Socio-economic and Environmental Significance of Dry Land Resources of Ethiopia and their Development Challenges

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Abstract

Dry land resources have national and global significance. Ethiopia, in particular, is a dry land country whose resources are yet to be managed properly if they are to contribute meaningfully to the country's socio-economic development and environmental resilience. Using major findings of several on-going and completed studies and field level observations , the paper presents brief descriptions of the major natural resources in the dry lands of Ethiopia in terms of agricultural land, wildlife and ecotourism, water (irrigation potential), range for livestock and wildlife, commercial crop and livestock farming, biofuels plantations, and dry forests. It identified the major challenges to developing these resources as misconceptions surrounding the dry lands, policy related constraints, demographic pressure, climatic variability and change, chronic food insecurity, land degradation, and weakening of traditional institutions. In conclusion, the paper outlines measures that would help in sustainably managing these resources. It specifically suggests the need for developing physical land use plans to designate agricultural lands and conservation areas and building the capacity of local authorities to monitor land use and enforce relevant regulations while encouraging and supporting communities to invest in natural resources management work.

Key words: Dry land areas, dry forests, livelihoods, wood and non-wood products, sustainability.

Introduction

Dry lands are recognized mainly by limitations in moisture. Variability and scarcity of precipitation on the one hand and high temperature and high evapo-transpiration on the other are used to delimit dry lands. Yet, there is no universally agreed definition for the dry lands. Murphy and Lugo (1986) defined dry land as an area characterized by seasonal climate having several months of drought, while FAO defines it as area with the length of growing period only up to 179 days (FAO, 2000; Koohafkan and Stewart, 2008). UNESCO's (1979) definition on the other hand draws on the ratio of precipitation (P) to Potential Evapo-Transipration (PET), referred to as aridity index (AI). Areas with AI of ≤ 0.65 are thus classified as dry lands. Dry lands

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are diverse in their nature and are by no means mono type. They encompass different sub-categories, traditionally labeled as dry sub-humid, semi-arid and arid lands. The sub-classes vary in terms of their moisture and radiation reception, altitude and natural resources endowment.

World-wide, dry lands cover 6,150 million ha, or about 47% of the total land area. They host 62 % of the total irrigated land, 36 % of the total rain fed cropland, and 68 % of the total rangelands in the world. In Africa alone, excluding the hyper-arid Sahara desert, dry lands cover some 40 % of the total land area (Koohafkan and Stewart, 2008). Ethiopia's share of dry lands proportional to its territory is huge, and estimates range between 67 and 75% of the landmass (Anonymous, 1997; Lemenih and Teketay, 2004; Cullis, 2009). Indeed, Ethiopia is predominantly a dry land country. The estimate of dry lands, their major attributes, and regional distribution in the country are presented in Table 1.

Table 1. Dry land areas, regional distributions and their main climatic and land use attributes in Ethiopia

Eco-region	Area ('000 ha)	Mean annual temperature	Mean annual rain fall	PET	Major land use	Regional distribution (% of the total area of the region)
Arid	42,300	21-27.5	100-800	1700-2600	Pastoral	Somali (40%), Afar (30%), Oromia (5%)
Semi-arid	2,900	16-27	300-800	1600-2100	Agro-pastoral	Tigray (90%), Oromia (20%), Beneshangul (60%)
Dry sub-humid	19,000	16-28	700-1000		Mixed farming	Oromia (10%), Amhara (10%), Benishangul (10%), Gambella (15%), SNNPRS (5%),
Total	64,200					

(Source: Anonymous, 1997)

However, the dry lands of Ethiopia are also encountering multifaceted challenges. Their natural resources are fast degrading. Dry lands and their resources have been neglected in research and development for years, and infrastructure and social development indicators are the least even by national standards. Yet population pressure, development of infrastructure, notably roads, agricultural expansion even into ecologically fragile areas such as hillsides with shallow soils, poor governance in controlling access to and use of the natural resources, distinctly dry forests, and woodlands, and climate variability and change cause stress on the resource base. Under-development of the policy and regulatory framework, and poor implementation of existing

laws and regulations contribute to resource degradation in the dry lands. The objectives of this paper are to analyze resource endowments of Ethiopia's dry lands, and to explore opportunities and challenges for development.

Methods

The resource endowments and challenges within different dry land regions of Ethiopia differ and so do the level of their degradation, exploitation and management. Though there is one national forest policy and strategy document, these resources seem to be receiving good management in some regions but not in others. In order to capture the contemporary potentials as well as challenges besetting the dry lands, we used our own research findings from field observations that we conducted in most parts of the dry lands of Ethiopia. In addition to these, we also used data sets from a just completed major research project of CIFOR in Metema, as well as from completed M.Sc. and on-going PhD research of graduate students under our supervision.

Results and Discussion

Natural Resources in the Dry Land of Ethiopia

Agricultural land

One of the resource endowments of dry lands of Ethiopia is their vast land. As the national economy is predominantly agrarian, land is of high economic, social and political significance in Ethiopia. The significance of this is illustrated by the presence of articles on land ownership and transfer in the current constitution of the country. Most of the land in the semi-arid and dry sub-humid, particularly in the western and southeastern lowlands is underutilized. The land resource is suitable for crop farming, for animal production and even for forestry development provided that the resources, notably soil and water, are properly managed. If supported by appropriate policy, proper land use planning and participatory opertionalisation, the dry land areas can support and enhance the socio-economic development of both pastoral communities and the nation at large. There exist experiences in the Middle East (*e.g.* Israel) and in Asia (*e.g.* India) from where a lot can be learned.

Wildlife, national parks and ecotourism resources

The savanna, woodlands and dry forests of Ethiopia host vast diversity of big and small mammals, birds and other tourist attractions. The Rift Valley lakes and their surrounding wetlands serve as breeding grounds for endemic and migratory birds. Most of the wildlife protected areas (National Parks, Wildlife Sanctuaries, Wildlife Reserves and Wildlife Controlled Hunting Areas) of

Bio-fuel potential

Ethiopia imports its entire petroleum fuel requirement, and the demand for petroleum is rising rapidly due to improving economy and expanding infrastructure. The annual consumption of petroleum amounts to 1.1 million tones, and accounts for 40% of the total imports and absorbs over three-quarters of the foreign currency earnings. This will have a significant and negative effect on the country's socio-economic development. Raising global energy price coupled with climate change is shifting the attention of most countries in favor of renewable energies such as biofuel. These energy alternatives are largely assumed to have substantial development roles in countries like Ethiopia that heavily depend on imported commercial fuel on the one hand and possess large biologically productive land on the other. However, some also argue that biofuel development agenda can jeopardize food security for already food insecure nations by competing for land. Nonetheless, sooner or later biofuel development option is inescapable since the volume and value of imported fossil is likely to rise.

Table 3. Bio-diesel developers in operation by Regions and land areas allocated to them

Company Name	Region	Land Acquired (ha)	Out-growers land (ha)	Crop type
Sun Biofuels Eth/NBC	Benshangul	80,000		Jatropha
Amabasel Jatroph Project	Benshangul	20,000		Jatropha
Jatropha Biofuels Agro Industry	Benshangul	100,000		Jatropha
IDC Investment	Benshangu	15,000		Jatropha
ORDA	Amahara	884		Jatropha
Jemal Ibrahim	Amahara	7.8		Castor bean
BDFC Ethiopia Industry	Amahara	18,000	30,000	Sugarcane/sugar beat
A Belgium Company	Amahara	2.5		Castor bean
Flora Eco Power Ethiopia	Oromia	10,000	5000	Castor bean
Petro Palm Corporation Ethiopia	Oromia	50000		Castor bean/Jatrohpa
VATIC International Business	Oromia	20,000		Not known
Global Energy Ethiopia	SNNPRS	2700	7500	Castor bean
Omo Sheleko Agro Industry	SNNPRS	5,500		Palm
Sun Biofuels Eth/NBC	SNNPRS	5000		Jatropha
	Total	327,094	42,500	

(Source: Lakew and Shiferaw, 2008)

The Ethiopian Biofuel Development Strategy (Ministry of Mines and Energy, 2007) envisages the development of biofuel program that will help in import substitution to petroleum, provide employment opportunities and export

earnings and, reducing environmental pollution and emissions of green house gas from the country. The emphasis will be on (i) bio-ethanol from sugar beet, sugar cane, sweet sorghum and others, and (ii) bio-diesel from Jatropha, castor bean and palm. The total available potential land for the production of feedstock for bio-diesel is estimated at about 23 million ha, all of which are in the dry lands. Currently about 60 developers have been registered for the cultivation of energy crops in Ethiopia, and 14 of them have already began operation on about 350,000 ha of land (Table 3). For bio-ethanol six potential developers are said to have been involved, four of which government owned sugar estates. The total irrigable land for sugarcane based ethanol production is estimated to be 1,390,000 ha (Fessehaie, 2009). With this potential, Ethiopia could annually produce 2.2 billion litres of ethanol.

Dry forests

Dry forests cover some 55 million ha in Ethiopia (WBISPP, 2004), and are the largest vegetation resources in the country. The term dry forests here is used to refer to the different vegetation types found in the dry lands of Ethiopia, and comprise vegetations from the very dry *Acacia* and *Commiphora* scrublands in the deserts of Afar and Ogaden to forests in the dry sub-humid Afromontane ecosystems in the central highlands. On the basis of climate, vegetation formation (physiognomic and habitat groupings) and associations (species composition/structure), nine broad vegetation types are recognized in Ethiopia (Demissie, 1996; Anonymous, 1997). Out of the nine, seven are typical of dry lands and can be designated as dry forests. These are: (i) dry evergreen Afromontane forests; (ii) lowland dry forests; (iii) lowland wetland (riparian) vegetations; (iv) evergreen scrubs; (v) *Combretum - Terminalia* (broadleaved) deciduous woodlands; (vi) *Acacia – Commiphora* (small-leaved) deciduous woodlands, and (vii) Desert and semi-desert scrubs.

Dry forests provide diverse goods and services; (i) provision of land for expansion of crop farming through land conversion, (ii) serving as rangeland for livestock and wildlife, (iii) supplying construction and fuelwood, and (iv) provision of subsistence and marketable non-timber forest products. When conversion of forestlands to crop fields is done extensively and with less consideration to its ecological sensitivity, resources degradation follows. Likewise, similar effect is observed when forests are overexploited for wood. Biomass is the major source of energy, accounting for 97% of the total domestic energy consumption, out of which woody biomass covers 78% (WBISPP, 2004). The volume of fuelwood demand at national level is nearly twenty fold greater than the demand for other forest products combined. In the 1990s, the demand was 80 million m^3/yr and a recent estimate puts the demand

at 109 million m^3/yr (FAO, 2005). While most households harvest fuelwood for home consumption, the poor and female headed households in rural and urban areas also depend most on fuelwood business to generate cash income.

Ethiopia's dry forests are endowed with diverse *Acacia, Boswellia* and *Commiphora* species that produce gum Arabic, frankincense, myrrh and opoponax, which are traded globally. Gums and resins are exported and hence source of foreign currency at the national scale, and employment and cash income to producing households. Between 1998 and 2007 about 25,192 tons, approximately 2,519 tons per year, of natural gums and resins were exported from Ethiopia. This is worth 307,248,000 Birr (34,138,670 USD) (Lemenih and Kassa, 2008). Domestic sales during the same period are estimated at 750 tons per annum. The export volume is also increasing on average by 12% a year over the past 10 years. There are over 40 import destinations (countries) for gum and resin products from Ethiopia. The bulk of the products are destined among others to China (29%), Germany (13%), Persian Gulf (9.5%), Tunisia (8.6%) and United Arab Emirates (7.3%) (Lemenih and Kassa, 2008). If extracted and managed properly, these products would provide investment opportunity and foreign currency earnings. Important lessons can be learnt from Sudan as to how to develop and benefit from the sub-sector.

Challenges to Developing Resources in the Dry lands

The drylands of Ethiopia are faced with multiples of natural and anthropogenic problems that threaten their sustainable development. The most important ones are perceptions about these reources, policy and institutional factors, climate change and demographic pressure, and unplanned agricultural expansion that cause resource degrdation.

Misconceptions surrounding the dry lands

Misconceptions and faulty assumptions revolve around dry lands and their natural resource endowments. Three important misconceptions about dry lands have been well articulated by Georgis (2005). First, dry lands are often labeled as waterless areas. This assumption, although partly true, is not always the case. In fact, the word 'dry' by itself reflects the scarcity of moisture, but this is usually used to refer to the amount of moisture received through precipitation-based moisture input rather than referring to the surface and sub-surface water availability. Thus, dry lands are 'low rainfall' areas but not necessarily 'low water' resource areas. Large areas of the dry lands in Ethiopia are fed by networks of permanent and irrigable rivers. The 12 major river systems originating in the highlands of Ethiopia flow through the dry lands with greater volume of surface and sub-surface water. In other words, most of

the precipitation received in the highlands ultimately ends up in the lowland dry lands. However, despite the rich water resources, there is no uniform distribution throughout the dry lands, and utilization of the available water resources requires development of irrigation infrastructure.

The second major misconception is equating dry lands to lowlands. For most people, dry lands are low altitude areas or classically called lowlands. In fact, dry lands cover wide altitudinal ranges spanning from below sea level (-126 m) in the Afar depression in the northeast to over 2400 m elevation in the northern and central highlands. Thus, dry lands include highland, mid-altitude and lowland areas, and are not synonymous with lowlands (Georgis, 2005). The third misconception about dry lands is the assumption that they are resource poor and challenging for development. They are wrongly labeled as low potential rather than low rainfall areas (Georgis, 2005). Dry lands are not necessarily resource poor. They hold rich soil and water resources that offer high potential for commercial agriculture, particularly for sesame, sugar cane, cotton, floriculture, horticulture, ranching and eco-tourism. They could provide livelihood options for millions of food insecure households through re-settlement programs. Thus, these areas hold the future of Ethiopia's agriculture and economic development because most commercial agricultural investments are targeting the dry lands.

Policy related challenges

Given the dominant role of agriculture in the economy, emphasis of the Government has been on agriculture in general and on small holder farming in particular as the land-related legal and policy documents reflect. Farmers in some regions are required to stay on-farm to ensure holding and use rights. Some point out that such provisions curtail peoples' mobility and tie the population to rural areas. In areas with less forested lands this would further result in interfamily land redistribution or landlessness. This, coupled with high population growth, compounds the problem by the continuous encroachment of farmlands into forested landscapes as well as overgrazing. Landlessness and shrinking farm sizes promote migration from the highlands to the dry lands. This movement of people to dry lands is also supported by the Government through its resettlement program that aims at settling hundreds of thousands of households from degraded highlands to the dry lands in the lowlands (PASDEP, 2006).

On the other hand, several policy documents state the severity environmental degradation, particularly in the dry land areas of the country. Ethiopia has signed the convention on combating desertification, and also developed a National Action Plan for combating desertification. The country has also

issued Environmental Policy (EPA, 1998) and enacted Rural Land Administration and Land Use Proclamation, and the Forest Conservation, Development and Utilization Policy. In the Environment Policy, population growth and climate variability were recognized as threats. The rural land administration and land use policy contains important provisions to facilitate sustainable land use. However, there are no specific land use plans developed to guide field implementation and restrict improper uses. Land management obligations, measures and rights are not worked out to implement and enforce. Most of the policies and proclamations relevant to the dry land resources lack accountable and stable institutions to see them implemented on the ground. Most do not have detailed implementation guidelines either. Thus, their implementation and subsequent revision aspects leave much to be desired. Inter-sectoral policy integrations are also very weak, in some cases, with contradicting or conflicting contents (e.g. conservation and investment). A study we have conducted in Metema illustrates the impacts of these weaknesses on forest lands. Forest cover has declined by about a third in less than ten years. Perception response of interviewed locals in Metema as to which institution is responsible to regulate access to and use of the dry forests is summarized in Table 4 below.

Table 4. Perception of locals on who is responsible for regulating forest access and management in Metema district

Agent	Frequency	Percent	Cumulative Percent
District Office of Agri.	79	43.9	43.9
Forest guards	44	24.4	68.3
Community	14	7.8	76.1
PA/District authorities	10	5.6	81.7
None	16	8.9	90.6
Don't know	7	3.9	94.4
Other	10	5.6	100.0
Total	180	100.0	

Source: CIFOR-dry forest project report, Ethiopia

About 18.4% of the respondents either assume that there is none or do not know the legally responsible regulatory body for determining forest access, use and management in the district. Consequently, 66.1% of the respondents agree that the current forest management system is absolutely insufficient, and felt that this has led to *de facto* open access to dry forests. The same is likely to be true for wildlife, land and water resource. This implies that natural resources in dry lands are almost open access resources; and improper use and unscheduled tree cutting due to open access could negatively affect the

resource base on which many depend, and may increase the vulnerability of the poor in particular.

Demographic pressure

The human and livestock population in the dry lands of Ethiopia is increasing rapidly. Estimates show that population natural growth in the low dry lands is about 2.7% (Sandford and Habtu, 2002). Higher population implies increasing demand for forest products, grazing and farming area. For instance, a study conducted in Metema revealed that the three most important factors for the decline in the area of dry forests in the district as identified by the respondents are: (i) expansion of croplands (68%); (ii) unsustainable wood harvest (57%); and (iii) grazing pressure (45%). Self-initiated and government sponsored re-settlement programs are conducted in the dry land areas. Successive governments used re-settlement to the lowland dry forests as strategy for reducing food insecurity of vulnerable households in the degraded highland areas. Between 2000 and 2004 alone, about 440,000 household heads or 2.2 million people have been formally resettled in four regional states of Ethiopia namely Amhara, Oromiya, SNNPR and Tigray. Considering the wood demand for construction and fuel wood as well as land for crop cultivation, moving such number of people would lead to clearance of an estimated 1.7 million ha during the same period. Although officially 2 ha of land are allocated to settling households, the open access nature at settlement district favors households to clear as much as they want. Recent study in Metema district, for instance showed that the average land holding of a resettled household is about 7 - 8 ha (Lemenih *et al.*, 2007; Dejene *et al.*, 2008). Clearance for subsistence agriculture is the leading cause of deforestation in the dry forests in Ethiopia (Lemenih *et al.*, 2008), causing the loss of 91,400 ha of woodlands and 76,400 ha of shrub lands annually (WBISPP, 2004).

There are also resource use related conflicts between indigenous people of the area, who often need wider areas for pastoralist and agro-pastoralist way of life, and settlers. Settlers begin clearing down vast woodlands and put it under cereal production system (Lemenih *et al.*, 2007). Clearance is exacerbated by open access nature of land as the result of weak regulatory frameworks whether formal or informal at local level. Settlements and areas under crops hamper seasonal mobility of the indigenous people and this may instigate conflicts. Reducing mobility may force pastoralists to exercise agro pastoralist or even sedentary farming way of life, provided that irrigation is available. The changing life style coupled with the population increase encourages expansion of villages with large livestock number concentrated in limited areas, resulting in overgrazing. This in turn increases demand for products for construction

and energy and triggers additional and intense deforestation in certain areas. Thus, careful land use planning and administration is needed.

Climatic variability, climate change and chronic food insecurity

Dry lands of Ethiopia are vulnerable to climatic change and variability. The climate variability map of Africa constructed by Thornton *et al.* (2006) put Ethiopia as one of the countries vulnerable to climate change with the least capacity to respond, while Vincent (2004) represents Ethiopia as the 7th most vulnerable countries in Africa. Moreover, evidences of climate change on the ground are very apparent. In the last 50 years the annual average minimum and maximum temperatures of the country have been increasing every decade by about 0.25 and 0.1 ^{0}C, respectively (INCE-2001), a change that is also perceived by the local people (*e.g.* Deressa et al., 2008). Coupled with ecosystem degradation, climate change will continue to be significant challenge to Ethiopia given its limited adaptive capacity.

According to some official documents (INCE, 2001; TNA, 2007; NAPA, 2007), and scientific reports (Hailemariam, 1999; Tarekegn, 2000; Deresse *et al.*, 2008), in addition to biodiversity (flora and fauna) sectors such as agriculture, human health, water, energy are climate sensitive resources of the country. Sector wise, agriculture is identified as the most vulnerable. In terms of livelihoods, subsistence farmers and pastoralists, who together comprise 84% of the country's population, are the most vulnerable to the effects of climate change. Drought is the single most important climate related natural hazard even though climate related hazards in Ethiopia include, floods, heavy rains, strong winds, frost and heat waves (high temperatures). The second is flood. Major floods which caused loss of life and property occurred in different parts of the country in 1988, 1993, 1994, 1995, 1996 and 2006. The effects of drought and flood are severe in the dry land areas.

According to FAO (2008), the combined effects of below average rainfall, conflict, insecurity and higher than average food prices in the Horn of Africa have resulted in more than 17 Million food insecure people. The same trend was also confirmed by the report of USAID (USAID, 2009). In Ethiopia, erratic rainfall and poor crop production, coupled with rising cereal prices, made nearly 5 million people to be dependent on emergency food aid, over and above the 7.2 million Productive Safety Net Program beneficiaries (Cullis, 2009). As a coping mechanism, most households revert to public resources such as forests and harvest wood and non-wood products for subsistence and to augment family income. Food insecurity and persistent deforestation in the dry ecosystems could lead to desertification which threatens vast dry lands of Ethiopia (Hawando, 1997).

Land degradation

Land degradation can be defined as the reduction or loss of economic productivity of land due to loss of physical, chemical or biological properties of land. This loss may arise from inappropriate use of land resources such as soil, water and vegetation. Land degradation is a great threat to environmental sustainability and poverty reduction. Thus, it requires commitment and large resources mobilization to prevent and ameliorate. There are complex causes although the direct ones are deforestation, improper cultivation, (poor soil and water conservation practices), soil erosion, loss of soil fertility particularly organic matter and improper livestock husbandry. Inappropriate land-use systems, lack of legally enforceable tenure security and/or accountability in land use and management exacerbate land degradation. Land degradation in dry lands is increasing due to poor governance of access to and use of resources, notably forests and land.

Given the ecological sensitivity, cultivation of crops without adequate soil and water management practices will quickly deteriorate the biological and pysico-chemical properties of the soil. Removal of perennial plant cover in dry lands causes rapid reduction of SOM, which further induces soil erosion by water and wind, soil crusting by raindrop splash and salinization by evaporation. Particularly, vegetation clearance followed by repeated tillage that also involve crop residue burning and harvesting causes substantial reduction in SOM contents (Lemenih and Itana, 2005; Lemenih *et al.*, 2005). For instance, a study along a topo/climo sequence around the Central Ethiopian Rift Valley area showed that deforestation followed by subsequent cultivation cause soil carbon (C) losses of 94 and 1748 kg $ha^{-1}yr^{-1}$ from semiarid and dry sub-humid zones, respectively (Lemenih and Itana, 2005). Study in the same area showed that cleared forestlands cannot be used sustainably more than 25 years (Lemenih *et al.*, 2005). According to this study, subsequent cultivation for over 25 years would cause severe soil degradation. Furthermore, deforestation and subsequent cultivation of any intensity have been shown to degrade and alter the soil seed flora of the forest, a phenomenon that will reduce the potential for future secondary forest regeneration (Teketay, 1996; Lemenih and Teketay, 2004).

Reduction in SOM in turn reduces soil aggregate stability. Unstable and poorly developed structures result in soil compaction which increases surface runoff, lower porosity, lower permeability to water, and lower water holding capacity. Lower permeability in turn results in increased edaphic aridity and hence reduced productivity. Low SOM also means lower biological activity from micro-, meso- and macroflora and fauna, particularly symbionts. The decline

in organic matter also reduces the turnover of geo-biogene elements (N, P, K, S, Ca, Na, Mg, Fe, Cu, Zn, Co, etc.), causing reduced fertility. The ultimate consequences of all these processes are low carrying capacity of the land, reduction in regeneration capability of the ecosystem, loss of biodiversity, depletion of water availability and, finally, abandonment of the area as a desert land. These and other signs of desertification are becoming common across the dry lands of Ethiopia.

Weakening of traditional institutions

A range of traditional institutions have been used in determining access to, use and management of dry land resources, particularly rangelands, forests and water resources. Borana is a good example in this respect. The Borana people own a strong indigenous institution called *Gada* with well recognized role to managing the rangelands and water resources in the entire Borana dry lands. The complexities of *Gada* are described by many scholars (Legesse 1973, 2000; Coppock, 1994; Watson, 2003; Homann *et al.*, 2008). This egalitarian Borana institution is very popular and is often cited as a model of sustainable pastoralism in sub-Saharan Africa (e.g. Hogg, 1997; Coppock, 1994; Watson, 2003; Homann *et al.*, 2008). The *Gada* system is primarily concerned with regulating the use of the Borana natural resources, maintaining peace among the multitudes of users, and protecting them and their cattle from external invasion (Coppock 1994; Watson, 2003). The system comprises decentralized social organization to govern resource use. The structure begins from head of a household at micro unit in the social organization through *Kora Olla* (village council), *Kora ardaa* (area/county council) and *Kora Gossa* (clan council) to *Gumi gayyo* (the pan Borana assembly). A consensus on important community issues - such as redefinition and enforcement of rules, regulations, and norms is reached through open, participatory discussions in assemblies beginning from the village council and terminating at the macro (*Gumi gayyo*) level. *Gumi gayyo* (an assembly of all Borana people and/or their representatives) is held every eight years to discuss issues such as resource conflicts and cardinal rules, including those that have been violated, and to collectively devise the future of the Borana society. *Gada* used to play lead role in managing dryland resources, at least for few hundred years. But its role was weakened in the recent past.

The Borana communal-grazing system allows access to pasture and water to every member of the Borana society, contingent upon compliance with the prevailing rules and regulations, and the performance of duties and responsibilities. The entire Borana Plateau is divided into traditional administrative units called *maddas*, which geographically are configured

around a permanent water source (traditional deep well or permanent ponds). Each water source is administered by a father of the well. The father of a well regulates its use, organizes its maintenance, and coordinates with *madda* elders for the implementation of rules, regulations, and sanctions regarding the water source. Each *madda* is subdivided into *ardas*: a collection of villages or encampments (*ollas*). Each *arda* has jurisdiction over some form of grazing area, cultivation land, and, to a lesser extent, water resources. The *ollas* comprise about 10 households and are the smallest units of communal resource-management. Three types of grazing arrangements are recognized and these are: *warra*, *forra* and calf enclosures. *Forra* grazing areas are areas designated for grazing bulls and non-lactating cows (dry herds), and are customarily open to all Borana people. Transit areas around permanent water points are also *forra*. Permanent settlement in *forra* areas is prohibited by *madda* elders. Such areas are regarded as fall-back areas for all Borana people during periods of forage scarcity. *Warra* areas are grazing areas for lactating cows, and for sick and weak animals that return to the encampment everyday so that they can be milked and looked after. Areas designated as *warra* are only open to members of the same *arda* but can be used by members of different *ardas* under special arrangements, usually on a reciprocal basis. The most individualized pastures in Borana are calf enclosures. Calf enclosures are fenced pastures that are reserved for use by calves and to a lesser extent by milking cows mainly in the dry season. The use of calf enclosures is restricted to members of the community that erected the fences, usually one or more *ollas*. Access to an enclosure is restricted only to periods of absolute forage scarcity and for specific types of animals. The *Gada* institution does not constitute specific rules geared towards gum bearing species and gum-resin collection. These species are part and parcel of the woodlands and are managed as components of the entire woodlands. The absence of specific rules could relate to the fact that importance of gums and resins to livelihoods is still low and its production on relatively recognizable scale is just a recent phenomenon.

Unfortunately, changing biophysical, socio-economic and political conditions are threatening the role and the strength of the *Gada* institution in governing the resource base (Figure 1). The major challenge is growing lack of adherence of the community to the *Gada* norms. The lack of adherence originates from the multi-dimensional changes in life style of the Borana people as the result of (i) expanding urbanization and its 'modern culture' with more individualistic and changing life styles; (ii) changing livelihood strategy from pure pastoralism towards agro-pastoralism and petty trade; (iii) growing influence over the *Gada* rulers either through corruption or political interferences and subsequent lack of trust by communities; (iv) resource

scarcity particularly pasture and water due to recurring drought; (v) population pressure, regionalism (ethnicism) that curtailed pastoral mobility, and (v) exogenous interventions (state and NGOs) that assist new way of sedentary mode of life. The sedentary mode is also associated with increasing privatisation of communal rangelands and conversion to private crop fields.

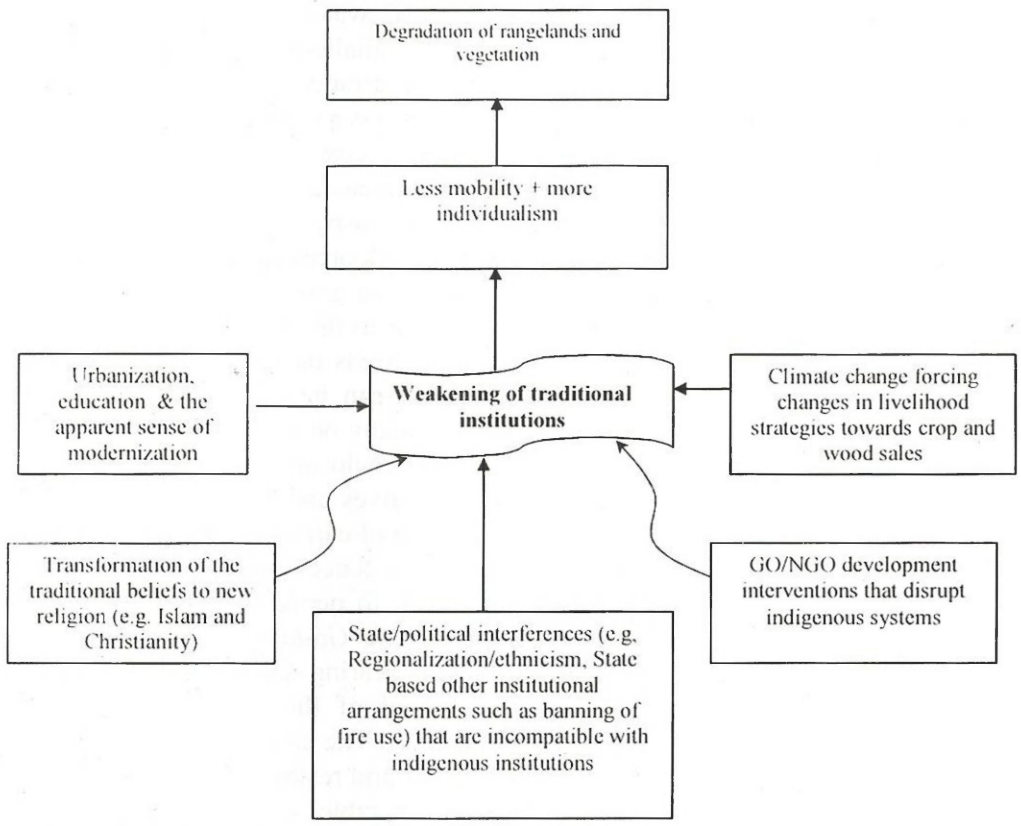

Figure1. Multidimensional challenges that undermine the power and effectiveness of the *Gada* system in natural resource management in Borana.

Conclusion

Since dry lands comprise diverse resources with huge development opportunity but still compounded with some challenges, it will be difficult to outline simple and few general recommendations on the way forward. The best, however, is to design development strategies and programs that are integrated, participatory and location specific. Developing proper land use plan and enforcing it appears to be the first priority. The obvious demographic pressure from human and livestock population must be addressed, and the

need for governing process of settlement and commercial farming must not be delayed any further. Responsible use of the resource base must be enforced. Unrestricted clearance and conversion of woodlands to farming must be regulated in relation to the production potential of the areas and also the conservation goals of the nation. By addressing the challenges cautiously, the opportunities that dry lands offer could be utilized optimally. Particularly, the land and water resources can be utilized through well planned commercial farms. Large scale irrigation infrastructures will certainly help. At the same time, the rangeland potential could be utilized for commercial ranching with improved livestock husbandry. At the same time, the eco-tourism potentials need to be fully exploited.

The following specific recommendations are outlined as possible areas of intervention for proper management and sustainable utilization of dry lands:

- Change the perceptions of key actors on the importance and potentials of dry lands;
- Improve inter-sectoral integration and harmonization of policies;
- Improve the communications infrastructure and the marketing system;
- Appropriate land use planning, and strengthening rural land administration capabilities
    - o to enforce the law and settle disputes timely (*e.g.* designate areas for agricultural expansion and identify and conserve areas for conservation);
    - o to improve public awareness on land use rights and obligations;
    - o to develop capabilities to monitor appropriate land use practices by all;
    - o to mainstream natural resource management programs in resettlement plans;
- Integrate and optimize market oriented crop framing, livestock husbandry and forestry systems whenever possible to enhance sustainable intensification;
- Promote restoration and rehabilitation of degraded dry lands, through appropriate soil and water conservation measures that are tailored to local contexts but also coupled with biological measures with attractive economic returns;
- Scale up on-farm and homestead forestry and agro-forestry practices in arid, semi-arid and dry-sub humid parts of Ethiopia to meeting subsistence and market wood demands;
- Improve livestock management practices to reduce pressure on the resource base;

- Devise an incentive schemes (*e.g.* through payment for environmental services, by linking producers to carbon markets, *etc.*) to reforest hill sides and waters sources;
- Tap and build on local knowledge on dry land farming and resources management;
- Enhance adaptive capacity of communities to climate change and food security through rational and sustainable use of natural resources;
- Community capacity building to initiate and implement natural resources management programs on their own farms and on communal lands; and
- Reinvigorate traditional institutions, build their capacity and internal accountability and provide them certain legal recognition to promote responsible natural resources management.

All these measures must be designed and implemented with active participation of local resource users.

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