Haramaya University

School of Geography and Environmental Studies

Geography of Ethiopia and the Horn

Module

THE TOPOGRAPHY OF ETHIOPIA AND THE HORN

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CHAPTER THREE
THE TOPOGRAPHY OF ETHIOPIA AND THE HORN

3.1. Introduction

- The topography of Ethiopia is largely determined by the geologic activities of the **Cenozoic Era.**
- The **uplifting** of the Arabo-Ethiopian swell and the subsequent outpouring, spreading and thick **accumulatioan of Trapean lava** have given rise to an outward sloping **highland plateau and mountains**.
- The major **faulting** resulted in the division of the plateau into two broad units and the formation of a great structural valley.
- Faulting elsewhere and on the floor guided part of the course of some rivers.
- They also formed depressions on which lakes were subsequently created.
- **Geomorphic** processes brought some modification to the structural landform by river dissection and roughening on the highlands, and deposition on the lower areas.

General Characteristics of the Ethiopian Physiographic

- The Ethiopian landform is characterized by great diversity. There are flat-topped plateaus, high and rugged mountains, deep river gorges and vast plains.
- **Altitude** ranges from 125 meters below sea level (Kobar Sink) to the highest mountain in Ethiopia, Mount Ras Dashen (4,620 m.a.s.l), which is the fourth highest mountain in Africa.
- Ethiopia has the largest proportion of elevated landmass in the African continent. It is sometimes described as the Roof of East Africa because of its height and large area.
- More than 50% of the Ethiopian landmass is above 1,000 meters of elevation; and above 1,500 meters makes 44% of the country. Half of this, in turn, is at more than 2,000 meters above sea level.
- Most of the Ethiopian **Highlands are part of central and northern Ethiopia**, and its northernmost portion extends into Eritrea.
- The highland core, on the other hand, is encircled by semi-arid and lowlands.
- The Ethiopian Highlands are rugged mass of mountains, situated in the Horn of Africa.
- They are the most significant physical features of the country, which form the largest continuous area of its elevation in the continent.

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- .Most of the country consists of high plateau and mountain ranges that are **sources of many rivers and streams** that made the country to be described as the *"Water Tower of East Africa".*
- The diversity in topography is accompanied by differences in other natural features such as soil, climate, vegetation and wild life.
- Likewise, the socio-cultural and economic phenomena are also affected by the topography.
- Taking the **1,000 meters** contour line for the highland-lowland demarcation, one observes the following contrasting features between the Ethiopian highlands and lowlands:
- Characteristics of Ethiopian highlands:
  - Ø Moderate and high amount of rainfall (>600 mm per year).
  - Ø Lower mean annual temperature (<20^0C).
  - Ø The climate is favourable for biotic life.
  - Ø Rain-fed agriculture is possible.
  - Ø Free from tropical diseases.
  - Ø Attractive for human habitation and densely settled.

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- The cumulative effect of all this is that, the highlands have been **significan**t throughout Ethiopian history in the economic, cultural and political life of the people.
- These highlands make up nearly 56% of the area of the Ethiopia.
- This is further subdivided into lower highland (1,000 - 2,000 m.a.s.l), which make up 35% and higher highland (>2,000 m.a.s.l) constituting nearly 22%.
- In contrast to the highlands, the remaining **44%** of the Ethiopian lowlands are characterized by:
  - Ø Fewer amounts of rainfall and higher temperature.
  - Ø High prevalence of tropical diseases.
  - Ø Lower population densities.
  - Ø Nomadic and semi-nomadic economic life.
  - Ø Vast plain lands favourable for irrigation agriculture along the lower river basins.

3.2. The Physiographic Divisions of Ethiopia

- Following the structural divisions brought about by the geologic processes of the Cenozoic Era,
- Three major physiographic units can be identified in Ethiopia. These are:
    1. The Western highlands and lowlands
    2. The South-eastern (Eastern) highlands and lowlands
    3. The Rift Valley

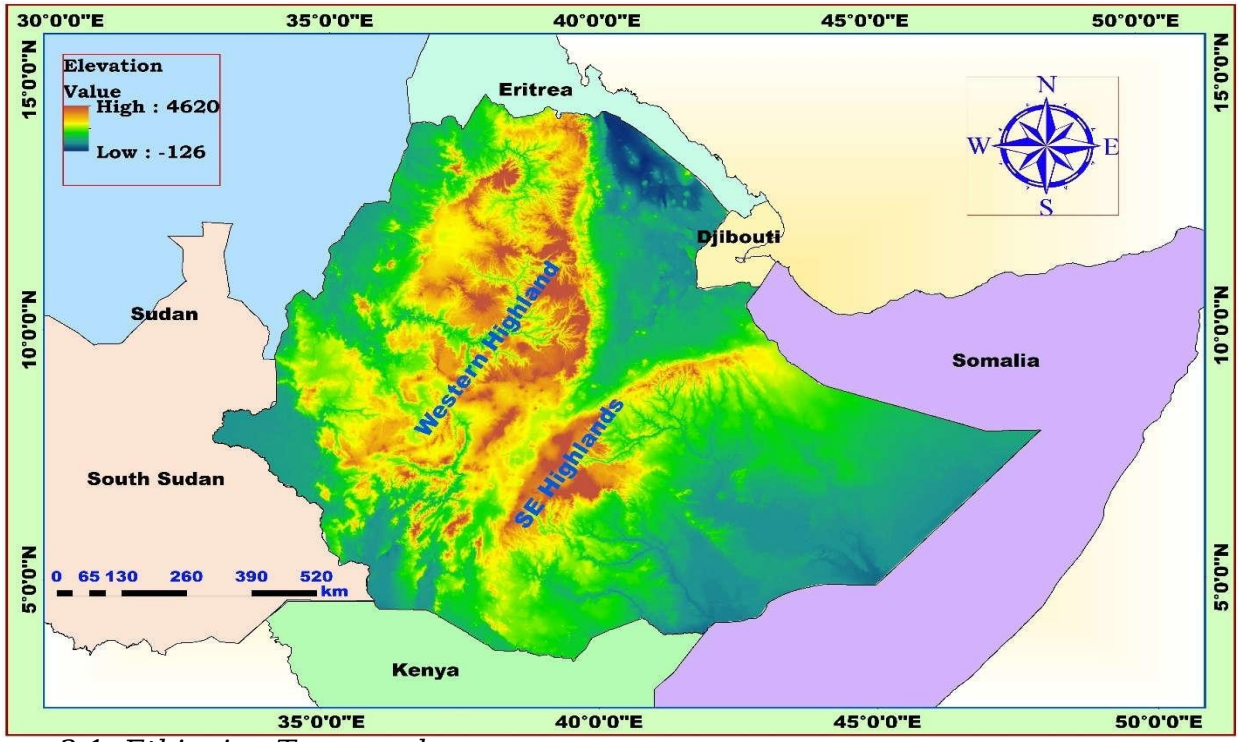


Figure 3.1. Ethiopian Topography

The Western Highlands

3.2.1. The Western Highlands and Lowlands

- This physiographic unit includes all the **area west of the Rift Valley.**
- It extends from north to south encompassing nearly the whole western half of Ethiopia.
- It makes up about 44% of the area of the country.
- In the east the western escarpment of the Rift Valley bound it whereas westward,
- The land gradually descends in altitude until it merges into the western foothills and lowlands, along the Sudan and South Sudan border.
- This region is further subdivided into 4 groups of highlands (76.3%) and 4 groups of lowlands (23.7%)

A. The Tigray Plateau

- ✓ It extends from **the Tekeze gorge** in the south to central Eritrean highlands.
- ✓ The Tigray plateau is separated from the Eritrean plateau by the **Mereb River**.
- ✓ It constitutes about 13% of the area of the region. It is an **elongated highland** with most of the land being in between 1,000 and 2,000 meters above sea level.
- ✓ Long period of **denudation** has created residual features of granite hills, rugged topography, and Ambas.
- ✓ There are high mountains in this plateau with elevations of over 3000 meters, namely *Mount Tsibet (3988 m.a.s.l), Mount Ambalage (3291 m.a.s.l), and Mount Assimba (3248 m.a.s.l).*
- ✓ The famous **monastery at Debre-Damo,** a tableland that can only be climbed by a rope pulley is also located in this plateau region.

B. North Central Massifs

- This Physiographic division is the largest in the western highlands. Much of its northern and southern limit follows the **Abay and Tekeze gorges.**
- The Abay, Tekeze and their tributaries have cut into this region a maze of gorges, steep sided river valleys, dividing the land into many isolated plateau blocks, precipitous tablelands and other rugged surface forms.
- But much of these plateau and tablelands are still capped by the **Trappean lava.**
- In its central part, the physiographic unit also accommodates the Lake Tana basin surrounded by plains of Fogera and Dembia in the north and an upland plain in its south.
- 58% of the region is at an altitude of more than 2,000 meters, making it, next to the Shewan Plateau, the second highest physiographic division.
- The region consists of the Gonder, Wello and Gojjam Massifs.

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- Out of the 26 mountain peaks with altitude of more than 4,000m.a.s.l in Ethiopia, 19 mountain peaks are found in this physiographic region.
- Among these, the most popular ones include Mount Ras Dashen (4,620 m.a.s.l), Mount Weynobar/Ancua (4462 m.a.s.l), Mount KidisYared (4453 m.a.s.l), and Mount Bwahit (4437 m.a.s.l) in the Simen Mountain System.
- Mount Guna (4,231m.a.s.l) in the Debre Tabour Mountain System, Abune Yoseph (4,260 m.a.s.l) in the Lasta highlands of Wello and Mount Birhan (4,154 m.a.s.l) in the Choke Mountain System in Gojjam are also part of Simen Mountain System.
- The Mountain systems in Gonder and Gojjam are separated from the eastern group of mountains in **Wello by impenetrable and deep gorges.**
- At one point though, they are connected by Yeju- WadlaDelanta land bridge (ridge).
- This land bridge has been significant in history. It served as a route of penetration by the Turks, Portuguese, and Italians etc.

C. The Shewa Plateau/central highlands

- ✓ The Shewan plateau is bounded by the Rift Valley in the east and southeast, by the Abay gorge in its northern and western limit, and the Omo gorge in the south and west.
- ✓ This plateau occupies a central geographical position in Ethiopia. With only 11% of the area of the whole physiographic region, the Shewa Plateau is the smallest of the Western highlands.
- ✓ Nearly three-fourth of its area is at an altitude of more than 2,000 meters above sea level.
- ✓ It has, therefore, the largest proportion of elevated ground.
- ✓ The Shewa plateau is drained, outward in all directions by the tributaries of Abay, Omo, and Awash.
- ✓ It, therefore, forms a water divide for these three river basins. The tributaries of Abay- Guder, Muger, Jema etc. have cut deep gorges and steep sided river valleys.
- ✓ They have created several tablelands and isolated plateau units in the north.
- ✓ Similarly, the tributaries of Omo and Awash have dissected the other sides of the plateau.
- ✓ Otherwise, this plateau has relatively extensive flat-topped uplands, giving it the appearance of a true plateau.
- ✓ The highest mountain in the Shewan plateau is Mount Abuye-Meda (4,000 m.a.s.l) in Northern Shewa, Mount Guraghe in the south is 3,721 meters high.

D. The Southwestern Highlands

- This Physiographic subdivision consists of the highlands of Wellega, Illuababora, Jimma, Kaffa, Gamo and Gofa.
- This region is separated from the adjacent highlands by the Abay and Omo river valleys.
- It extends from the **Abay gorge** in the north to the Kenya border and **Chew Bahir in the south.**
- It accounts for 22.7% of the area of the region.
- The region is the **second largest** in the Western highlands. About 70% of its area is lies within 1,000-2,000 meters altitude.
- It is drained by Dabus, Deddessa (tributaries of Abay), Baro, Akobo and the Ghibe/Omo rivers.
- The numerous streams have cut these highlands to produce the most dissected and rugged terrain that accommodates the most numerous and diverse ethnic linguistic groups in Ethiopia.
- With a height of 4,200 meters above sea level, Guge Mountain is the highest peak in this physiographic subdivision.

The Western Lowlands

- These are the western foothills and border plains that extend from Western Tigray in the north to southern Gamo-Gofa in the South.
- In certain places, ridges or part of the highlands protrude into the lowlands, interrupting their continuity.
- They make 11% of the area of the physiographic region.
- The general elevation ranges between 500 and 1000 meters above sea level.
- This physiographic sub-region is further subdivided into four by the protruding ridges.
- These are Tekeze lowland, Abay-Dinder lowland, Baro lowland, and Ghibe lowland from north to south.
- With the exception of the *Baro* lowland, the region is generally characterized by arid or semi-arid conditions.
- *Pastoral or semi-pastoral economic activities* dominate the area.
- As one moves northwards, the degree of aridity increases, making rain-fed agriculture more difficult.

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- Since one or two rivers cross all of these lowlands, irrigation agriculture is highly feasible.
- For example, the *Baro* lowland has an extensive flat area suitable for mechanized agriculture.
- The *Ghibe/Omo* lowland, which includes the lower *Ghibe/Omo* Valley and the northern section of the Turkana basin, is classified in the Western lowlands from its geographical location.
- But structurally it also belongs to the Rift Valley. It is an area, which is both faulted and tectonically depressed.
- In the Western lowlands, there are small but important towns.
- Their importance could be related to agriculture, history, or are simply border towns and frontier ports.
- These are *Humera, Metema, Omedla, Kurmuk, Gambella* etc.

3.2.2. The South eastern Highlands and Lowlands

- This physiographic region is the second largest in terms of area. It accounts for 37% of the area of Ethiopia.
- The highlands make up 46% of the physiographic division while the rest is lowland.
- In the west and north, the eastern escarpment of the Rift Valley makes the western and northern limit.
- In many places the land raises so abruptly that from the edge of the plateau one literally looks down the Rift Valley.
- From here, the land gradually descends southeastward into the southeastern lowlands and then to the plains of Somalia.
- These are further subdivided into two units of highlands and two units of extensive lowlands. These are briefly discussed as follows.

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The Southeastern Highlands

A. The Arsi-Bale-Sidama Highlands

- These highlands are found to the east of the Lakes Region.
- They are located in the south western section of the physiographic region.
- They make up 28.5% of the area of the region and 62% of the south - Eastern Highlands.
- The Arsi Highlands are made up of flat rolling uplands and dissected mountains.
- The well- known mountains in this area are Mount Kaka (4,180 m.a.s.l), Mount Bada (4,139 m.a.s.l) and Mount Chilalo (4,036 m.a.s.l).

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- The Bale highlands are separated from the Arsi highlands by the head and main stream of Wabishebelle.
- They consist of a platform looking basaltic plateau in the north-central part and high mountain massif to the south.
- The highest mountain peaks in this region are Tulu-Demtu (4,377 m.a.s.l) and Mount Batu (4,307 m.a.s.l).
- The Arsi-Bale Highlands are important grains producing areas with still high potential.
- The Sidama Highlands are separated from the Bale Highlands by the Ghenale river valley.
- They occupy the southwestern corner of this region.

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- The prominent feature here is the Jemjem plateau, an important coffee growing area.
- Rivers Wabishebelle and Ghenale along with their tributaries have dissected this physiographic region.
- Specially, Weyb River, tributary of Ghenale, has cut an underground passage (Sof Omar cave) through the Mesozoic Limestone rocks.
- The cave is found near Bale Mountains.
- It is one of the World's most spectacular and extensive underground caverns creating a magnificent view accessible only by an underground stream.

The Hararghe Plateau

- This plateau is a north-easterly extension of the south-eastern highlands.
- It extends from the Chercher highlands in the south-west to Jigjiga in the east.
- It makes up 38% of the South Eastern highlands and 17.4% of the whole physiographic region.
- It has the smallest proportion of upper highland (>2,000 meters).
- It is a low lying and elongated region.
- Rising sharply from the Rift Valley floor, it immediately but gently descends east and southeastward.
- The left-bank tributaries of Wabishebelle drain it.
- Much of the Trappean lava is removed and the Mesozoic rocks are extensively exposed.
- The highest mountain here is Mount Gara-Muleta (3,381 m.a.s.l).

The Southeastern Lowlands

- The Southeastern lowlands are located in the southeastern part of the country and
- they are the most extensive lowlands in Ethiopia.
- They make up 54% of the area of the physiographic region and around one-fifth of the country.
- This region is divided into Wabishebelle plain (60%) and the Ghenale Plain (40%).
- They include the plains of Ogaden, Elkere, and Borena. Southeastward sloping plains characterize these lowlands.
- These extensive plains are interrupted here and there, by low hills, low ridges, inselbergs and by shallow and broad river valleys and depressions.
- Because of the harsh climatic conditions, these lowlands are little used and support very small population.
- They are sparsely inhabited by pastoral and semi-pastoral communities.
- The economic potential for this region includes animal husbandry, irrigation, agriculture and perhaps exploitation of petroleum and natural gas.

3.2.3. The Rift Valley

- ✓ The Rift Valley is a tectonically formed structural depression.
- ✓ It is bounded by two major and more or less parallel escarpments.
- ✓ The formation of the Rift Valley has separated the Ethiopian Highlands and Lowlands in to two.
- ✓ It extends from the Afar triangle in the north to Chew Bahirfor about 1,700 km^2. and 18% of the area of Ethiopia.
- ✓ It is elongated and funnel shaped, with a NE-SW orientation. It opens out in the Afar Triangle, where it is the widest, and narrows down to the south.
- ✓ The floor of the Rift Valley is made up of interconnected troughs, grabens and depressions.
- ✓ Volcanic rocks, fluvial and lacustrine deposits cover the floor.

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- ✓ In many places, numerous volcanic domes, hills and cinder cones rise from the floor.
- ✓ Altitude in the floor ranges from 125 meters below sea level at Dallol Depression, to as high as 2,000 meters above sea level in the Lakes region.
- ✓ The bounding escarpments are also of varying heights.
- ✓ From the floor to the edge of the escarpment, the heights vary from 200 to 1500 meters.
- ✓ Because of its altitudinal variation and positional differences, the climate also varies from warm, hot and dry to cool and moderately moist conditions.
- ✓ Similarly, the social and economic life reflects this pattern.
- ✓ There are places, which are isolate and sparsely inhabited by pastoralists where as in others parts people practice some rain-fed agriculture.
- ✓ The Rift Valley is further subdivided into three physiographic sub-regions.
- ✓ These are the Afar Triangle, the Main Ethiopian Rift, and the Chew Bahir Rift.

i. The Afar Triangle

- The Afar Triangle is the largest and widest part of the Rift Valley.
- It makes up 54% of the Rift Valley area. It is bounded by the high western and eastern escarpments in the west and east
- respectively, and by the Afar and Aisha Horst in the northeast.
- The area is generally of low altitude (300-700 meters).
- Quite different is the morphology of the Afar depression, triangular-shape lowland, where elevation drops uniformly from approximately 1,000 meters in the southwest to below sea level in the north (**Danakil depressio**n) and in the east, where the shores of Lake Asal, fluctuating at around 125 meters below sea level, represent the lowest subaerial point of the African continent.
- The depression, which hosts one of the most hostile environments on Earth (maximum temperatures can exceed 50°C during the summer wet season; Dallol, at the northern tip of Afar.
- The area is characterized by faulted depressions (grabens), volcanic hills, active volcanoes, volcanic ridges, lava fields and low lava platforms.

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- Lakes (*Abe, Asale*, and *Afrera)* occupy some of these basins.
- A prominent feature in this region is the *Denakil Depression* (*Kobar Sink*).
- Separated from the Red Sea by a 200 meters high land barrier, much of it lies below sea level.
- A larger part of this is covered by thick and extensive salt plain.
- Lake Asale and Lake Afreraoccupy the lowest parts of this sunken depression.
- The Afar Triangle is generally hot and dry.
- The only respite one gets in the Southern part is from the waters of the Awash River.
- The economic importance of this region includes salt extraction, irrigation along the Awash River and electric potential from geothermal energy.

ii. The Main Ethiopian Rift/Central Rift

- It refers to the narrow belt of the Rift Valley that extends from Awash River in the north to Lake Chamo in the south.
- It is bounded by the western and eastern escarpments.
- With the exception of the Arbaminch area, the bounding escarpments are generally low.
- This part of the Rift Valley is the narrowest and the highest. It has an average width of 50-80 kilometers and general elevation of 1,000-2,000 meters above sea level.
- The floor in many places is dotted by cinder cones and volcanic mountains.
- The big ones include Mount Fentale, Boseti-guda (near Adama), Aletu (north of Lake Ziway) and Chebi (north of Lake Hawasa).
- The northern section has more of these cinder cones and lava fields.
- The prominent features, however, are the numerous lakes formed on tectonic sags and fault depressions.

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- Because of altitude, the lakes region of the Main Ethiopian Rift is generally milder and watery.
- Here rain-fed agriculture is practiced.
- Other resource bases include the recreational value of the lakes, the agricultural importance of some streams and lakes, and the geothermal energy potential.

iii. The Chew Bahir Rift

- This is the smallest and the southern-most part of the Rift Valley.
- Gneissic highlands of Konso and the surrounding highlands separate it from the Main Ethiopian Rift to the north.
- The characteristic feature of this region is the broad and shallow depression,
- which is a marshy area covered by tall grass, into which the Segen and Woito streams empty.

3.3. The Impacts of Relief on Biophysical and Socioeconomic Conditions

- The highly dissected character of the landscape over much of the country's territory along with the limited extent to which flat surfaces are present influence the various socioeconomic aspects of Ethiopia as presented hereunder.

1. Agricultural practices

Relief influences farm size and shape in that in an area of rugged terrain the farmlands are small in size and fragmented and tend to be irregular in shape.

- ✓ Choice of farming techniques and farm implements are highly influenced by relief as in rugged terrain mechanized farming techniques are difficult to practice.
- ✓ Relief influences crop production as some corps are well adapted to higher altitudes (barley, wheat) and others to low altitude (sorghum, maize).
- ✓ The practice of animal husbandry is also influenced by relief as most equines and sheep are reared in the higher altitudes and camels and goat are well adapted to lower altitudes

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2. **Settlement pattern**

- Highlands of Ethiopia that experience a temperate type of climatic condition that are mainly free from most of the tropical diseases are densely settled.
- Rugged and difficult terrain hinders the development of settlement and its expansion.
- The highlands of Ethiopia are characterized by sedentary life and permanent settlements while lowlands that are inhabited by pastoralists have temporary settlements.

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3. Transportation and communication

- The highly dissected nature of the landscape is a barrier to the development of internal surface transportation that resulted in the long-term isolation of many communities
- The difficult terrain makes infrastructure development and maintenance costly.
- TV and radio communications are also highly influenced by relief.
- The rugged topography rendered rivers less navigable due to the waterfalls, deep gorges and steep cliffs.

4. Hydroelectric power potential

- The great difference in altitude coupled with high rainfall created suitable conditions for a very high potential for the production of hydroelectric power in Ethiopia.

5. Socio-cultural feeling

- The rugged terrain as a result of excessive surface dissection resulted in the long-term isolation of communities that led to the occurrence of cultural diversity.
- People who live in the highlands have been identifying themselves as *degegnas* (mountaineers) and those who live in the lowlands as *kollegnas* (lowlanders).

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6. **Impacts on climate**

- The climate of Ethiopia is a result of the tropical position of the country and the great altitudinal variation of the general topography.
- Highlands with higher amount of rainfall and lower rate of evapo-transpiration tend to be moisture surplus compared to the moisture deficit lowlands.

7. Impacts on soil

- Steep mountain slopes provide low angle of rest, unstable surface materials and subject to degradation processes and relatively form shallow and little developed soils.

8. Impacts on natural vegetation

- Relief through its effect on climate and hydrology affect the type of natural vegetation grown in an area.