

# **Lesson 4**

# **Ethiopia:**

# **Population**

# **and the**

# **Environment**

Aynalem Adugna



## Past Trends and the dire forecasts

- World Bodies Involved



## Assessing the health of the Ethiopian environment



## Population and environment: Can they get along?



## The issues

# The Ethiopian Population and Environment

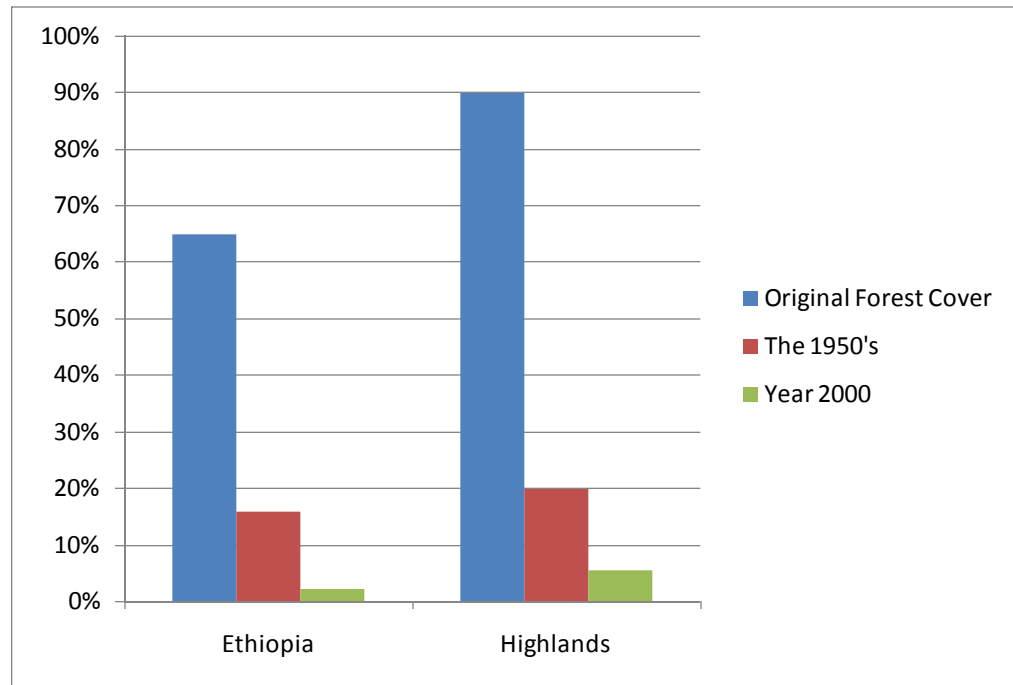
## The Issues:

### Deforestation and Land Degradation

An Ethiopian Highland Reclamation Study (EHRS) conducted two decades ago [1] revealed a frightening trend in environmental degradation where by "...27 million ha. or almost 50% of the highland area was significantly eroded, 14 million ha. seriously eroded and over 2 million ha beyond reclamation. Erosion rates were estimated at 130 tons/ha/yr for cropland and 35 tons/ha/yr average for all land in the highlands.... Forests in general have shrunk from covering 65% of the country and 90% of the highlands to 2.2% and 5.6% respectively"[2]. With the

country's population now almost double what it was then, things have, obviously, gotten much worse since.

**Fig. 4.1 The Percentages of Original Forest Cover and the Coverage in 1950 and 2000.**



Source: Based on [2]

Seventy percent of arable land in the highlands is under cereals – teff, wheat, barley, sorghum, and maize – with bare areas and exposed soil most of the year. Perennial crops – coffee, cotton, enset, fruit trees, oil seeds – cover about twenty percent. [2]. With the doubling of the Ethiopian population twice in the last half century fragile marginal lands have been brought under cultivation and fallow periods have been shortened.

Environmental degradation is most severe in the highlands, especially in the northern half of the country due, in part, to the following reasons:

- *History: long history of settlement*
- *Primitive land-use practices which included clearing of vegetation cover for farming and fuel, and lack of innovation in farming practices*
- *Vague legal environments of land ownership and uncertainty of tenure with the resultant fragmentation of land-holdings*

- *Government policies, including a move toward collectivization in the 1980's and 1990's which deprived rural citizens a sense of ownership and entitlement to the land they farmed*
- *Exponential growth in population numbers*
- *Climate change, drought, and the resulting population dislocation*
- *Cultural animal husbandry involving the overstocking of grazing land as well as use of dung and crop residues for fuel*
- *Several decades of war and conflict (northern Ethiopia)*
- *Lack of capital resources for investment in environmental rehabilitation*

A more recent accounting of available forest cover reveals that the 1990-2000 decade in Ethiopia saw an average yearly deforestation rate of 0.8 percent; among the highest in the world. It is said that, in the year 2000 alone, 87.5 million m<sup>3</sup> of timber were cut down for fuel wood [3]. With an estimated forest-land loss of 150,000-200,000 hectares annually [4], environmental degradation in Ethiopia has been persistent, widespread, and costly. The costs include the following:

Direct Costs include:	Indirect Costs include:
*Nutrient loss due to top soil erosion (or the cost to replace lost nutrients)	*Loss of the indirect benefits such as marketable forest products
*Lost crop yields due to nutrient and soil loss	*Siltng of dams and river beds
*Loss of forest cover and the cost of reforestation	*Fluctuations in river and spring waters
*Loss of livestock carrying capacity	*Reduced groundwater capacity

Source: Based on [ 2]

Some have tried to assign numbers to the damage suffered, by ascribing to it monetary loss values : [2]

The total loss per hectare of wheat is about 400 birr (\$46) per hectare in areas of low loss and 4736 birr (\$544) per hectare in areas of high soil loss. The comparable data for maize is \$31 and \$379. If we applied the lowest level of loss (\$31 ha to the 54 million hectares of cropland in the highlands, we have a total of \$1.674 billion.

A recent study cast an interesting light on a possible effective solution to the environmental puzzle; a solution that is, nevertheless, impossible to implement. It promised that regeneration of

ecosystems to a much healthier form in the hills and slopes of the Ethiopian highlands is possible if these areas “...can be kept free of human and animal intervention” [5]. Some practical examples have also been offered. The Gunono community and others in southern Ethiopia have reduced the number of cattle per family and have witnessed some environmental healing [5]. Others have done the same but in response to forces not entirely within their control. A recent study of a community in the southern regions showed that “in the mid 1980s, the average household kept 7-8 heads of cattle, but this has since declined to 1-2 head per household, because of shortages of feed, the conversion of grazing areas to farmland, the forced sale of livestock to pay off taxes and debts, and losses from disease” [6]. On the plus side, a hopeful story has been written about a model community in the same region where land holdings “are consolidated, unlike those in the northern highlands of Ethiopia, where fragmentation is the norm [and multiple cropping practices, such as intercropping and relay cropping, are common....’ [6].

In some parts of the country, including large areas of Oromia and Amhara, agricultural extension programs have shown good results. “By using fertilizers and improved varieties of seeds, farmers have substantially increased their crop yields, as well as household incomes. Research shows that these inputs, and access to credit, have often had a greater impact in lower rainfall areas than under high-rainfall conditions (drought-prone areas excepted)” [8]. A more recent research focused on the Adwa area of northern Ethiopia and came up with the suggestion that “matching the human and livestock densities with the carrying capacity of the land through recruitment of the surplus labour force for a modern economy, resettlement, off-farm employment and intensification of agriculture are the long and short-term actions that may contribute to the rehabilitation of the degraded areas” [9]. Moreover, a recent comparison of the year 1958 and 1986 area maps of Kalu in Wello has shown that clearing of vegetation for fuelwood, to use as grazing lands, new farm lands, etc., was the primary cause of land-use changes observed in the study area, thus contributing to the ongoing problems of severe land degradation in the area, and in the country at large [10]. Another study focusing on the effects of the top export earner – coffee planting and harvesting – revealed this crop’s sinister impacts through encroachment into adjacent forest lands:

“The major causes of deforestation and degradation of natural resources in the Belete-Gera Forest of Ethiopia are coffee production activities and encroachment into forestland to expand farmland and pasture. ...It is estimated that up to 49% of the accessible natural forest is under the influence of coffee production activities, among which collecting of naturally grown coffee beans has the least and the coffee plantations has the most impact on the natural forest. Coffee plantations in natural forest have reduced the forest density and species diversity. Age structure of the trees is limited to mature and old classes only, which eventually endangers their function as shade for coffee plantations” [11].

An ecological study [12] compared the land degradation assessment techniques used by indigenous ecological knowledge (IEK) of the Booran pastoralists to the techniques used by trained ecologists. It concluded that “IEK was effectively used to determine landscape suitability and potential grazing capacity of individual landscapes and at regional levels” and challenged the notion that “IEK is mythical and could not meet scientific rigor”.

## Environmental Policy:

One of the culprits of environmental damage in Ethiopia is land fragmentation. According to a local environmentalist's recent report "there are 9.3 million agricultural households, of which 6.4 million have 4-9 family members, and most of these have land holdings of 0.10-2 acres". The report adds that "...these figures vividly showed land fragmentation to be one of the causes of environmental degradation" [4]. Another study with a focus on the role of markets has shown that market forces and government subsidies (or lack thereof) can have environmental impacts [5].

The Environmental Policy of Ethiopia [EPE], was launched in 1997. It contains 11 sectoral (and another 11 cross-sectoral) policy elements. Its overall policy goal is:

"...to improve and enhance the health and quality of life of all Ethiopians, and to promote sustainable social and economic development through the sound management and use of natural, human-made and cultural resources and the environment as a whole, so as to meet the needs of the present generation without compromising the ability of future generations to meet their own needs" [7].

Urgent priority is placed on a) the need to arrest environmental degradation and combat desertification, b) sustainable agriculture, c) conservation of natural resources, and d) biodiversity. According to official reports "the Ethiopian government has embarked on a two-pronged policy in an effort to stem deforestation and the degradation of agricultural lands – tree planting or afforestation as a long-term strategy and dissemination of more efficient food stove technologies in the short term". [3]. A policy research focusing on the link between rural poverty, food insecurity and environmental degradation in Ethiopia [3] found that a crucial possible link between all three was land ownership. "Farmers express strong desire to have land ownership title as reported by the majority (73 percent) of farmers in the two districts surveyed. One of the best ways to provide farmers the incentives to increase productivity and to protect natural resources is, to give them security of land through ownership...", It also came up with the following policy recommendations:

- ***Investment in agricultural research and technology. Such an investment is seen as a catalyst for increasing agricultural production while, at the same time, protecting the natural environment.***
- ***Access to modern inputs and technology:***
- ***Removal of market and policy distortions: "Institutional and market distortions must be minimized or eliminated".***
- ***Incentives and regulatory policies to compensate for externalities that may adversely affect natural resources: "Here, the use of price based incentives such as subsidies, taxes, and other incentives are preferable to direct regulation".***

A study in Meket Wereda of North Wello documented oral testimonies of individual farmers between December 1996 and October 1998 [14] and found that "the overriding preoccupation of the narrators of these testimonies is the diminished productivity of the land", and that "this is variously attributed to poor rainfall, the small size of plots of land resulting from redistribution under the Derg, and population growth". Furthermore, "the testimonies highlight the problem of

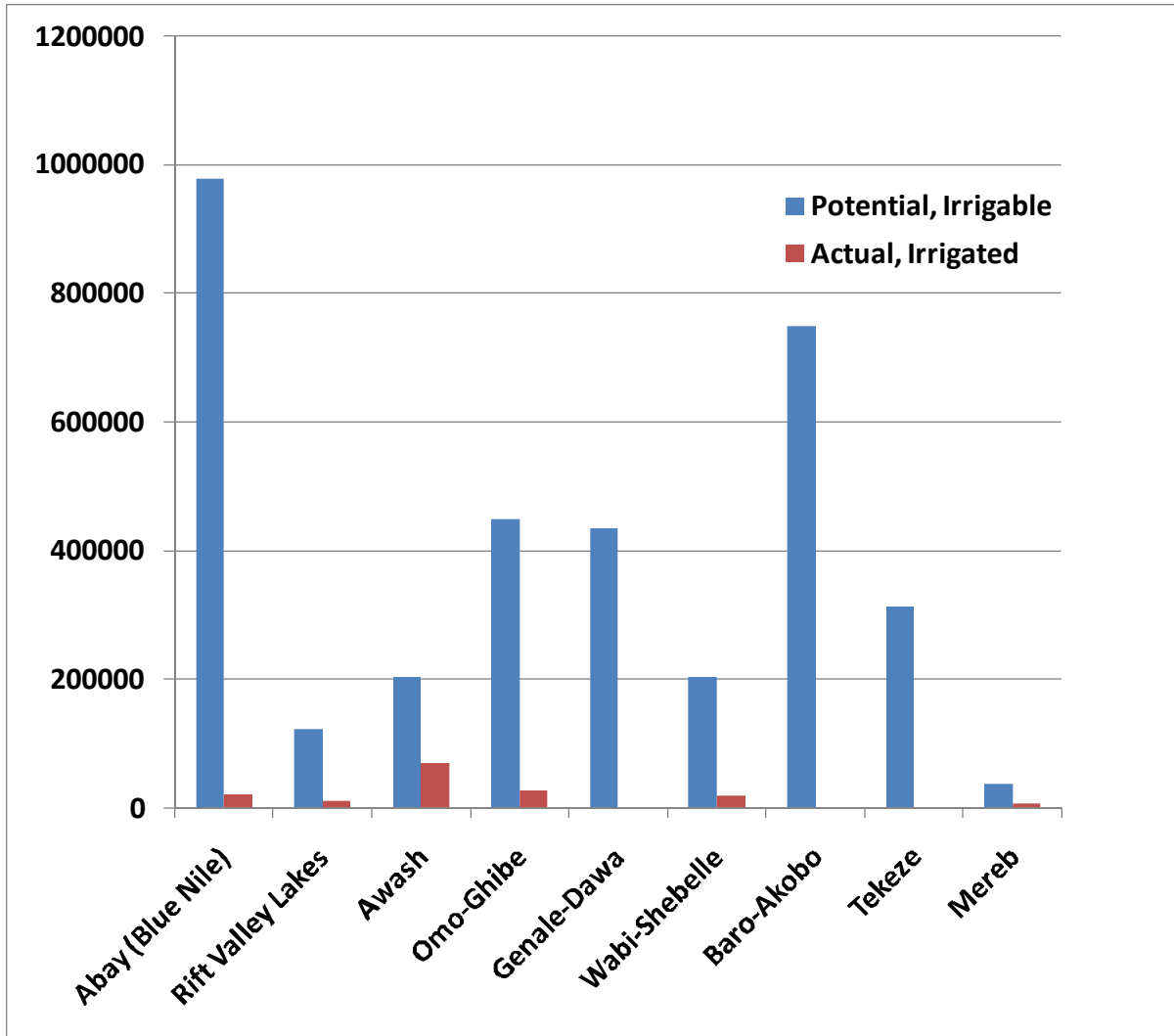
people being unable to leave their fields fallow to recover their fertility”. The study also observed emerging trends and changes in value systems fueled, in part, by unchecked population growth rates. It noted that, “... while land distribution was largely welcomed as a contribution to greater equality, it has also led to a loosening of bonds between relatives and diminished their sense of shared history, as family land is increasingly fragmented. Individual families now tend to focus on securing their own futures and expect less from the protection or patronage of relatives.” [14]

Markos Ezra [15] studied the link between all of the issues above, and rural out migration which represents a capitulation on the part of an individual, in the face of insurmountable environmental challenges. Among the study’s findings was the fact that “... individuals belonging to economically poor households in ecologically vulnerable communities have a higher propensity to out-migrate for economic reasons, compared with those who belong to wealthier households in ecologically less vulnerable communities”. Markos also noted that the dual policy objective of the National Population Policy – to reduce the rate of rural–urban migration and to ensure a spatially balanced population distribution – are facing formidable challenges and remain unfulfilled.

## **Can Irrigation Agriculture Save the Highland Ecosystems?**

Available estimates of land under potential use for irrigation suggest that only 5 percent of the “...3.7 million hectares of irrigable land in Ethiopia has been developed” [16]. A study by Mintesinot reduces the proportion under irrigation agriculture to 3 percent. [17].

**Fig 4.2 Potential irrigable and actual irrigated (ha.) area of the main drainage basins, Ethiopia**



Source: Based on [18]

Figure 4.2 depicts the enormous potential Ethiopia's river basins offer as an alternative to destructive hillside tilling of the type practiced by highland farmers for several centuries. Only the Awash River basin has seen irrigation developments at substantial scales due, in part, to its topography [19, 20] and ease of access. It "...consists of various topographical features (flat to mountainous) [and] elevation ranges from 210 to 4195 meter above sea level (m.a.s.l)". Studies show that "the average mean annual rainfall of the area ranges from 135-1372mm [and that] the basin is comprised of different soil types dominated by Leptosol". In traditional nomenclature, this agro-climatic basin falls under 'dry kola' [21].



The Nile, Genale-Dawa, Baro-Akobo, and Tekeze basins remain virtually untouched. The Nile and Baro-Akobo represent the largest and second largest potential for future irrigation development.

Investigation of gender-specific roles in community-based irrigation systems was the focus of a study [22] in three irrigation schemes – Godino (near Debre Zeit), Doni, and Teddie-Dildima Kebelle (near Mojo). The conclusions include the statement that “Irrigated agriculture is likely to raise women’s work burden. In particular female-headed households are likely to be overburdened with work.” This does not bode well for the local environment and for the country at large given that women are known to be better stewardesses of the environment. The study outcomes also warn of the pitfalls of irrigation if implementation is not based on sound and scientifically-proven practices. The observed shortcomings included “...a) possible salination of the soil in Doni; b) the spread of water- borne diseases (such as malaria); and c) contamination of water resulting from pollution caused by livestock and household refuse”. This has also been witnessed in the Awash Valley at large:

The Awash River Basin faces land degradation, high population density, natural water degradation salinity and wetland degradation. Already desertification has started at lower Awash River Basin. In the high land part deforestation and sedimentation has increased in the past three decades. As more water is drawn from the river there could be drastic climate and ecological changes which endanger the basin habitat and human livelihood. Draining the wetlands for irrigation could imbalance the sustainability of the basin. [23]

The Awash Basin is home to 10.5 million people, and represents the most important river basin in the country. The river is 1,200 KMs long and “...rises on the High plateau near Ginchi town west of Addis Ababa in Ethiopia and flows along the rift valley into the Afar triangle, and terminates in salty Lake Abbe on the border with Djibouti. [23]. It is divided into sections including “Upland” (above 1500m), “Middle” (1000 – 1500m), “Lower Valley” (500–1000m). A significant threat to the valley inhabitants comes from the pollution and contamination risks posed by the fast growing city of population of Addis Ababa and the resulting discharge of untreated water into the Akakai River which is the tributary of the Awash.

## **Land-use Patterns and the Environment**

Over four-fifths (84%) of Ethiopians live in rural areas. Agriculture accounts for over half of the country’s GDP and 90 percent of its exports [24]. However, land productivity is seriously constrained by land degradation in most parts of the country. This, coupled with rapid increases in population numbers and growth rates, insures a rise, rather than a decline, in poverty levels. Mixed farming (crop and livestock) is practiced in most highland areas. Three broad agro-ecological zones are recognized [25]:

High Potential Perennial (HPP)	Growing period* (days) > 240
High Potential Cereal (HPC)	Growing period 180 - 239
Low Potential Cereal (LPC)	Growing period < 180

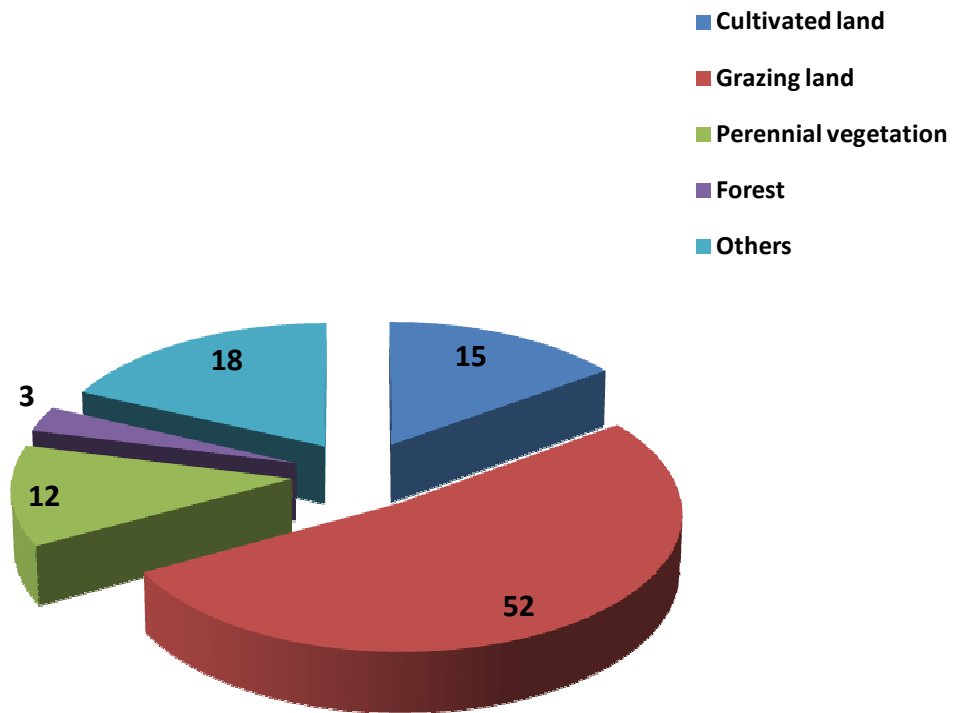
\*Number of days in a year that plants can grow without irrigation

A 1999 study by Japan International Cooperation Agency cited the following land-use and demographics factors for the country's economic and environmental woes [26]:

- *Population pressures, particularly in the highlands*
- *Conversion of forest land in to agriculture, resulting in soil erosion and environmental degradation.*
- *Lack of land ownership rights and the resulting lack of commitment to environmental stewardship of the land*
- *Conversion of crop residues and animal waste into fuel, thus depriving the soil a chance to replenish itself.*

Another study on rural poverty and food insecurity adds the need for "...complementary institutions such as research, extension, and transport services...." [27]

**Fig 4.3 Land-use Types, Ethiopia (1997)**



Source: Based on [26].

One of the available methods in the evaluation of changes in land-use over time is the use of aerial photographs and/or satellite imagery from two time periods. One such study looked at a 30-year change (1971 – 2000) in the Yerer Mountain areas of Oromia. Results of the land cover change analysis showed that the size of the cultivated land increased from 25% in 1971/72 to 56.4% in 2000”, and that “the increase in cultivated land in three decades was 125%, which was mainly at the expense of the grasslands”. The report also showed that the area coverage of grasslands decreased from 65.35% in 1971/72 to 32.7% in 2000 [27].

A recent environmental study sought to examine the diverse nature of environmental problems faced in different corners of the country, and the equally diverse solutions sought to address the disparate issues, and find remedies. Eight Weredas were targeted. Namely: Adaa, Adaba, Alamata, Atsbi, Dale, Fogera, Metema, Mieso [28]. The chart below details the existing environmental issues in the Weredas listed, and the proposed new interventions.

Wereda	Existing environmental issues	Type of interventions/ new technology
Adaa	Deforestation, soil degradation and nutrient loss, poor watershed management, flooding, siltation (some areas), Standing water at Cheleleka serving as a breeding ground for mosquitoes. Water pollution due to urban waste (Debre Zeit)	Crop cultivation under agrochemicals, improvement of efficiency of vegetable cultivation under Irrigation, and use of livestock drugs & chemicals..
Alaba	Rainfall maldistribution, malaria, poor soil, flooding, soil erosion, shortage of grazing land, low water table	Expansion of haricot bean for export, enhancement of irrigation water use, cultivation with agrochemicals, use of livestock veterinary drugs.
Alamata	Steep slopes/land degradation, increasing number of water harvesting ponds and hence, Malaria and Bilharzia, contamination-water toxins injurious to livestock, Congress Weed, Flooding	Wetlands reclamation, development of irrigation potential, cultivation with agrochemicals, improved animal feed program, use of livestock veterinary drugs.
Atsbi	Shallow soils due to steep slopes and deforestation, severe gulleying and river-bed erosion, thousands of water harvesting/fun-off ponds, high ground water but too few water wells, night frosts and high winds	Land closure for livestock and bee forage, and improved watershed management, development of irrigation potential, cultivation with agrochemicals, and use of livestock and poultry drugs and chemicals.
Dale	Malaria in humans, trypanosomiasis in animals, rainfall maldistribution, poor soils, land scarcity/low productivity, over	Reintroduction of improved native Sidama coffee types, peri-urban dairy development cultivation with

	grazing, pollution of rivers and streams by coffee pulping plants	agrochemicals, and use of livestock veterinary drugs and chemicals
Fogera	Deforestation, land degradation, mountain slopes prone to soil degradation/loss of vegetation, siltation on the plains and in Lake Tana, standing flood waters and malaria	Expanded and improved rice production program, improvement in efficiency of cultivating vegetables under irrigation, use of agrochemicals in improved cultivation of vegetables and pulses, use of livestock and poultry drugs and chemicals and improved fisheries program.
Metema	High temperatures/evapotranspiration, malaria, invasive weeds, deforestation, waterlogging, animal diseases, the custom of setting fire to kill ticks	Minimum/Zero tillage, expansion of irrigation potential, and cultivation with agrochemicals.
Mieso	Draught, overgrazing, Malaria, Anthrax, pasteuriosis, blackleg (livestock), clearing of vegetation for charcoal, soil erosion, water points where thousands of cattle congregate, gulleys in old quarry sites,	Expansion of vegetables and fruits production, expanded adoption, and introduction of new crops.

## The impacts of Urbanization, Modernization, and Technology

On a global level, modernization and technology have also brought about changes in land-use patterns as did the urbanization. A somewhat less consequential but serious (in terms of rural lives disrupted) agent of change in rural landscapes in the latter half of the 20<sup>th</sup> century is commercial farming and the building of dams for hydroelectric power. The construction of dams has given rise, among other things, to "...social, environmental, and economic problems by increasing the relocation of communities against their will and inducing watershed land degradation". A case in point is the Fincha Dam in Oromia where the reservoir "... has inundated a total of 100 km<sup>2</sup> of grazing land, 120 km<sup>2</sup> of swamp, 18 km<sup>2</sup> of cropland and 1.2 km<sup>2</sup> of forest" [29] leading to widespread dislocation and marginalization of the settler population.

The expansion of the cropland to adjacent slopes and increasing population pressure has led to severe environmental degradation of the steep and vulnerable slopes.

Urbanization has been a double-edged sword. On the one hand, it acted as a pressure valve (as it did in all regions of the world) to relieve the environmental and land-use stress on rural farms. On the other, it has led to an intense concentration of people in places like Addis Ababa where pollution of land, water, and air is becoming a significant health concern.

## **Indigenous Knowledge and Sustainable Land Management**

An excellent example of a home-grown indigenous talent, and a highly effective sustainable agricultural practice, comes from the Konso area of the Southern Nations Nationalities and Peoples Region (SNNPR) [30].

The farmers of Konso are well known for their own homegrown/special terrace building, which is one of the best locally available techniques for soil and water conservation. In addition, the Konso's are well known for their crop diversification to minimize risk, mixed cropping and multi-story crop and tree production in traditional intensification. Unlike the tradition such as in the northern parts of Ethiopia, weavers, smiths, potters etc., are not outcasts but having equal status in the society. Merit is given to hard work, productivity and natural resource conservation. As a result, the Konso's people have controlled land degradation even in hilly and mountainous areas. Each terrace has been in place for more than 50 years. All Konso people participate in terrace building. Konso's terracing and agro forestry practices have significant contribution to combat desertification and mitigate the effects of drought and needs to be replicated in other parts of the country.

Another example comes from Gedio (also from SNNPR) where 86 percent of the population is "...involved in agro-forestry development activities" [30] and nearly all inhabitants live off of a home-garden land use system. "In this system slopes as steep as 80 degree are under production". As a result "... soil and water resources are well conserved, home garden agro-forestry and biodiversity have been enhanced; and most area of the zone is covered by evergreen vegetation" [30]. All of these have combined with the cultivation of Enset *Ventricosum* to make Gedio one of the most densely populated Weredas with densities reaching almost 600 persons per km<sup>2</sup>.

## Global Issues

### Population and Environment:

#### General

Discussions of the interplay between population, economic development, and the environment predate the emergence of economics as a field of study. “Since ancient times, statesmen and philosophers have expressed opinions about such issues as the optimum number of people and the disadvantages of excessive population.... The recurrent theme was the balance between population and natural resources conceptualized as means of subsistence or, more concretely, food and water”. [31] The world population grew four-fold (from 1.6 billion to 6.1 billion) between 1900 and 2000. This was coupled with a twenty to forty-fold increase in world GDP, leading to vastly higher living standards for a significant portion (but not all) of humanity. What is more notable than the unevenness of benefits accrued from the GDP growth is, however, the unsustainable utilization of the Earth’s physical resources and the attendant environmental impacts.

These are some of the major Population-Environments Conferences in the past 35 years convened to address the population-environment issues:

1. **Conference on the Human Environment:** Stockholm, June 1972: the first world intergovernmental conference on the protection of the environment. This led to Declaration of the UN Plan of Action for the Environment (1973). The Declaration affirmed that “the natural growth of population continuously presents problems for the preservation of the environment, and adequate policies and measures should be adopted, as appropriate, to face these problems” [31].
2. **First global population-environment conference:** Bucharest , Rumania ( 1974)
3. **Second global population-environment conference:** Cairo, Egypt (1984)
4. **The UN Conference on Environment and Development,** Rio de Janeiro, Brazil (1992). This conference “..... was a milestone in the evolution of an international consensus on the relationships among population, development and environment, based on the concept of *sustainable development* articulated a few years earlier by the World Commission on Environment and Development”. Sustainable development was defined as a development that “meets the needs of the present without compromising the ability of future generations to meet their own needs” [31]
5. **Third International Conference on Population and Development,** Cairo in (1994)

The program of action (1995) noted that “...poverty, patterns of production and consumption, and the environment are so closely interconnected that none of them can be considered in isolation”

6. **The United Nations Conference on Human Settlements** (Habitat II), Istanbul, Turkey (1996). Here, “.....population, environment and development interrelationships received extensive treatment, particularly as they related to issues of urbanization...Specific reference was made to changes in structure and distribution, especially the tendency towards excessive population concentration.” [31].
7. **The Kyoto Protocol, Kyoto, Japan** (1997) where “.... developed countries agreed to specific targets for cutting their emissions of greenhouse gases”. [32]
8. **The UN millennium summit (2000)** where 189 leaders of countries around the world agreed on a number of new principles“.....which include halving the proportion of people living in poverty and hunger by 2015, ensuring primary schooling for all children, and reversing the spread of HIV/AIDS, malaria and other major diseases” [33].
9. **Millennium+5 summit** (2005). The summit showed that between the years 2000 and 2005 “... many governments had not acted on their promises, and the gap between rich and poor continued to widen. Many calculated that the world would not meet the UN goals in one hundred years, let alone by 2015” [33]
10. **The 10th session of the Conference of the Parties to the U.N. Framework Convention on Climate Change**, Buenos Aires, December 2004. “There were some 6,000 participants from 180 countries, including representatives of governments, multilateral agencies and civil society organizations”. [34]
11. **Climate change conference** in Montreal, Canada , December 2005. “The conference was the largest intergovernmental climate conference since the Kyoto Protocol was adopted in 1997, and some 10,000 participants attended.” [34]
12. **Copenhagen Climate Conference (December 2009)**: Saw the participation of over 100 heads of states and 194 countries. It resolved to “keep the maximum temperature rise to below 2 degrees Celsius; the commitment to list developed country emission reduction targets and mitigation action by developing countries for 2020; USD 30 billion short-term funding for immediate action till 2012 and USD 100 billion annually by 2020 in long-term financing, as well as mechanisms to support technology transfer and forestry”

## Carrying Capacity

Over the years, individuals have attempted to estimate the number of people that the planet can support, or its “carrying capacity”. Figures ranging from 1 billion to 1000 billion have been thrown around. However, most researchers recognized that “...culturally and individually variable standards of living, including standards of environmental quality, set limits on population size well before the physical requirements for sheer subsistence” [35]



As the 21st century begins, growing numbers of people (86 million new people per year) and astronomical increases in consumption per capita, even in the formerly less developed countries (LDC) like China and India, are further depleting natural resources and degrading the natural environment. In many countries widespread water shortages, deterioration of arable land, unsustainable use of the natural habitats, and rampant pollution are undermining socio-economic progress and posing severe dangers for public health. "There is no question that improving standards of living for the current poor of the world, plus providing for the billions still to come, will increase global demand for food, water, energy, wood, housing, sanitation, and disposal of wastes," [36]. Despite an emerging trend of a slowdown in population growth rates too many millions are still added each year there by increasing the pressure on available agricultural, fresh water, and other finite resources. "A new Germany is added annually, a new Los Angeles monthly". [37] One of the proposed solutions/plan of actions is the Millennium Development Goals (MDG).

### **The Millennium Development Goals [32]**

- *Eradicate extreme poverty*
- *Achieve universal primary education*
- *Promote gender equality and empower women*
- *Reduce child mortality*
- *Improve maternal health*
- *Combat HIV/AIDS, malaria and other diseases*
- *Ensure environmental sustainability*
- *Develop a global partnership for development*

## **The Main Environmental Issues**

### **I. Biodiversity**

The interrelated existence of the diverse life on earth – animals and plants - is commonly referred to as biodiversity. Detailed discussions on the subject focus on "... species of plants, animals, and microorganisms, the enormous diversity of genes in these species", as well as "... the different ecosystems on the planet, such as deserts, rainforests and coral reefs..." [38]. Biodiversity boosts ecosystem productivity whereby every species, no matter how big or small, have an important productivity role to play. According to estimates by Harvard entomologist, Edward O. Wilson:

“... some 27,000 plant, animal and insect species become extinct every year (the vast majority being insects). About 24 per cent (1,130) of mammals and 12 per cent (1,183) of bird species are currently regarded as globally threatened. Most species extinction can be traced to human encroachments on habitat, including forests and coral reefs, which results from population growth and economic development” [39].

## Definition:

The online encyclopedia – Wikipedia – defines biodiversity as follows [40]:

“The most straightforward definition is ‘variation of life at all levels of biological organization’. A second definition holds that biodiversity is a measure of the relative diversity among organisms present in different ecosystems. ‘Diversity’ in this definition includes diversity within a species and among species, and comparative diversity among ecosystems.”

“A third definition that is often used by ecologists is the ‘totality of genes, species, and ecosystems of a region’. An advantage of this definition is that it seems to describe most circumstances and present a unified view of the traditional three levels at which biodiversity has been identified:

Genetic diversity - diversity of genes within a species. There is a genetic variability among the populations and the individuals of the same species. (See also population genetics.)

Species diversity - diversity among species in an ecosystem. "Biodiversity hotspots" are excellent examples of species diversity.

Ecosystem diversity - diversity at a higher level of organization, the ecosystem. To do with the variety of ecosystems on Earth.

Studies with hard numbers are hard to come-by but it is feared that human economic activity and centuries of environmental destruction have caused massive extinctions in Ethiopia. Anecdotal evidence and individuals’ recounting of stories passed on by parents and grandparents speak of a land now barren, but once teeming with a multitude of plant and animal life. This ranges from various animal species, forests and the ecosystems that forests support, to shrub lands, grass lands, and semi-desert habitat as well as the plant and animal life they once sustained. The main shortcomings of ongoing programs and policies in Ethiopia include the elitist nature of proposed solutions with appointed city officials in the driving seat while rural folks living the nightmarish life of changing environmental fortunes are taking the back-seat in policy formulations and implementations. Rural stakeholders’ detailed knowledge of their land, its current conditions, and solutions to its problems needs to be acknowledged and incorporated into programs of action. The following quote from a 45 year old female head of a household in Meket (north

Wello) should put to rest any doubts that policy makers might have about rural folks' understanding of the causes of, and solutions to, their environmental misfortunes:

“In the old days the forest was well kept and we used to go there and get a load of firewood from just one tree. Now you may travel a long distance and get not even a single load of firewood in a whole day. The trees were cut down and the land made barren. So, even the wild animals have disappeared. The soil was exposed to erosion by the flood water and there are large gullies now where there were none before. The population has grown and the land is not producing at all. The livestock have nothing to graze on and spend the whole day lying on the barren land. They are dying of hunger and disease. In the days of our fathers, one could reap about 10 donkey loads of crop from a small plot of land ploughed with just two pairs of oxen. Now you cannot reap even 3 *aqmada* of crops from the same area of land. Some people may be called rich now, but all they are left with is their big one-storey house and their fence. *Dagusa*, which we didn't know before, is now brought here by the traders and consumed as food. Irrigation has been reduced due to the shortage of rains. The number of children is increasing and people's resources depleted. Livestock production has been replaced by the production of children.” [14]

Her proposed solution is in no way inferior to one proposed by scientists: “For her, hopes of reversing current hardships lie most in planting trees and tackling soil erosion. In this way, she believes, “the locality will be transformed” [14]. The solution is **sustainable agriculture and population control** at all scales and in all parts of the country supported by enabling government policies and institutions.

## II. Climate Change/ Global Warming

The world climate is changing, and not for the better. Most scientists believe that climate change is here, and is human-induced. They also predict that it will lead to more extreme weather patterns such as hurricanes and drought, longer spells of dry heat or intense rain and seriously affect the world's ecosystems, as well as humanity.

There is now irrefutable evidence and scientific consensus that global warming is taking place. “Many are agreed that climate change may be one of the greatest threats facing the planet. Recent years show increasing temperatures in various regions, and/or increasing extremities in weather patterns”. In 1988, the United Nations Environment Program (UNEP) and the World Meteorological Organization (WMO) created the Intergovernmental Panel on Climate Change (IPCC) “... to assess the scientific knowledge on global warming. The IPCC concluded in 1990 that there was broad international consensus that climate change was human-induced” [40]. An issue with particular relevance and importance to Ethiopia might be “global dimming”:

“Research has shown that air pollutants from fossil fuel use make clouds reflect more of the sun's rays back into space. This leads to an effect known as global dimming whereby less heat and energy reaches the earth. At first, it sounds like an ironic savior to climate change problems. However, it is believed that global dimming caused the droughts in Ethiopia in the 1970s and 80s where millions died, because the northern hemisphere oceans were not warm enough to allow rain formation. Global dimming is also hiding the true power of global warming. By cleaning up global dimming-causing pollutants without tackling greenhouse gas emissions, rapid warming has been observed, and various human health and ecological disasters have resulted, as witnessed during the European heat wave in 2003, which saw thousands of people die”. [41]

A growing concern is the impact global warming would have on developing countries. It is feared that the consequences of climate change will be most severe for the world's poorest countries.

### III. Human Populations

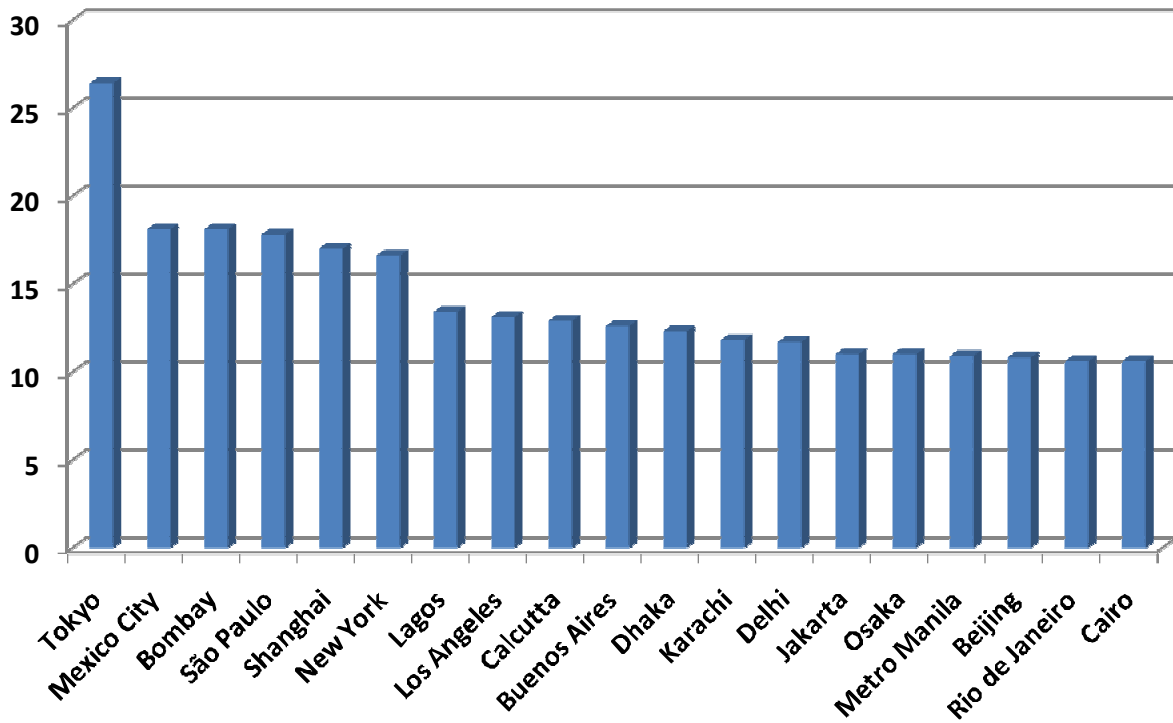
The human population of the planet is approximately 6.6 billion and rising. As the population continues to increase, there will be more and more strain on the environment, food production, a nation's ability to provide for its population. Economic growth, social stability as well as society's ability to flourish are being impacted.

The following information is derived from the United Nations Fund for Population Activities (UNFPA) web site [39]

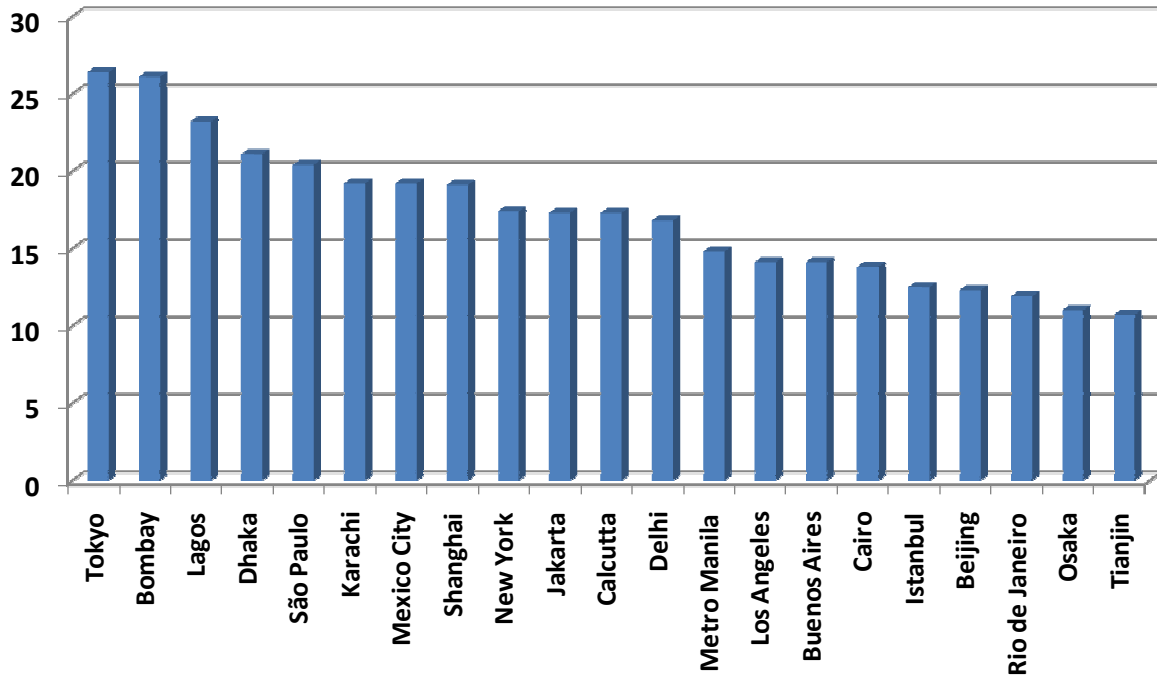
- *Fragile ecosystems are being decimated by persistent and rapid population growth. Farmers and fishermen are exploiting the finite food sources on land and water with untold rapidity leading to near exhaustion of these resources. Since the early 70's the agent of change and the force behind the immense population pressure on land and water resources has been increasing food production. About thirty years later additional food is needed to feed two and a half billion more people than in 1972. There are still close to a billion hungry people around the world.*
- *Under conditions of limited resources, rapid population growth increase can make it more difficult to tackle issues of poverty and underdevelopment because the infrastructure necessary to bring about development - pool of doctors, teachers, and other professionals - all need to grow faster.*
- *Although the percentage of people in absolute poverty has fallen from 28 to 24.5 per cent in recent years, the increase in population means that the actual number of people in poverty has stayed the same.*
- *“More than any other resource, water shortage is becoming critical issue both for agriculture (which makes up about 70 per cent of demand) and industry. A safe water supply is also one of the most important factors in improving the health of poor families. Up to 7 billion people, in 60 countries, will face water scarcity within the next half century, according to the UN World Water Development Report released in March 2003”[39].*
- *About 11 percent of the world's arable land (the size of China and India combined) has been destroyed by human activity, and over 40 per cent of available agricultural land is now degraded in some way. As a result, the world's farmers must feed 87 million more people with 27 billion fewer tons of topsoil every year.*

- ***”Population growth is fuelling very rapid urban growth in the developing world. By 2030, nearly 5 billion people (over 60 per cent of the world's population) are expected to live in towns and cities. And while urban settlements have great potential to enrich life, the speed of their growth has led to immense environmental problems. Some 600 million city dwellers are today without adequate shelter and over 400 million do not have access to the simplest latrines”. [39]***

Massive population concentration, also known as urbanization, has hastened the environmental damage in the developed countries (DC), and more recently (starting in the last quarter of the 20<sup>th</sup> century), in the less developed countries (LDC). Urban pollution is the root cause of numerous illnesses and deaths. In LDC's of Asia (notably China, and India), Latin America, and Africa, “...the old killers are still around—tuberculosis, malaria, and diarrheal diseases, among others—and now HIV/AIDS. But joining these as important causes of death and ill health are cancers and chronic diseases caused by industrial and agricultural chemicals and other pollutants in the atmosphere, soil, and water”. It is estimated that “air pollution kills an estimated 2.7 million to 3.0 million people every year—about 6% of all deaths annually, and that “...about 9 deaths in every 10 due to air pollution take place in the developing world, where about 80% of all people live” [42]. The graph below shows the population sizes of mega-cities around the world in the year 2000 and in 2015:

**Fig. 4.4 Population of Megacities (millions), Year 2000**

Projected Population of Megacities (millions), 2015



Source: Based on [42]

Land, air, and water pollution are the main environmental issues in these cities and the countries they are located in but their impacts goes well beyond the confines of city and country borders. For instance, according to a recent BBC headline news report “...the US Environmental Protection Agency estimated that on certain days nearly 25% of pollution in the skies above Los Angeles could be traced to China”. It also reported that “...China is the world's largest sulphur dioxide polluter [the main cause of acid-rain], emitting nearly 26m tons of the gas in 2005”. [43].

Other air pollutants include [44]:

**Ozone (O<sub>3</sub>):** is not usually directly emitted into the air, but is created by a chemical reaction between oxides of volatile organic compounds (VOC) and nitrogen (NO<sub>x</sub>) and in the presence of sunlight.

**Particulate matter (PM):** also referred to as particle pollution, is a complex mixture of extremely small particles and liquid droplets.

**Carbon monoxide (CO):** is an odorless and colorless gas resulting from incomplete combustion of fossil fuel

**Nitrogen oxides (NOX):** form when fuel is burned at high temperatures, as in a combustion process.

**Lead:** is a metal found naturally in the environment the major sources being motor vehicles and industrial sources.

## References

1. FAO 1986. *Highlands Reclamation Study* rugocifyxcgdyup;jzyu *Ethiopia Final Report*. Vol. I & II. Rome, Italy
2. [http://lada.virtualcentre.org/eims/download.asp?pub\\_id=92120](http://lada.virtualcentre.org/eims/download.asp?pub_id=92120).
3. Kebrom Tekle. *Natural regeneration of degraded hillslopes in Southern Wello, Ethiopia: a study based on permanent plots*. Applied Geography, Volume 21, Issue 3, July 2001, Pages 275-300
4. <http://www.addistribune.com/Archives/2003/09/05-09-03/Environmentalist.htm>
5. Stein Holden . *Economic Reforms and Soil Degradation in the Ethiopian Highlands: A Micro CGE Model with Transaction Costs*, Department of Economics and Social Sciences, Agricultural University of Norway
6. Tilahun Amede, et.al. *Reversing the degradation of arable land in the Ethiopian Highlands*. Managing Africa's Soils No. 23, Areka Research Centre, 2001
7. The Federal Democratic Republic of Ethiopia Environmental Protection Authority. The 3rd National Report on the Implementation of the UNCCD/NAP in Ethiopia, February 2004. Addis Ababa.
8. [http://www.ifpri.org/media/lfl\\_results.htm](http://www.ifpri.org/media/lfl_results.htm)
9. <http://www.springerlink.com/content/q4x6166807170355/>
10. Kebrom Tekle, Lars Hedlund . *Land Cover Changes between 1958 and 1986 in Kalu District, Southern Wello, Ethiopia*, Mountain Research and Development, Vol. 20, No. 1 (Feb., 2000), pp. 42-51
11. Journal of forest research, Vol.3, No.4(19981116) pp. 199-204
12. G. Oba and D.G Kotile, Assessment of Landscape-level Degradation in southern Ethiopia: Pastoralists VS Ecologists. Paper Prepared for the International Conference on Policy and Institutional Options for the Management of Rangelands in dry Areas. May 7 - 11, 2001(Hammamet, Tunisia)



13. Sisay Asefa and Tesfaye Zegeye. Rural Poverty, Food Insecurity and Environmental Degradation in Ethiopia: A Case Study from South Central Ethiopia. prepared for presentation at 2nd EAF/IDR International Symposium on Contemporary Development Issues in Ethiopia , July 11-13, Addis Ababa, Ethiopia Revised April, 2003
14. <http://www.mountainvoices.org/ethiopia.asp>
15. Markos Ezra. Ecological Degradation, Rural Poverty, and Migration in Ethiopia: A Contextual Analysis.
16. [http://agcal.usask.ca/ethiopia/about\\_ethiopia.html](http://agcal.usask.ca/ethiopia/about_ethiopia.html)
17. Mintesinot Behailu et.al . Report on Community Based Irrigation Management in Tekkeze Basin: Performance Evaluation. A Case Study on Three Small-Scale Schemes (Micro Dams), March 2005.
18. [http://www.iwmi.cgiar.org/assessment/files/pdf/publications/WorkingPapers/INCREASINGWater\\_Girma.pdf](http://www.iwmi.cgiar.org/assessment/files/pdf/publications/WorkingPapers/INCREASINGWater_Girma.pdf)
19. Atesmachew Bizuwork, et. al. GIS suitability for analysis of Land Suitability and Determination of Grazing Pressure in Upland of the Awash River Basin, Ethiopia., ILRI
20. [http://www.iwmi.cgiar.org/assessment/files/pdf/publications/WorkingPapers/GIS\\_based\\_livestock.pdf](http://www.iwmi.cgiar.org/assessment/files/pdf/publications/WorkingPapers/GIS_based_livestock.pdf)
21. Atesmachew Bizuwork, et. al. Application of GIS for Modeling Soil loss rate in Awash River Basin, Ethiopia, ILRI
22. Dejene Aredo, et. al. Gender, Irrigation, and Livestock: Exploring the Nexus. Policy Briefing, ILRI, June 2005.
23. Girma Tadesse et.al The water of the Awash River Basin: A future Challenge to Ethiopia. ILIR , <http://www.iwmi.cgiar.org/assessment/files/pdf/publications/WorkingPapers/WaterofAwasBasin.pdf>
24. Badege Bishaw and Abdu Abdulkadir, Agroforestry and Community Forestry for Rehabilitation of Degraded Watersheds on the Ethiopian Highlands. International Symposium on Contemporary Development Issues in Ethiopia, July 11-12, 2003, Addis Ababa, Ethiopia
25. Deforestation and Land degradation in the Ethiopian Highlands: A Strategy for Physical Recovery. Northeast African Studies, Vol 8, No. 1 (New Series, 2001), pp 7-26.
26. Ethiopia. Country Profile on Environment. Japan International Cooperation Agency, 1999.
27. Sisay Asefa and Tesfaye Zegeye, Rural Poverty, Food insecurity and Environmental Degradation in Ethiopia: A Case Study from South Central Ethiopia. Revised April 2003. aper prepared for presentation at 2nd EAF/IDR International Symposium on Contemporary Development Issues in Ethiopia, July 11-13, Addis Ababa, Ethiopia
28. <http://www.ipms-ethiopia.org/Focus-Area/Environmental/Assessment-and-screening-report.asp>
29. Bezuayehu Tefera and Geert Sterk, Environmental Impact of a Hydropower Dam in Fincha'a Watershed, Ethiopia: Land Use Changes, Erosion Problems, and Soil and Water Conservation Adoption.
30. The FDRE Environmental Protection Authority. 3<sup>rd</sup> National Report on the Implementation of The UNCCD/NAP in Ethiopia. February, 2004. Addis Ababa.
31. UN Department of Economic and Social Affairs, *Population, Environment and Development*. The Concise Report. New York, 2001
32. <http://www.globalissues.org/EnvIssues/GlobalWarming/Kyoto.asp>

33. <http://www.un.org/millenniumgoals>
34. <http://www.globalissues.org/EnvIssues/GlobalWarming/Delhi.asp>
35. Cohen, J. (1995). *How Many People Can the Earth Support?* New York: W. W. Norton.
36. <http://www.infoforhealth.org/pr/m15/m15chap1.shtml>
37. <http://www.fpif.org/briefs/vol4/v4n14pop.html>
38. <http://www.globalissues.org/EnvIssues/Biodiversity.asp>
39. <http://www.peopleandplanet.net/doc.php?id=199&section=2>
40. <http://en.wikipedia.org/wiki/Biodiversity>
41. <http://www.globalissues.org/EnvIssues/GlobalWarming.asp>
42. <http://www.infoforhealth.org/pr/m15/m15chap2.shtml>
43. <http://news.bbc.co.uk/2/hi/asia-pacific/5241844.stm>
44. <http://www.epa.gov/air/ozonepollution/index.html>