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CHAPTER SIX

SOILS, NATURAL VEGETATION AND WILDLIFE RESOURCES OF ETHIOPIA AND THE HORN

6.1. Introduction

The previous geological process and different climatic events followed Ethiopia to have different soil and biological diversity. The formation and spatial variability's of **soils** in Ethiopia is largely related to ***topographic*** and ***climatic factors***, ***parent material (rocks)*** and ***land use***. Different parts of Ethiopian regions experiences. Likewise, the distribution of **wildlife** and **natural vegetation** in Ethiopia and the Horn is controlled by many factors important among which are ***climate, soil types, drainage*** etc. **Natural vegetation's** are vital for human beings in many ways. *Plants* can provide **shelter, food, source of fuel, pasture and grazing, raw material for industries**. Ethiopia possesses unique and characteristic ***fauna*** and ***flora*** with a high level of endemicity. However, manmade as well as natural problems are threatening their availability and distribution.

6.2. Ethiopian Soils: Types, Degradation and Conservation

6.2.1. Introduction

What is soil?

Soils are the uppermost loose or unconsolidated material overlying the earth's crustal rocks. Its major components are ***water***, ***air***, ***organic*** and ***inorganic minerals***. It is a dynamic, natural and complex substance which can support animals and plants.

Soils of Ethiopia owe their origin to:

- **Parent rock material** which has been broken into small particles by way of weathering and natural decomposition.
- **Climatic conditions**, which largely determine the speed and nature of the processes that form the soil; for example, extreme heat, or cold, could stop the work of bacteria, and the amount of moisture influences on several aspects of soil formation.
- **Vegetation cover**, which adds humus to the soils and renders support to the soil making animals and bacteria.

Soil formation

Soil formation is a long-term complex process. It could take several thousands of years to form a single stratum of soil.

Weathering also acts as a soil formation process. It disintegrates the inorganic substances (rocks) of soils. It is the breakdown of rocks at the Earth's surface, by the action of ***rainwater, extremes of temperature,*** *and* ***biological activity***.

- There are 3 Types of weathering involving in soil formation.

A. **Mechanical (physical) weathering**: The process of differential stresses due to ***heating*** and ***cooling*** or ***expansion*** of ice breaks the rock. Abrasion (erosion by friction) due to water containing sediment or Wind carrying debris.
B. **Biological weathering**: It involves the weakening and subsequent disintegration of rock by plants, animals and microbes.
C. **Chemical weathering**: It involves the modification of the chemical and mineralogical composition of the weathered material. The common chemical weathering processes are hydrolysis, oxidation, reduction, hydration, carbonation, and solution.

- **Soil properties:** *Soils have two basic properties***.**

1. Physical properties

Soil physical properties are influenced by composition and proportion of major soil components. These properties affect air and water movement in the soil, and thus the soils ability to function**.** These properties are: - *Texture, Structure. Porosity etc*.

2. Chemical Properties

Soil chemistry is the interaction of various chemical constituents that takes place among soil particles and in the water retained by soil. The properties that affect soil biological activity and indirectly the nutrient dynamics. These are properties like: - *availability of minerals, electrical conductivity, soil pH, etc.*

6.2.2. Major Soil Types in Ethiopia

The soils of Ethiopia are basically derived from crystalline, volcanic and Mesozoic sedimentary rocks. According to the latest classification made by the FAO, there are eighteen classes of soil in Ethiopia. The six major groups of soils are discussed based on *Environmental Condition, Characteristics (properties), Agricultural suitability,* and *Occurrence (location).*

- Here are the main soil types. They cover more than 85 percent of the country.

A. Nithosols (red basaltic soils): These soil types:

- Cover about 12 percent of the country.
- Are basically associated with high rainfall and are found in areas that were previously covered with forest.
- Are predominant in the Western Highlands of Wellega, Keffa, Illubabor, the Southern Highlands of Sidama, the Central and Western Highlands of Shoa, the Highlands of Gojjam and the Eastern Highlands of Hararghe.
- Are matured soils with deep profiles. They are highly leached and lack soluble minerals like Sodium, Calcium, etc., but they are rich in iron and aluminum.
- Are potentially good for farming and other agricultural practices since they are friable, and have a stable structure; as a result,
- Are the most widely cultivated soil type. They are the best soils for coffee, inset and cereals.

B. Vertisols (black Basaltic soils): soil types of these sort:

- Cover about 10 percent of the total land of Ethiopia.
- Have high clay content; so, are sticky. For this reason and for poor drainage qualities, such soils are difficult to be used for farming purposes.
- Have excellent nutrients that could provide support for agriculture, but their poor drainage qualities limit their use for grazing purposes.
- Are largely found in Arsi, Bale and central Hararghe, where there are pronounced wet and dry seasons.

C. Acrisols: These soil types:

- Are found associated with Nithosols.
- Cover about 4.5 percent of the country.
- Are widely found in the Southwestern Highlands of Ethiopia, where there is high rainfall.
- Are extremely leached; and therefore, have low productivity capacity.

D. Cambisoils: Such soils:

- Are soils that developed from the recent lava deposits of the Quaternary Period.
- Are young and shallow.

- Are found on the rugged and sloping terrain of the Plateau of Shoa (eastern escarpment) and Chercher Highlands.

E. Regosols: These types:

- Like the cambisols, are shallow and young; but they are coarse-textured.
- Have low agricultural value.
- Are found in the Danakil and Ogaden plains.

F. Xerosols: These soils:

- These soils are generally young and shallow, and are found in arid and semi-arid regions. They have a weakly developed profile.
- Are found extensively in the Northeastern escarpment, Northwestern and Southeastern Lowlands.
- Are characterized by high salt content and humus deficiencies.
- Have little significance for agriculture except places where they could be irrigated.

G. Yermosols: Soils of this sort:

- Are found in desert and semi-desert areas, as are xerosols.
- Are salty, acidic and have a weakly-developed profile.
- Are not suitable for cultivation, even when irrigated, due to their salty and acidic nature.

H. Luvisols: These soils:

- Are well-developed in areas where there are clearly marked wet and dry seasons and when leaching is not very high.
- Are among the best soils, since they have good chemical nutrients.
- Are intensively cultivated, except in areas that are steeply sloped or water-logged.
- Are found around Lake Tana, and in the eastern part of the Northern Central Highlands and in the Southern Lowlands.

I. Lithosols: Such soils:

- Are similar to cambisols and regosols in their poor maturity and their location on steep slopes.
- Are found in areas of low precipitation.
- Cover the escarpments of the Northeastern and Chercher Highlands.

J. **Fluvisols**: This type of soils:

- Are soils that rivers have transported from highlands to lowlands.
- Cover about 10 percent of the country's total area.
- Are associated with river, sea and lake deposits.
- Have very good agricultural potential.
- Are found extensively in the lower regions of the Omo, Awash, Abbay and Baro-Akobo Rivers.

6.2.3. Soil Degradation

Soil degradation is defined as a change in any or all of soil status resulting in a diminished capacity of the ecosystem to provide goods and services.

- There are three major types of soil degradation. These are:

i. **Physical Degradation**: refers to the deterioration of the physical properties of soil. This includes:

A. **Compaction**: densification of soil is caused by the elimination or reduction of structural pores. Soils prone to compaction are susceptible to accelerated runoff and erosion.

B. **Soil erosion**: is a three-phase process consisting of the detachment of individual soil particles, transportation and deposition. The continuous strike of soil surface by rain droplets considerably weakness the soil and makes susceptible to erosion. When sufficient amount of water accumulates, the soil will begin to move towards lower slope until the erosive agent loses its energy. Erosion of topsoil by wind and water exceeds soil formation at an alarming rate. Obviously for countries like Ethiopia where agriculture plays the dominant role in the economy and livelihood of the people, the causes, consequences and possible ways of minimizing soil erosion require serious consideration.

In Ethiopia, an estimated average of 42 tons per hectare of soils is eroded annually.

ii. Biological Degradation

Reduction in soil organic matter content, decline in biomass carbon, and decrease in activity and diversity of soil fauna are ramifications of biological degradation. Because of prevailing high soil and air temperatures, biological degradation of soil is more severe in the tropics than in the temperate zone. It can also be caused by indiscriminate and excessive use of chemicals and soil pollutants.

iii. Chemical Degradation

Nutrient depletion is a major cause of chemical degradation. In addition, excessive leaching of cat-ions in soils with low-activity clays causes a decline in soil pH and a reduction in base saturation.

- **Causes of soil degradation**

Soil degradation may result from **natural** and **human-induced** causes. *Topographic* and *climatic factors* such as *steep slopes, frequent floods* and *tornadoes, storms* and *high-velocity wind, highintensity rains* and *drought in dry regions* are among the **natural causes**. ***Deforestation*** and ***overexploitation of vegetation, overgrazing, indiscriminate use of agrochemicals*** and ***lack of soil conservation practices,*** and ***over extraction of ground water*** are some **anthropogenic causes** of soil degradation.

6.2.4. Soil Erosion Control Measures

The aim of soil conservation is to reduce erosion to a level at which the maximum sustainable level of agricultural production, grazing or recreational activity can be obtained from an area of land without unacceptable environmental damage. We have **two** major soil erosion control mechanisms. These are:

A. Biological Control measures

These types of soil erosion control mechanisms include vegetative strips, plantation, and reforestation. Biological controls can prevent splash erosion, reduces the velocity of surface runoff, increases surface roughness which reduces runoff and increases infiltration, and etc.

B. Physical control measures

Physical measures are used to control the movement of water and wind over the soil surface. The major types of physical erosion control measures commonly applied in Ethiopia includes terracing, check dams, gabion, trenches, contour ploughing, soil bunds etc.

6.3. Natural Vegetation of Ethiopia

Natural vegetation refers to any original plant grown in and covering an area. The distribution of natural vegetation is influenced by many factors. The most important ones are: - ***altitude, climate, soil type,*** and ***drainage.***

The types of natural vegetation in an area are strongly determined by **temperature** and **rainfall**. That is why the natural vegetation of an area is a good indicator of the area's climatic conditions.

6.3.1. Major Natural Vegetation Types of Ethiopia

Based on **altitude**, we can classify the natural vegetation of Ethiopia into the following five types: -

A. Afro-alpine and sub-Afro alpine
B. Forests
C. Woodland savanna
D. Steppe vegetation
E. Desert and semi desert vegetation

A. Afro-alpine and Sub-afro alpine Region

This type of vegetation is found at very high altitudes (above 3300 meters). Sub-afro-alpine vegetation is found between 3000 – 3300 m, while Afroalpine vegetation is found at higher altitudes than these. In Ethiopia, Afro-alpine and sub-Afro-alpine vegetation's are found in the:

- ✓ **Highlands of Semein** and
- ✓ **Highlands of Bale**

Afro-Alpine vegetation consists of tussock grasslands, serules, scattered mosses and lichens. *SubAfro Alpines are* predominantly woodland scrubs. Gibra (Lobelia rhynchopetalum) and Asta (Erica arborea) are dominant plant species in this region of natural vegetation.

B. Forest Region

In Ethiopia, forests are characterized by broad altitudinal ranges (450 – 3300 m) and large variations in mean annual rainfall (200 – 2200 mm). This wide variation in altitude and rainfall results in the formation of highland and lowland forests. These two types of forests have very different characteristics since they are the results of altitudinal zonation.

1, Highland Forests (forests that grow between 1500 - 3300 masl altitude)

Ethiopia's highland forests consist of : - Kerkha (Arundinarial)
- Tid (Juniperous Procera) or Coniferous trees
- Zigba (Podocarpus)
- Woira (Oliia Africana) and Kosso (Hagenia Abbyssinia)

2, Lowland Forests (forests that grow below 1500 m altitude)

These forests are known as ***gallery/riverine*** forests. In Ethiopia, they grow along the banks of the Awash, Wabishabelle, and Ghanalle Rivers where moisture is available in the soil. The predominant trees are Sholla and Warka. In areas where mean annual rainfall exceeds 500 mm, Baphia forest predominates.

C. Woodland Savannah Region

Like forests, Savanna woodlands are found in both highland and lowland areas. Their altitudinal range is 250 – 2300 m, and their mean annual rainfall range is between 200 – 1400 mm. (Example: acacia, grass etc.)

In areas where mean annual rainfall is more than 1000 mm, these grasslands can form attractive park-like areas with acacia, wild fig, sycamore and kosso trees. Ethiopia's savanna grasslands are found in the southern half of Ziway, Langano, Abiyatta and Hawassa. Woodland can be classified into 3 divisions: - ***Juniper procera (tid), Acacia woodlands,*** and ***Mixed deciduous woodlands.***

D. Steppe and Semi Desert Regions

These are regions in the arid and **semiarid** parts of the country where the temperature is very high and the rainfall very low. **Both** are found at low elevations, the **steppe** at elevations of 100 to 1,400 m above sea level and the **semi-deserts** at 130 meters below sea level to 600 meters above sea level.

The **steppe** gets a mean annual rainfall of 100 to 550 mm as compared to 50 to 300 mm for the **semi desert** areas. Growing period lasts up to **2 months** for the **steppe** and a maximum of one **month** for the **semi-deserts**. Even though there is a variation in the degree of alkalinity and salinity; soils in **both** regions are generally **alkaline** and **saline**.

In these regions **xerophytic** (i.e. drought-resisting plants) such as **short shrubs**, **scattered tufts of grass species** and a **variety of acacias** are the dominant vegetations.

6.3.2. Natural vegetation Degradation

Over the past century, a rapid growth of the already dense Ethiopian population has led to overexploitation of the land. Major causes for the gradual disappearance of the natural vegetation in Ethiopia are:

- Clearing of forests for cultivation
- Timber exploitation practices
- Charcoal burning and cutting for fuel

- Extensions of coffee and tea production areas
- Overgrazing
- Expansion of settlements both rural and urban, and clearing for construction.

6.3.3. Natural Vegetation Conservation

Conservation of biodiversity is protection and management of biodiversity so as to maintain at least its current status and derive sustainable benefits for the present and future generation. There are three main approaches of biodiversity conservation:

- **Protection**: through designation and management of some form of protected area. Protected areas include sanctuaries, national parks, and community conservation areas.
- **Sustainable forest management**: involving sustainable harvesting of forest products to provide a source of financial income.
- **Restoration or rehabilitation**: is the process of assisting the recovery of a forest ecosystem that has been degraded, damaged, or destroyed.

6.4. Wild Life/wild animals in Ethiopia

The diversity in Ethiopia's topography, climate, and vegetation has given the country a wide variety of wild animals. Ethiopia's wild-animal stock is generally similar to that of East Africa as a whole, due to topographic similarity and other aspects.

Ethiopia has about 279 species of mammals and 860 species of birds. Of these, 31 species of mammals and 16 species of birds are endemic to Ethiopia.

- **Types of Wild Animals in Ethiopia**:

The many types of wild animals found in Ethiopia can be grouped into 5 major categories.

1. Common wild animals: (those animals that are found in many parts of the country (e.g. hyenas, jackals)

2. Game (lowland) animal,: (which include many herbivores like giraffes, wild asses, zebras etc. and carnivores like lions, leopards, and cheetahs)

3. Tree animals or arboreals :(which include monkeys, baboons)

4. A variety of birds in the Rift Valley lakes

5. Rare animals : (gelada baboon and Semien fox) scattered in highlands; walia- ibex in the Semien Massifs, Nyala in the Arsi Bale massifs).

6.4.1. Wildlife Conservation

Wildlife plays an important role in several ways. Wild animals can be used for:

- scientific and educational researches (valuable information for medical purposes and environmental studies)
- physical and mental recreation (aesthetic value)
- promotion of tourism (economic value)
- its potential for domestication
- maintaining ecological balance

To prevent the destruction of wildlife a total area of nearly 100,000 square kilometers of national parks, sanctuaries, community conservation areas, botanical gardens, wildlife reserves etc. have been established in different part of the country. Hence in Ethiopia there are:

- 21 major national parks (see Table 6.2), - 2 major wildlife sanctuaries,
- 3 wildlife reserves, - 6 community conservation areas,
- 2 wildlife rescue centres, - 22 controlled hunting areas,
- 2 botanical gardens, and 3 biosphere reserves

Figure 6.2. Spatial distribution of National Parks (four national parks are not mentioned)

Even though the number and the predominant animals may vary, many of the national parks in Ethiopia have different turnovers of animals. These include buffaloes, zebras, lions, elephants, ostriches, giraffes, Oryx, African wild asses, etc.

S.no	Name	Region	Year est.	Area in sq.km
1	Kafeta Shiraro	Tigray	1999	5000
2	Semien Mountains	Amhara	1959	412
3	Alatish	Amhara		
4	Bahir Dar Blue Nile River Millennium	Amhara	2008	4729
5	Borena Saynt	Amhara	2008	4325
6	Yangudi-Rassa	Afar	1969	4731
7	Awash	Oromiya and Afar	1958	756
8	Dati Wolel	Oromiya	2010	1031
9	Bale Mountains	Oromiya	1962	2200
10	Yabello	Oromiya	1978	1500
11	Abijata Shala	Oromiya	1963	887
12	Arsi Mountains	Oromiya	2012	
13	Geralle	Somali	1998	3558
14	Gambella	Gambella	1966	4650
15	Nechsar	SNNPR	1966	514
16	Omo	SNNPR	1959	3566
17	Mago	SNNPR	1974	1947
18	Maze	SNNPR	1997	202
19	Gibe Sheleko	SNNPR	2001	248
20	Loka Abaya	SNNPR	2001	500
21	Chabra Churchura	SNNPR	1997	1190

Source: Young, 2012

Some of the national parks are unique in their wild animals they have. E.g. 1. Abiyatta-Shalla lakes National Park is predominantly **bird sanctuary**. Important bird species include the **flamingos** and **pelicans**. 2. Omo, Mago, and Gambela National Parks have **hippopotamus** and **crocodiles** in rivers and lakes. 3. Semien and Bale Mountains National Parks have **rare** animals like **Walia ibex**, **Semien fox**, **gelada baboon** and **Nyala**.

6.4.2. Challenges of wildlife conservation in Ethiopia

- Limited awareness on the importance of wild life
- Expansion of human settlement in protected areas.
- Conflict over resource
- Overgrazing (fodder and wood)
- Illegal wildlife trade
- Excessive hunting
- Tourism and recreational pressure
- Mining and construction material extraction
- Forest fire

Conclusion

This chapter is about the soil, natural vegetation and the wildlife in Ethiopia In general, the soils of Ethiopia are basically derived from crystalline, volcanic and Mesozoic sedimentary rocks that was formed millions of years ago and there are many types of soil found in different regions in Ethiopia.

The natural vegetation in Ethiopia is determined by Temperature and rainfall, and altitude is one of the major factors that is used to classify the 5 types of natural vegetation in Ethiopia.

The diversity in Ethiopia's topography, climate, and vegetation has given the country a wide variety of wild animals with different kind of species including mammals, and birds being the large variety of wild species.

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