quantitative methods. The qualitative data were analysed using content and functional analysis techniques (Kajembe, 1994); whereas quantitative data were analysed using Statistical Package for Social Science (SPSS) and Microsoft excel software. Regression analysis was used to establish the influence of different socio-economic parameters on domestication of medicinal plants. The general model used in regression analysis was in the form of:

$$Y_i = a + b_1x_1 + b_2x_2 + \dots + b_kx_k + e_2$$

Where Y_i = the i^{th} observed value of the dependent variables (i.e. domestication effort)

x_1 to x_k = independent variables (i.e. gender, age, family size, farm size, education, wealth and ethnicity)

a = intercept at Y axis (dependent variable)

b_1 to b_k = regression coefficients

e = random disturbance error

$i = 1, 2, \dots, n$; where n is the total number of variables

Specifically, the hypotheses tested were:

$H_0: \beta = 0$; meaning that there is no correlation between dependent and independent variables, and

$H_1: \beta \neq 0$; meaning that there is a positive or negative relationship between dependent and independent variables

T-test was also employed to determine the influence of gender by comparing the number of trees domesticated between male and female-headed households.

RESULTS AND DISCUSSION

Domestication of medicinal plants

Being an important practice in agroforestry, domestication has played fundamental role in conservation of medicinal plants in the study area. Forty (89%) and 12 (27%) out of 45 medicinal plant species were domesticated on farms and around homesteads, respectively (Table 1). These species treat numerous diseases as shown in Table 1.

Table 1: Domesticated medicinal plants identified in Assosa Zone, sites of domestication and diseases treated (■ = species present)

Species Name	Family	Sites of domestication		Diseases treated
		on farms	around homesteads	
<i>Adansonia digitata</i>	Bombacaceae	■		Stomach pains and teeth problems
<i>Adenia cissampeloides</i>	Passifloraceae		■	Malaria and stomach ache
<i>Albizia gummifera</i>	Mimosaceae	■		Chest pain, headache and occasional fever
<i>Albizia schimperiana</i>	Mimosaceae	■		Coughs and rheumatism
<i>Artemisia afra</i>	Compositae		■	Malaria, sore throat and expulsion of intestinal worms
<i>Basella alba</i>	Basellaceae		■	Stomach problems especially for women
<i>Bridelia micrantha</i>	Euphorbiaceae	■		Worms, diarrhoea and headache
<i>Catha edulis</i>	Celastraceae		■	Malaria, coughs, stomachache, Gonorrhoea & influenza
<i>Clausena anisata</i>	Rutaceae		■	Stomach pains, worms, diarrhoea, headache, malaria and influenza
<i>Clerodendrum myricoides</i>	Verbenaceae		■	Venereal diseases and malaria
<i>Commelina latifolia</i>	Commelinaceae		■	Eye diseases
<i>Commiphora eminii</i>	Burseraceae		■	Stomach pains, snakebite, dysentery, leprosy and fever
<i>Cussonia arborea</i>	Araliaceae		■	Snakebite, malaria and constipation
<i>Deinbollia borbonica</i>	Sapindaceae		■	Hernia and infertility to women
<i>Dodonaea angustifolia</i>	Sapindaceae		■	Toothache and intestinal worms
<i>Dracaena usambarensis</i>	Agavaceae		■	Abdominal pain
<i>Dracaena afromontana</i>	Agavaceae		■	Abdominal pain
<i>Ehretia cymosa</i>	Boraginaceae		■	Brucellosis
<i>Erythrina abyssinica</i>	Mimosaceae		■	Malaria, convulsions for children, anthrax and snakebite
<i>Euclea divinorum</i>	Ebenaceae		■	Teeth ache and stomach ulcers
<i>Ficus sycomorus</i>	Moracaceae		■	Diarrhoea, sore throat and chest pain
<i>Ficus thoringii</i>	Moracaceae		■	Medicines to cure witched people
<i>Flueggea virosa</i>	Euphorbiaceae		■	Bilharzias, malaria, stomach-ache and itching skin
<i>Harrisonia abyssinica</i>	Simaroubaceae		■	Fever, nausea, vomiting, snakebite, tuberculosis, stomachache and malaria
<i>Grewia similes</i>	Tiliaceae		■	Wounds, sore throat and snakebite
<i>Hibiscus fuscus</i>	Malvaceae		■	Pneumonia and sore throat
<i>Jasticia engleriana</i>	Acanthaceae		■	Stomach pains, coughs and colds
<i>Lonchocarpus capassa</i>			■	
<i>Maesa lanceolata</i>	Myrsinaceae		■	Diarrhoea, teeth ache and rashes
<i>Markamia lutea</i>	Bignoniaceae		■	Gonorrhoea, intestinal worms, backache and fresh wounds

<i>Microglossa oblongifolia</i>	Compositae			Stomach-ache and hernia
<i>Myrica salicifolia</i>	Myricaceae			Tuberculosis, chest pain, reduce pain for cancer patients
<i>Newtonia buchananii</i>	Mimosoidae			Brucellosis and inflammation of joints
<i>Parinari excelsa</i>	Chrysobalanaceae			Gonorrhoea, colds and coughs
<i>Plectranthus barbatus</i>	Labiatae			Malaria, teeth ache and stomach pains
<i>Prunus africana</i>	Rosaceae			Hernia and neck ache, cancer
<i>Psidium guajava</i>	Myrtaceae			Stomach pains
<i>Rauvolfia caffra</i>	Apocynaceae			Rheumatism, pneumonia, intestinal worms and hypertension
<i>Senna singueana</i>	Caesalpiniaceae			Malaria, convulsions, epilepsy, coughs, intestinal worms and constipation
<i>Solanum nigrum</i>	Solanaceae			Malaria, coughs
<i>Syzygium guinense</i>	Myrtaceae			Intestinal worms and dysentery
<i>Tefairia pedata</i>	Cucurbitaceae			Improve lactation after child birth
<i>Toddalia asiatica</i>	Rutaceae			Malaria, chest pain, convulsion for children and infertility for women
<i>Trema orientalis</i>	Ulmaceae			Coughs, sore throat, asthma, gonorrhoea, malaria, yellow fever, teeth ache and intestinal worms
<i>Vangueria infausta</i>	Rubiaceae			Headache, stomachache and fever
<i>Zanthoxylum chalybeum</i>	Rutaceae			Stomach pains and convulsions

On average, each household in the study area had domesticated 5 ± 3 (SE) medicinal plants. The villages located far from the Forest Reserves had domesticated more medicinal plants (an average of 6 ± 4 (SE)) per household) compared to those situated close to forest reserves (4 ± 2 (SE)). Statistically, this difference was significant ($P = 0.09$, $t = 2.62$). Village-wise response also reflected similar situation as indicated in Figure 2. Mender 49, Oromela and Sonka (the villages located far from the Forest Reserves) had high proportion of respondents reported to have domesticated medicinal plants compared to Basha Buda, Tsore Almetema and Gori (villages which bordered the forest reserves) (Fig. 2). This could be attributed to the fact that people from villages sharing the immediate boundaries with the forest reserves can easily meet their medicinal needs from the forests while domestication is more feasible option to those living far from the reserves.

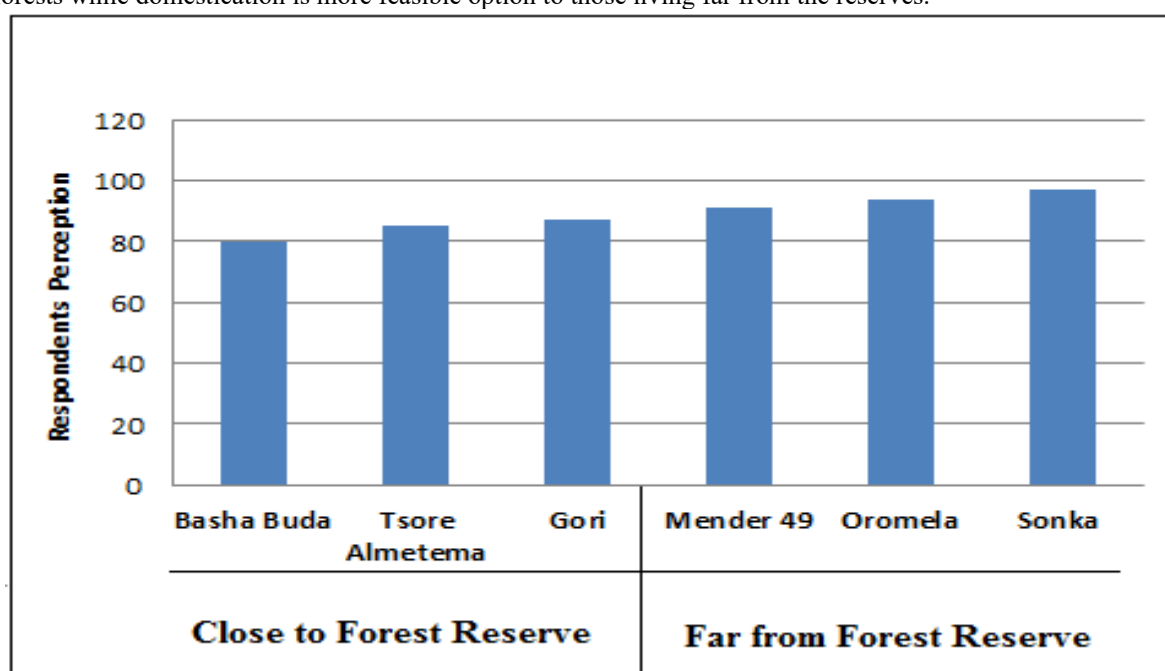


Figure 2: Response on domestication (in percentage) per village in the Western Ethiopia

As depicted by this study, majority of the respondents (89%) reported to have practiced domestication for a long period. These results are in line with Hamilton's findings (1989) which revealed that domestication as part

of the traditional agroforestry system and a conservation practice started in the West of Ethiopia as early as about 20 centuries ago. Similarly, domestication has been reported by various studies conducted in the study area (Kaoneka 1993; Kajembe, 1994; Moshi, 1997; Msuya, 1998; Msuya *et al.*, 2008; Msuya and Kideghesho, in press). Certain medicinal plant species such as *Albizia* spp., *Erythrina abyssinica*, *Catha edulis*, and *Tamarindus indica* were domesticated deliberately to conserve them against excessive harvesting in their natural habitats (the forests).

Efforts of domestication of medicinal plants as a strategy of overcoming the problem of overexploitation are recognized globally. For example, in Cameroon and Madagascar, *Prunus africana*, which is threatened by excessive debarking for export is domesticated in areas bordering the natural forests (Cunningham and Mbenkum, 1993; Dawson, 1997). The bark of the species is used as effective medicine for ailments such as Hernia, cancer and neck ache (Msuya 1998; Augustino and Gillah 2005). Quinine (*Cinchona ledgeriana*) used to manufacture antimalaria drugs has been developed as a major crop species in Indonesia, Tanzania, Democratic Republic of Congo, Burundi, Kenya, Guatemala, Peru, Ecuador, Bolivia, Sri Lanka, Columbia and Costa Rica (WCMC 1992). Formerly, the entire world supply came from only one source – the Andes, and thus the species was at a risk of extinction (ibid). *Papaver somniferum* is domesticated in Turkey, India, Burma and Thailand while *Carica papaya* is domesticated in Sri Lanka, Uganda, Democratic Republic of Congo, South Africa, Tanzania and India (ibid.). Through a botanical survey conducted by Kessy and Temu (2000) in 47 home-gardens in the East Usambara Mountains, 18 domesticated medicinal plants were identified, one of which *Cola usambarensis* being endemic to the area and similar trend was observed in Assosa zone.

Gender influence on domestication of medicinal plants

From this study, it is apparent that gender had significant influence on conservation of medicinal plants through domestication. Female-headed households had domesticated more medicinal plants around homesteads than on farms while for male-headed households more domestication took place on the farms (Figure 2). Overall, male-headed households had domesticated more medicinal plants [6 ± 4 (SE)] than female-headed households [3 ± 4 (SE), $t = 3.77$, $p = 0.002$]. Study in SNNP (Kajembe *et al* 2008) and East Gojam (Kweka 2004) also reported similar results with more men pursuing domestication than women. Given the fact that women are more vulnerable to environmental problems and declining biodiversity, one would have expected the female-headed households to domesticate more medicinal plants than male-headed households. This, however, is not the case, the scenario that can be attributed to land tenure insecurity for women. In these mountains and elsewhere in Tanzania, land ownership is patriarch and only few widowed women could inherit land (Kaoneka, 1993; Msuya, 1998; Kweka 2004; Luoga *et al.* 2004). In a household, a husband makes all the decisions regarding the crops and tree species and the marketing of the products although the women shoulder over 90% of the workload. The heavy workload could also explain why female-headed households had fewer domesticated medicinal plants. In Africa, in general and in Ethiopia particularly virtually all household chores (washing, cooking, fetching water, feeding livestock, caring for children etc.) are exclusively women's responsibility (Fig. 3). Culturally, it is a shame for men to do these tasks. Women perform these household chores in addition to other economic activities such as farming. This gives women less time to invest in domesticating medicinal plants than men.



Figure 3: In Assosa Zone (Benishangul Gumuz Region) virtually all household chores are exclusively women's responsibility

Furthermore, in most cases female-headed households are economically disempowered, and therefore, they can hardly employ people to domesticate and care for medicinal plants. Elsewhere in the world, for example Thailand, domestication of indigenous forest plant species by women is not uncommon. Women were reported to have domesticated a total of 230 species for food, medicines and decorative value around homesteads (Geraldine *et al.*, 1994).

The influence of gender on domestication of medicinal plants is not surprising. This is because the ways in which a culture or society defines the gender roles affect several aspects of life such as household security, family welfare and planning production (Bravo-Bowmann 2000). In almost all communities worldwide, women and men have different gender-based roles, responsibilities, needs as well as local knowledge pertaining to access to and control over their environment (Augustino and Gillah 2005; Kingazi 2008). Similarly, the way women are affected by environmental degradation and declining biodiversity resources and their coping strategies against these effects are quite different from those of men. Women have been recognized as both the victims of environmental degradation and a part of the solution for addressing the underlying causes of this problem (Augustino and Gillah 2005). However, as observed in this study, women's coping strategies against environmental problems are stalled by cultural and economic reasons.

Influence of Socio-economic factors on domestication of medicinal plants

Age

Age of the respondents had significant effect on the number of domesticated medicinal plants in the study area (Table 2). The elders had more medicinal plants retained or planted on their farms and around homesteads than the young people ($P = 0.002$, $R^2 = 65\%$, $t = 3.15$). This is likely to be the case since most of the elders owned bigger farms and were more familiar with medicinal plants. Similar results were reported in East Northern Ethiopia (Kweka 2004) although in Western Ethiopia, the domestication efforts were much higher for younger people than older people (Kajembe *et al.* 2008). The issue of knowledge as a possible reason for elders to domesticate more medicinal plants has also been reported in Kenya, where young people below 20 years knew nothing about medicinal plants unlike the elders (above 60 years old) (Quiroz 1994). There is a general consensus that the indigenous knowledge, which was previously handed down through generations by cultural transmission, is declining with age (Kideghesho 2008; Songorwa *et al.* 2000). The means of transmitting this knowledge, which included folklore or storytelling, continuous observations, practising and attachment on natural resources are no longer effective. Because of formal education, there is less time for recipient (youth) to

interact with their traditional teachers (elders) and laboratory (natural resources). In Ethiopia education system, for example, nursery school begins at the age of five followed by primary school at the age of seven which lasts for seven years. Then a pupil joins secondary school and colleges for four to eight years, often in boarding schools away from the place of birth. Furthermore, the youth are more inclined to western rather than traditional medicines.

Table 2: Summary of the results of regression analysis indicating the influence of socio-economic factors (Xi) on the number of plants retained on farms and around homesteads in the Western Ethiopia

Socio-economic factors Xi	Y		
	R ²	t	P
Age	65%	3.15	0.002
Wealth (assets and income)	81%	3.52	0.001
Education	26%	0.27	0.21
Farm size	45%	2.29	0.023
Household size	52%	2.54	0.012

Affluence

Wealth ranking exercise indicated that majority of the households were poor, followed by the middle class and only 5% was ranked as rich (Fig. 4). These classes were very important in determining the domestication efforts. The number of domesticated medicinal plants was significantly influenced by affluence (P = 0.001, R² = 81%, t = 3.52). Although the poor constituted the majority of households in the study area, they had domesticated fewer medicinal plants than the few wealthy households.

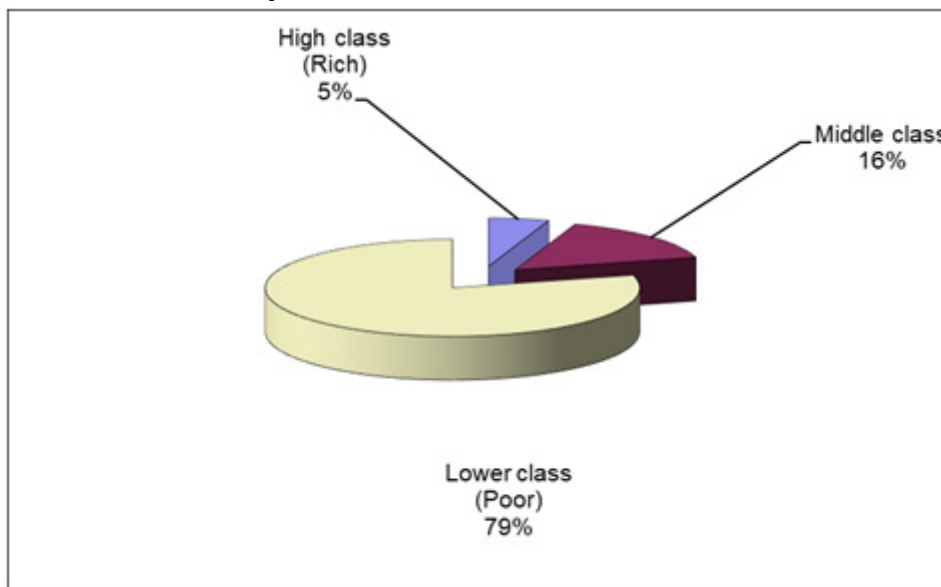


Figure 4: Wealth status/classes of the households in the surveyed villages in Assosa Zone of western Ethiopia

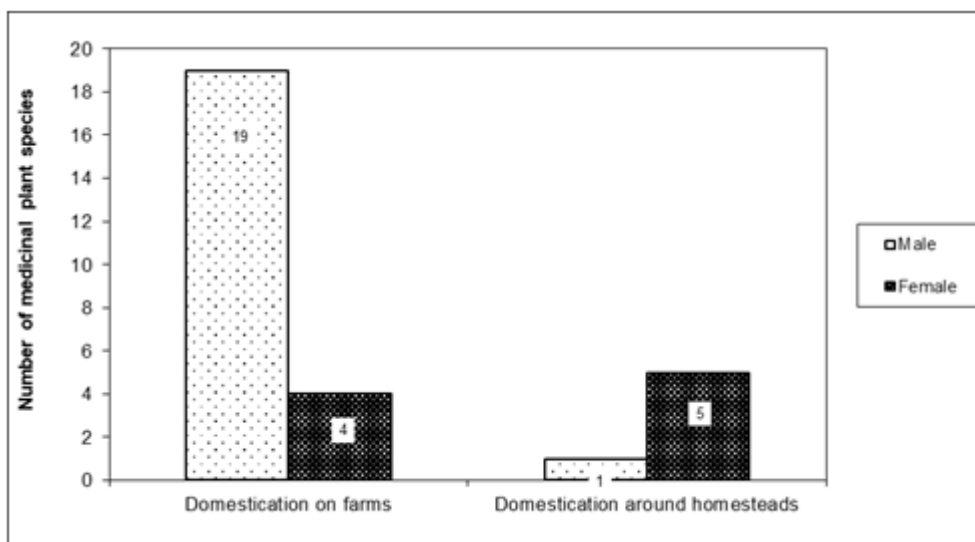


Figure 5: Gender effect on domestication of medicinal plants on farms and around homesteads in the Assosa zoe, Western Ethiopia

The high domestication effort among the wealthy households can be attributed to the cost of maintaining or managing the farms as poor farmers often spend more time looking for food than caring for medicinal plants which they can easily collect from the forests free of charge. Dependence of the poor on natural resources from protected areas is widespread in different parts of the world. In the eastern part of Awash National Park, for example, the households who had fewer or no livestock, constituted the higher proportion of illegal users of resources compared to those who were rich (Loibooki *et al.* 2002; Kideghesho *et al.* 2005). Sometimes, the poor households supplement their income by working for payment on farms owned by affluent households. This implies that although domestication of medicinal plants can be seen as important coping strategy for poor, economic reasons can impede its adoption.

Education

From this study, education seems to have had no significant influence on the number of domesticated medicinal plants ($P = 0.21$, $R^2 = 26\%$, $t = 0.27$). The reason for this might be attributed to the fact that virtually all household heads interviewed had formal primary education. The formal education in Ethiopia started orthodox tewahido church and thus many respondents had access to this kind of education (Kaoneka, 1993; Kajembe, 1994; Msuya, 1998). Therefore, given the uniformity in education level among the respondents, it is difficult to notice the influence that education can bear on conservation and, domestication in particular. Those educated beyond primary education level, whom we would expect to domesticate more trees due to a relatively high level of awareness, were spending most of their time in towns engaging in business and other activities. Therefore, it wouldn't be surprising if domestication effort would be low for the most educated people as they often spend less time in villages (Kweka 2004).

In areas where the disparity in education level is relatively high, the impact of this factor on participation in or attitude towards conservation is more visible. This is because education can also enhance other factors that can influence conservation efforts or attitudes such as conservation awareness and affluence. For example, an attitude survey on factors influencing conservation attitude in western Serengeti, Tanzania showed that the highly educated people had more income because they had more access to employment opportunities. They were, therefore, more positive and supportive to conservation efforts, because their livelihoods were minimally affected by conservation interventions (Kideghesho *et al.* 2007).

Family size and sizes of farms

Other socio-economic factors reported to significantly influence domestication of medicinal plants in the study area were the sizes of the farms ($P = 0.023$, $R^2 = 45\%$, $t = 2.29$) and family size ($P = 0.012$, $R^2 = 52\%$, $t = 2.54$) (Table 2)]. Domestication of medicinal plants was more prominent to households with big farms and big families than those with small. This is likely to be the case because the family size has an implication on the household labour force, and thus big families have more labour, which could contribute positively to the domestication of wild plants including medicinal plants. The studies conducted in South Omo Zone, Ethiopia gave similar results, with big families having planted more trees compared to small ones (Luoga *et al.*, 2004). Other studies have also reported the positive correlation between farm size and domestication of wild plants (Kajembe and Luoga, 1996; Michon and de Foresta, 1996; Moshi, 1997; Ndomba, 2004). A study conducted in the Assosa Zone, revealed

that the number of plots and farm sizes had a significant and positive influence on tree-growing efforts (Kajembe *et al.* 2008).

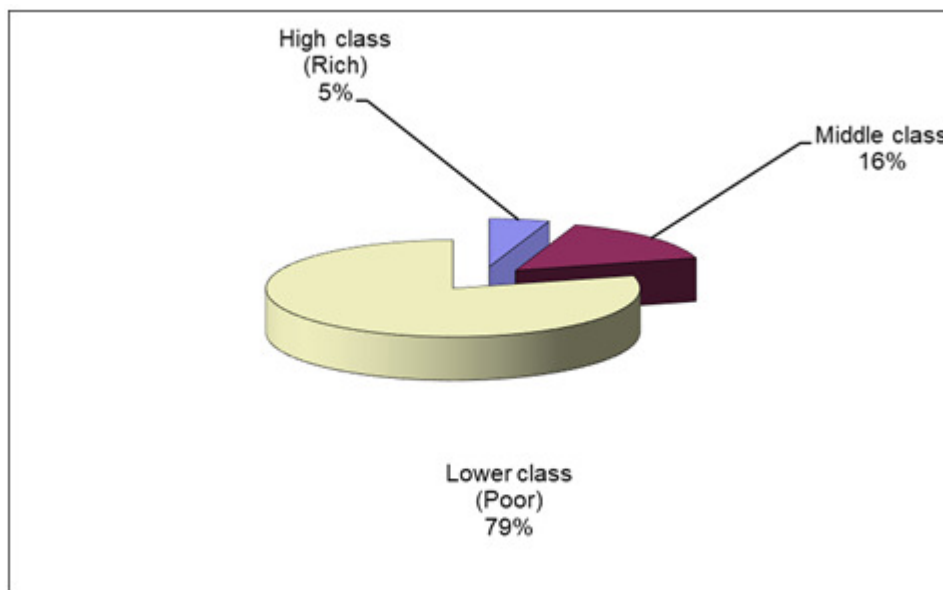


Fig. 5: Wealth status/classes of the households in the surveyed villages in Assosa Zone of western Ethiopia

Ethnicity

Ethnicity had also influenced domestication of medicinal plants in the study area. The Berta tribe had domesticated more plants (8 ± 4 (SE)) than other tribes (4 ± 6 (SE)). This practice differed significantly ($P = 0.001$ and $t = 5.84$). This difference could be attributed to the fact that the Berta is the native tribe in the study area and other tribes are immigrants to the Western Ethiopia, and that domestication has been one of the indigenous conservation practice for wild plants in these areas for over 2000 years ago (Hamilton, 1989; Kajembe, 1994; Msuya, 1998; Msuya *et al.*, 2008). Also most of the Berta are traditional healers and hence domestication of medicinal plants was pursued as a way of facilitating their service. Furthermore, traditional healing being a business, motivated domestication of these plants. Most often traditional healing operates on the basis of secrecy (Msuya and Kideghesho 2009). The traditional healers' knowledge on medicine is barely shared with other people. On treating the patients, they never expose the species and their locations. The patients receive the ready made medicines and prescriptions on how to use them. Traditional healers are often considered to be spiritually gifted. Their knowledge can be transmitted to some of their sons or daughters. In some occasions, a person may acquire knowledge on a particular medicinal plant, but he/she has to pay for it. There is a belief that, even if one is familiar with the use and preparation of medicinal species he cannot assume the role of traditional healer, since performance and efficacy of a particular medicine in curing some ailments depends on who dispenses it.

Conclusion and recommendations

Domestication of medicinal plants is been influenced by gender, socio-economic and cultural factors such as wealth (income), age, farm and household size, and ethnicity. Being part of indigenous agroforestry practice, domestication has played big role in conservation of medicinal plants especially threatened species due to over harvesting and human activities in the Western Ethiopia. It is recommended that more research should be done on medicinal plants to identify other threatened species available in the forests and elsewhere in the study area and come up with appropriate strategies for domesticating them either on farms or around homesteads for sustaining their availability. In the process of domestication; gender, socio-economic and cultural factors with both positive and negative influence, should be taken into consideration.

- Domestication, as a coping strategy, can hardly be implemented by poor communities, who comprise of the majority. Economic empowerment is, therefore, imperative
- Cultural and economic factors are the major factors that impede the ability of women to adopt coping strategies (including domestication) against environmental problems and declining biodiversity. Therefore, the strategies aiming at promoting domestication should aim, among other things, at empowering women economically and intensifying campaigns against discriminatory cultural practices including those denying women access to land and subjecting them to heavy workloads.

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