Opportunities and challenges for sustainable production and marketing of gums and resins in Ethiopia

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ISBN 978-602-8693-57-8

Lemenih, M. and Kassa, H. (eds) 2011 Opportunities and challenges for sustainable production and marketing of gums and resins in Ethiopia. CIFOR, Bogor, Indonesia

Photographs by Mulugeta Lemenih or Habtemariam Kassa, unless otherwise indicated.

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Chapter 1

Challenges and forest-based opportunities in the drylands of Ethiopia

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1.1 Drylands of Ethiopia

Drylands comprise the greater part of Ethiopia's landmass. Drylands are variously defined as areas characterised by a seasonal climate with several months of drought (Murphy and Lugo 1986), areas having a growing period of ≤ 180 days or areas with an aridity index of ≤ 0.5 (UNESCO 1979). UNESCO's aridity index refers to the ratio of potential evapotranspiration (PET) to precipitation (P); thus, all lands for which PET/P ≤ 0.5 are classified as drylands. This definition encompasses areas traditionally described as arid, semi-arid and dry subhumid, as well as the driest hyper-arid areas. Arid and semi-arid lands (ASALs) are estimated to cover 560 000–615 000 km^2 (50–55%) of the total landmass of Ethiopia. When dry subhumid areas are included in the definition, the total extent of the country's drylands may be 860 000–915 000 km^2 (76–81%) (Table 1.1). Drylands thus predominate across the lowlands and highlands in the country's north, east, west, central, south, southeast and northwest regions.

Table 1.1 Estimated extent of drylands in Ethiopia

Bioclimatic zone	Area ('000 km^2)	
	Lowest estimate	Highest estimate
Hyper-arid	53	55
Arid	300	310
Semi-arid	207	250
Dry subhumid	300	300
Total	860	915

Source: Lemenih and Teketay (2004)

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The drylands of Ethiopia support a significant proportion of the country's human and livestock populations, although the population is heavily concentrated in the dry subhumid region. ASALs, which are the focus of this publication, are relatively sparsely populated, home to only 12–15% of Ethiopia's 80 million people. Most of the people in ASALs are pastoralists and agro-pastoralists. They have long recognised the critical importance of sound management of the natural resource base in providing them with the diverse products and services that are important for their livelihoods. Thus, they have adopted pastoralism, which is a flexible, opportunistic and compatible production system, in the risk-prone ASAL environments. They also have selected highly adaptive and productive livestock species and breeds. Mobility is the norm of the production system to better exploit the various resources available during different seasons and in different locations.

Pastoralists place greater value on perennial vegetation than on annual crops because it has multiple functions, such as providing browse, particularly during the dry season, wood for carving, hut construction and energy, and a source of income from the sale of timber and non-timber products (Lemenih *et al.* 2003, Lemenih and Teketay 2004). The income from non-timber products such as gums and resins is crucial for food security in ASALs. Many of the gum and resin products obtained are traded internationally, generating considerable foreign currency earnings and supporting the national economy of Ethiopia and many other Sudano-Sahelian countries.

Demographic, environmental, socio-economic and political changes are putting pressure on the use and management of drylands.[3] Today, many dryland communities are experiencing increasing hardships, frequent droughts and food insecurity, as well as a declining quality of life. Areas in Ethiopia's drylands are probably amongst those with the country's highest incidence of poverty and poor access to basic social services such as infrastructure, education and health services. Due to the general misconception that drylands are resource-poor areas, they have not attracted much investment or any significant development initiatives from either the private or the public sector. These problems are further compounded by stresses related to global climate change.

1.2 Challenges facing the drylands of Ethiopia

The drylands of Ethiopia are facing multiple natural and anthropogenic challenges. The low and erratic rainfall is probably the most important natural problem, limiting the possibility of sustainable livelihoods from crop and animal production. In about 22% of drylands, cultivation is not possible even with

3 Hereafter, unless otherwise indicated, the term 'drylands' is used to refer to ASALs.

early-maturing crops (NCSS 1993, Hawando 1997). In the remaining areas, the unpredictable timing and low amounts of rainfall have always been a severe constraint on agricultural production. Agriculture in ASALs often requires additional investment, especially in irrigation facilities and other infrastructure (Steen 1994, Lemenih *et al.* 2003). Consequently, livestock production in the form of nomadic pastoralism has been the dominant land use system. However, in recent years, the upsurge in human and livestock population, recurrent droughts, severe land degradation and the consequent shortage of fodder and water have added further constraints on the sustainability of the pastoral land use system. Food insecurity is widespread in Ethiopia's ASALs, and food aid has become common.

Ethiopia's drylands are experiencing rapid changes in both the human and livestock populations. Several factors are behind the population growth, one of the most important being government-initiated resettlement programmes. Successive governments have used resettlement to the lowland dry forests as a strategy for reducing the food insecurity of vulnerable households in the degraded highland areas (Kebede 2006). In addition to the official resettlement programme, deteriorating livelihood conditions in the highlands due to land degradation have triggered large informal migration to the lowlands. These formal and informal resettlements are causing rapid demographic and land use changes in the drylands of Ethiopia.

Over most of the country's ASALs, nomadic pastoralism is gradually shifting to agro-pastoralism, and agro-pastoralists are being encouraged to become sedentary farmers. This changing mode of life coupled with the population increase has encouraged rapid villagisation and the emergence of urban centres. This in turn has increased the demand for timber products for construction and energy, triggering further deforestation over large areas of the drylands. Poor farming practices, population pressure, overgrazing, soil erosion, deforestation and the use of livestock manure and crop residue as fuel, combined with erratic rainfall, are leading to recurrent crop failures. Consequently, people often turn to harvesting and overharvesting of forest products, notably timber, to augment their household income, thus further driving land degradation and desertification. Desertification is a widely encroaching challenge across Ethiopia's drylands (Hawando 1997).

Global climate change is adding further stress to dryland areas. Ethiopia and similar African countries are likely to suffer most from the effects of climate change, even though their contribution to its causes is negligible on a global scale. The African continent as a whole is likely to be highly vulnerable to the effects of climate change not only because of increasing aridity and other climatic

anomalies, but also because of the widespread poverty that limits the population's capacity to adapt to climate change. According to the Intergovernmental Panel on Climate Change (IPCC 2001), temperatures in land areas across the Sahara and semi-arid parts of Africa may increase by as much as 1.6 °C by 2050. Equatorial Africa might be about 1.4 °C warmer. Mean annual precipitation has gradually declined during the past couple of decades, and the frequency of irregularities has increased. Projected rainfall changes indicate a decline by about 10% by 2050 over the Horn of Africa, and potential evapotranspiration is projected to increase by 5–10% (IPCC 2001). This will lead to increased moisture stress in the drylands, and hence further decline in crop and fodder production.

To summarise, with the growing human and livestock population, increased deforestation and land degradation, shrinking farm size, advancing desertification and poor infrastructure, in addition to gloomy scenarios in connection with global climatic changes, the prognosis for the drylands of Ethiopia looks grim. It is thus essential to enhance people's adaptive capacity and promote land use systems that contribute to increased environmental resilience and better livelihoods. The question, then, is what types of curative opportunity exist for these stressed and marginal lands?

1.3 Opportunities for forest-based enterprises

Despite the general perception that drylands are resource-poor areas, several studies indicate that the forests and woodlands in Ethiopia's drylands offer good opportunities for improving rural livelihoods and reducing poverty. Dry forests, which cover about 55–60% of the country's drylands (WBISPP 2004), are important in terms of their contributions to human welfare and environmental health. Everywhere, dry forests provide diverse goods and services such as fodder, fuel, cash income, building materials and herbal medicines, and they help to protect the soil from erosion and to restore soil fertility. Most importantly, several species of the genera *Acacia, Commiphora*, *Boswellia* and *Sterculia* yield commercial plant gums and resins that have been traded since antiquity (EFAP 1994, Lemenih *et al.* 2003). The best known of these products are gum arabic, frankincense/gum olibanum, myrrh, opoponax and gum karaya. Ethiopia has one of the largest resource bases for commercial plant gum and resin production (Kuchar 1995, Tadesse *et al.* 2002). Studies have shown that the country's natural gums subsector offers viable investment options for invigorating economic development in the drylands (Lemenih 2005, Roukens *et al.* 2005). Moreover, global demand for these products is growing. Improving access to this global market could create economic incentives for farmers to sustainably manage the dry forests. Higher prices also encourage efforts to improve the quality of gums and resins. This in turn contributes to local and national economic growth.

The collection, use and trade of gums and resins are age-old activities in Ethiopia. The subsector's contribution both to the national economy and to local communities cannot be overlooked. It offers one of the few opportunities available for dryland communities to supplement their cash incomes, particularly during dry seasons, and thus its role in food security is tremendous (Lemenih *et al.* 2003). The great potential for gum and resin production and marketing implies that the implementation of appropriate policy and resource management measures could enhance the socio-economic and ecological gains from the subsector (Tadesse *et al.* 2002, Lemenih *et al.* 2003, Eshete *et al.* 2005). Another advantage of the gum and resin resource base is that production can be integrated with other forms of production, particularly with livestock production, apiculture, sericulture and civiculture, to optimise returns per unit area.

Tree-based management of drylands has a number of advantages. It helps fight desertification, promotes conservation of biodiversity and assists farmers to better adapt to climate change (Lemenih and Teketay 2004). By so doing, it helps maintain healthy social and ecological systems. The production of gums and resins, when properly practised, is non-destructive to either trees or the ecosystem. The trees remain standing to continue providing ecosystem services. Thus, this development option enables the successful marriage of sustainable livelihood provision and ecosystem conservation. Gum- and resin-producing species are adapted to extreme aridity, which makes them appropriate options for dryland conservation and combating desertification.

Ethiopia is a party to and has ratified several international conventions of direct relevance to dryland environments, such as the UN Convention to Combat Desertification (CCD), Convention on Biodiversity Conservation (CBC) and Framework Convention on Climate Change (UNFCCC). Promoting tree-based land use systems in the drylands significantly assists the country to meet its requirements under these conventions. The following points summarise how gums and resins can contribute to the development of dryland areas in Ethiopia.

- Gum and resin products and their vegetation resources provide substantial economic incentives at local and national levels, and thus contribute to food security and improved livelihoods.
- The vegetation resources can offer alternative development opportunities through integration with other economic sectors such as livestock husbandry and apiculture to diversify income sources and optimise return per unit area. In particular, livestock husbandry, which is the dominant land use and principal capital asset of the pastoral families inhabiting ASALs, heavily depends on the same vegetation as a source of fodder.
- Local people can use some of the gums and resins from these plants as emergency food during famine periods, making them a safety net.

- The plant can help in combating desertification and assisting dryland communities to adapt to climatic changes (Teketay and Lemenih 2004).

Despite this potential, exploitation of these resources has not yet generated useful gains. People in the drylands of Ethiopia continue to experience severe poverty and critical food insecurity. Factors contributing to the neglect of these resources include (1) lack of awareness of the potential of the resources, particularly non-timber forest products (NTFPs); (2) lack of clearly defined policy on the development of drylands; and (3) ill-informed agricultural development strategies that solely focus on agricultural expansion. Nevertheless, the national and local contributions from these dryland vegetation resources are increasing.

1.4 Dryland vegetation resources of Ethiopia

Dry forests comprise Ethiopia's largest vegetation resource. The structure and composition of the country's dry forests are diverse, reflecting their wide distribution across various climatic types and a broad altitudinal range spanning from the salt marshes of the Afar depression below sea level to the dry cool subafroalpine mountains. Structurally, dry forests cover the spectrum from a 'real' forest (closed canopy with tall trees) to desert scrub. Compositionally, the forests are rich in endemic plant and animal species, especially in the lowlands in the country's southeast. Perhaps one in four of Ethiopia's plant species is found in this part of the country, which is characterised by its high diversity of *Acacia* and *Commiphora* species. The latter are particularly important, as about half of the 150–200 species of the genus are endemic to the small area of southeastern Ethiopia, northeastern Kenya and Somalia.

According to the Conservation Strategy of Ethiopia (CSE 1997), 9 broad vegetation types are recognised in Ethiopia. Of these, 7 can be designated as dry forests: (1) dry evergreen afromontane vegetation; (2) *Combretum–Terminalia* (broad-leaved) deciduous woodlands; (3) *Acacia–Commiphora* (small-leaved) deciduous woodlands; (4) lowland dry forests; (5) riparian (wetland) vegetations; (6) lowland semi-desert and desert vegetation; and (7) evergreen scrubs.

1.4.1 Dry afromontane vegetation

Vegetation in the seasonally dry mountainous areas in the central, eastern and northern highlands of Ethiopia is collectively classified as dry afromontane vegetation (Figure 1.1). Afromontane vegetation is found in areas at 1500–3200 metres above sea level (masl). The drier eastern areas are mainly composed of *Juniperus procera* and/or *Afrocarpus falcatus* species, with *Acacia abyssinica* and *Olea europaea* commonly appearing together also. Other trees in the area include *Prunus africana, Apodytes dimidiata, Allophylus abyssinica* and *Euphorbia*

ampliphylla. This class of vegetation is poor with respect to commercial gum- and resin-producing species, but is rich in species with other commercial NTFPs, such as *Prunus africana*, a well-known medicinal plant.

1.4.2 *Combretum–Terminalia* (broad-leaved) deciduous woodlands

Broad-leaved deciduous forests and woodlands are found in the western and northwestern lowlands of Ethiopia. Land in the moister western lower altitudes have deeper soils and support deciduous forests with considerable ground cover (Figure 1.2), which are the extension of Sudano-Sahelian vegetation formation (Ogbazghi 2001). Fires occur frequently, especially following human influxes from the surrounding highlands. Although natural fire has caused no noticeable deterioration and plants and animals are adapted to it, the frequency and high intensity of fire caused by human-related activities have harmed vegetation resources in recent years.

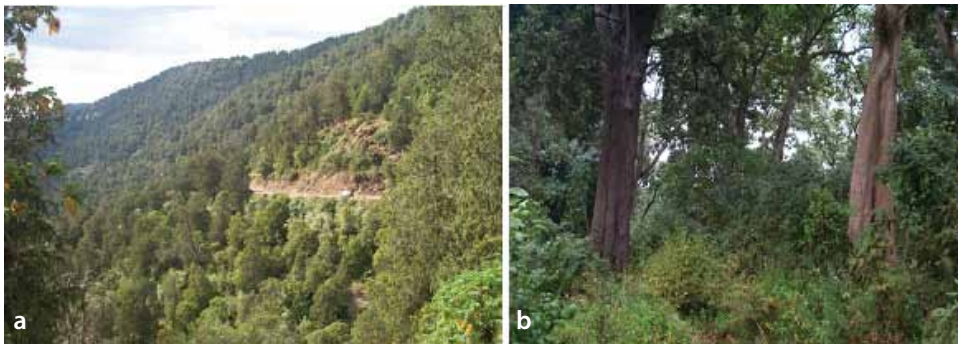

Figure 1.1 Examples of dry afromontane forests in Ethiopia: (a) *Juniperus procera*-dominated dry afromontane forest of Bale, and (b) *Afrocarpus falcatus*-dominated dry afromontane forests of Munessa, central Ethiopia. Photos © M. Lemenih

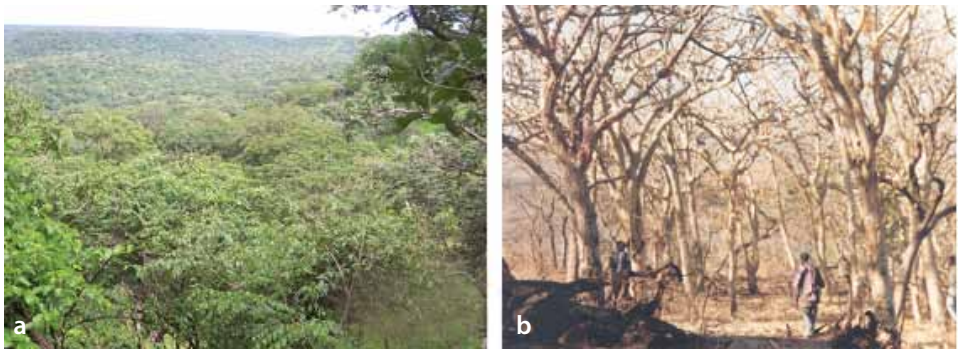

Figure 1.2 Combretum–Terminalia (broad-leaved deciduous) woodlands dominated by *B. papyrifera* species (a) during the rainy season and (b) during the dry season in the western lowlands of Ethiopia (Metema). Photos © M. Lemenih (a); G. Fitwi G. (b)

These woodlands represent the main *B. papyrifera*-growing regions in the Horn of Africa (Asfaw 2006).

The main tree species making up the broad-leaved deciduous woodlands of western Ethiopia other than *B. papyrifera* include *Balanites aegyptiaca, Combretum adenogonium*, *C. collinum, C. molle*, *Terminalia* spp., *Grewia* spp. *Gardenia* spp., *Flueggea virosa*, *Acacia polyacantha, A. senegal, A. seyal and Sterculia setigera*. Of these, *B. papyrifera, A. polyacantha, A. senegal, A. seyal* and *Sterculia setigera* are known to yield commercial gums and resins.

1.4.3 *Acacia–Commiphora* (small-leaved) deciduous woodlands

This vegetation type is predominantly found in the southern, central (Rift Valley) and eastern lowlands of the country at altitudes below 1900 masl. Plant species characteristic of this vegetation type are drought-tolerant small-leaved trees and shrubs, such as *Acacia tortilis, A. seyal, A. senegal, A. etbaica, A. sieberiana, A. mellifera, A. drepanolobium, Commiphora africana, C. myrrha, C. fluviflora, C. habessinica, C. paolii, C. crenulata, C. boranensis, C. guidotti, C. erythraea, C. schimperi, C. ogadensis, C. rostrata, C. serrulata, C. gileadensis, C. hildebrandtii, C. erosa, C. cyclophylla, C. corrugata, B. microphylla, B. ogadensis, B. neglecta, B. rivae, Balanites aegyptiaca* and *Maytenus senegalensis* (Figure 1.3). This

Figure 1.3 *Acacia–Commiphora* (small-leaved deciduous) dryland forest dominated by *Commiphora* and *Boswellia* species in the southeastern and northeastern parts of Ethiopia. Photo © A. Worku (2006) (top); M. Lemenih (bottom)

vegetation formation is the richest in terms of commercial gum- and resin-producing species of the genera *Acacia, Commiphora* and *Boswellia*.

1.4.4 Lowland dry forests

In Ethiopia, lowland dry forests are found only in the Baro lowlands of Gambela Regional State. Apart from common trees, this lowland forest is characterised by the presence of species that are widely distributed across tropical Africa and West Africa up to Ghana (Friis 1992). The forest does not contain any of the common gum- and resin-producing tree and shrub species identified in other dryland vegetations in Ethiopia.

1.4.5 Riparian (wetland) vegetation

In the plains of the Rift Valley, water gathers from the surrounding undulating terrains, creating swamps and wetlands. Such wetlands are abundant in the lake regions of the Ethiopian Rift Valley and along the plains of Awash and other major rivers. Although human activity has greatly damaged the wetland and riparian forests of these areas, significant patches remain in localised areas such as around Lake Langano and between the Abaya and Chamo Lakes in Arbaminch. Major species in such vegetation types are *Celtis africana*, *Ficus sycamorus*, *Mimusops kummel*, *Maytenus senegalensis*, *Acacia spp., Syzygium guineense* and *Afrocarpus falcatus*.

1.4.6 Lowland semi-desert and desert vegetation

Desert and semi-desert areas are found along the borders of eastern and southern Ethiopia at altitudes below 900 masl. Rainfall in these areas is low and very erratic. Vegetation consists of deciduous shrubs, mostly *Acacia* species, together with sparse evergreen shrubs and succulents (Figure 1.4). *Commiphora* and *Boswellia* species also exist here and, wherever available, they, along with *Acacia* species, provide the highest-quality gum and resin in this vegetation type (Lemenih *et al.* 2003).

1.4.7 Evergreen scrub

Evergreen scrub occupies the undulating and steep slopes of the highland plateaus. It covers vast areas, particularly in the north, west and east in Wello, Tigray, Shewa, Wollega and Hararghe, and is even expanding by overtaking areas where forests have deteriorated. The woody vegetation mainly consists of plants with small, tough, leathery leaves such as *Euclea schimperi, Dodonaea angustifolia, Carissa edulis, Scolopia theifolia, Rhamnus staddo, Myrsine africana, Calpurnia aurea* and *Jasminum abyssinicum*.

Figure 1.4 Semi-desert vegetation with scattered *Commiphora* and other species in northeastern Ethiopia (Afar). Photo © Lemenih M.

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