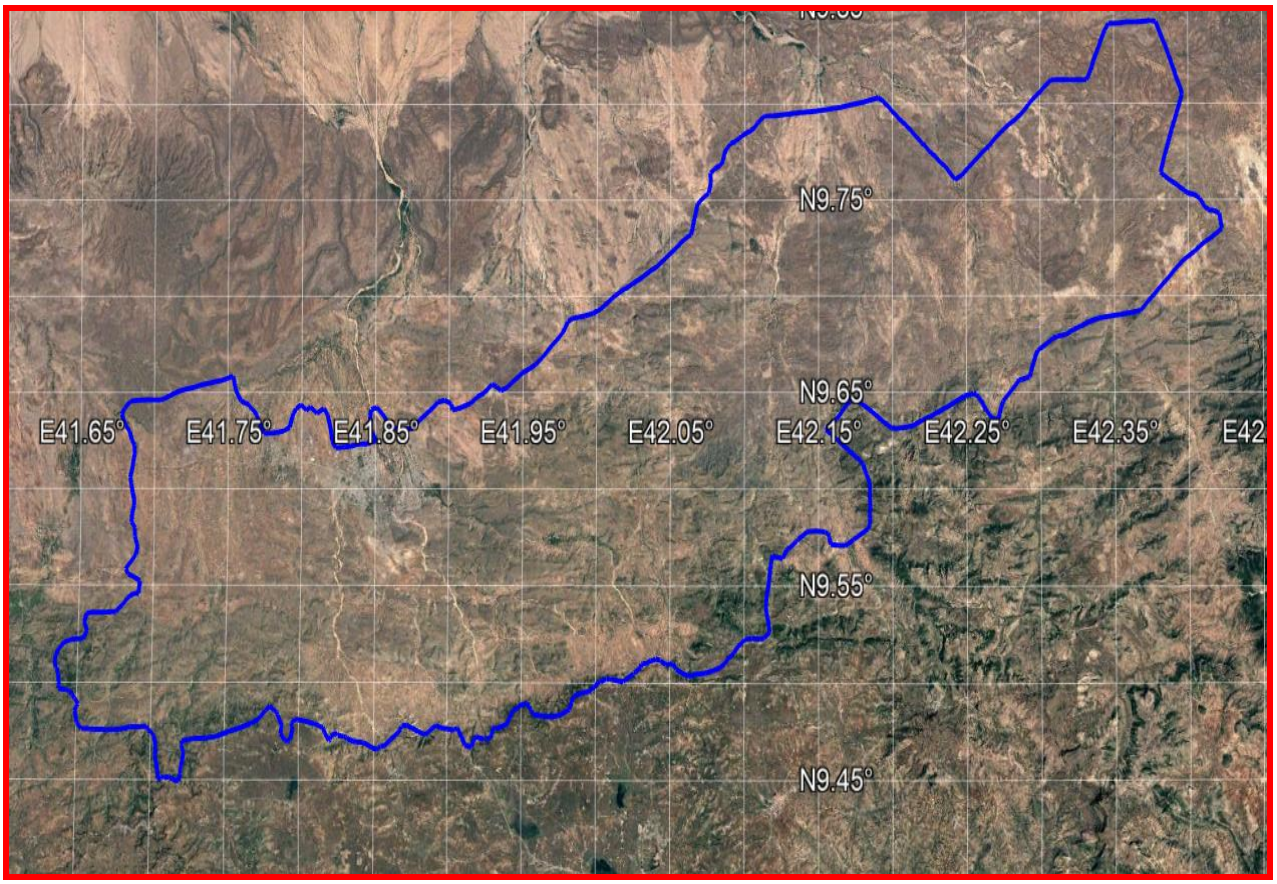
STATE OF ENVIRONMENT& NATURAL RESOURCE DATA PREPARATION DESK,

ENVIRONMENT & NATURAL RESOURCE DEGRADATION &PREVENTION OF DIREDAWA CITY ADMENSTRATION, ETHIOPIA



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List of Abbreivations

Al----------Aluminium

Cao----------Calcium Oxide

CO2----------Carbon Dioxide

DDAC----------DireDawa Adminstration City

DDC----------Diredawa City

FAO----------World Food Organization

FGD----------Focus Group Gisscussion

Ha----------Hectare

LULC----------Land Use Land Cover
N/A----------None Avaliable

Masl----------Meter Above Sea Level

Mn----------Manganese

NDVI----------Normalized Diffrential Vegetaion Index

NGO----------Non Governemnet Organization

NIR----------Near Infrared Band

^{o}C----------Degree Centigrade

PET----------Potential Evapotranspiration

PFM----------Participatory Forest Management

SWC----------Soil and Water Conservation

UDA----------Urban Dwellers Association

VRe----------eutric Vertisols

1. SPATIAL PROFILE OF CITY ADMINSTRATION

Location

Geographically, the Dire Dawa Administration is located in eastern part of the countryon the boarder of Afar plain and on the eastern highland just at foot slope of the Dengego mountain between $9^0$27' and $9^0$49'N Latitude and $41^0$38' and $42^0$19'E Longitude. The Administration is surrounded by Oromia National Regional State to the Eastern, Western, Northern and Southern sides, while the Somali National Regional State bounded the Administration in the east. Dire Dawa town is found at 515 km. east of Addis Ababa.

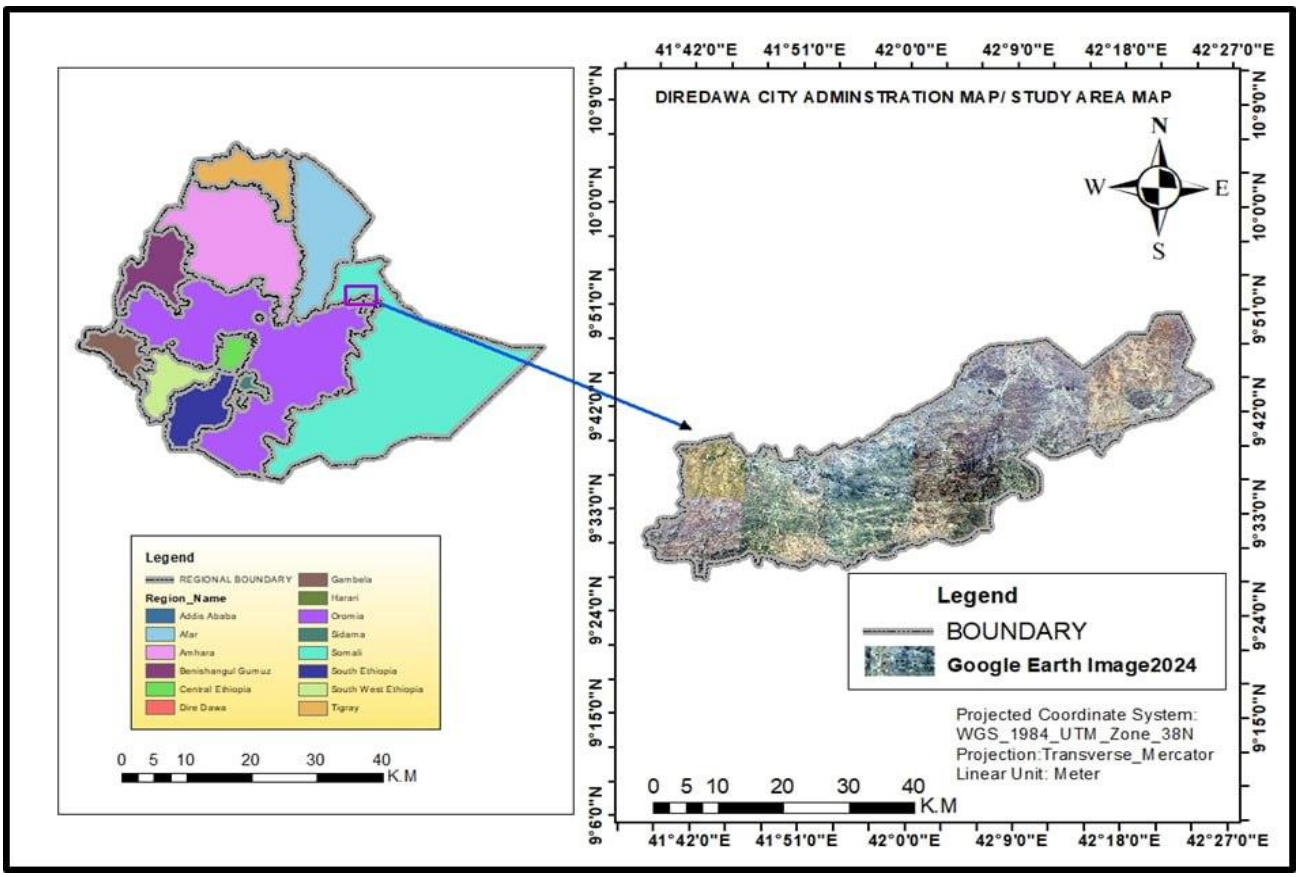


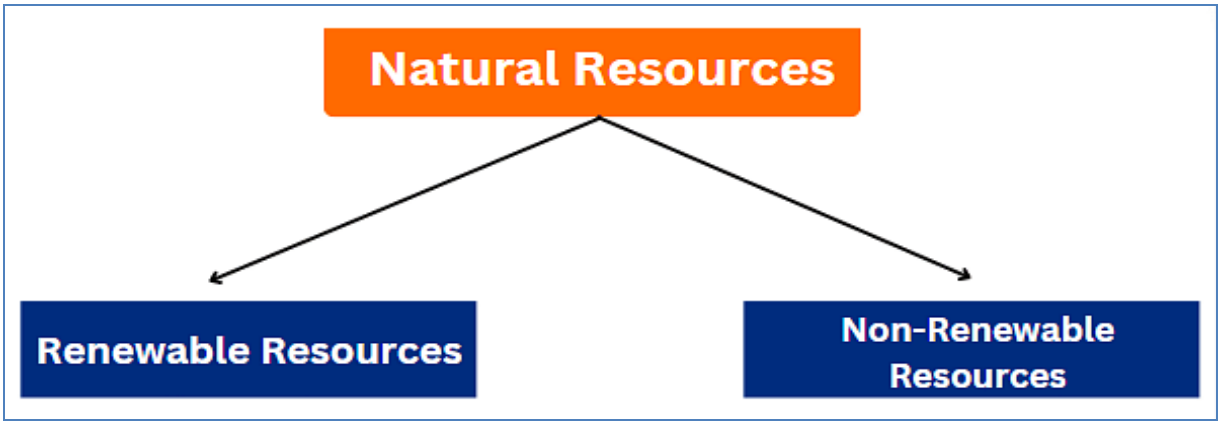
Figure 1 Location map of Diredawa city Adminstration

The area coverage of the Administration is estimated to be about 154,998.4 ha.& the Administration consists of nine Urban Dwellers Associations (UDA) or kebeles& 32 rural kebeles. The Administration is totally located in the Awash River Basin and the altitudinal

ranges varies from 950 to 2,260 masl. In the south, it comprises the main escarpment of the eastern edge of Harerghe highlands. The physiographic condition of the study area ranges from almost flat to very steep mountains over 50% slope and elevation of about 2,300 masl.

1.2 NATURAL RESOURCE BASE

1.2.1 Concept of Natural resources:-



Natural redources are:- finite, meaning once they are used, they cannot be replaced. Many valuable natural resources, such as gold and oil, have been nearly depleted, while others are still abundant. Common natural resources include trees, rocks, minerals, crude oil, fossil fuels, zinc, iron ore, lead and copper. Things such as sunlight, water and air are also considered to be natural resources, although these things do not have a monetary value. However, something such as water can be used to produce energy, which does have a monetary value.

1.2.2 Degradation of Natural Resources

Figure 2: Natural Resource Degradation

Natural Resource Degradation:- refers to the deterioration of the environment due to the depletion of resources like air, water and soil. The air we breathe, the water we drink and the food we eat - all come from natural resources. With the explosion of population and the technological boom, the degradation of natural resources is a subject of prime concern faced by the world today. Our natural resources are fast depleting; causing an alarming situation for the survival of the planet and humans.

1.2.3 Causes of Natural Resource Degradation

The causes of degradation of natural resource degradation are as follows:

1. Land and Soil Degradation

The topmost layer of soil on earth called the topsoil is the most fertile and full of nutrients, it is generally 2 to 8 inches deep. This topsoil is continuously being exposed to bad irrigation and farming practices which degrade the quality of the topsoil and leech the nutrients out of it making it lose its flora, fauna and wildlife. This leads to soil erosion and desertification of once-fertile land.

- Soil Erosion

Soil erosion and desertification: A form of soil degradation called soil erosion is the blowing or washing away of the topsoil by agents such as water and wind. Some of the main causes of soil

erosion are malpractices such as overstocking, overgrazing, deep ploughing, over-cultivation for crop production, deforestation, lack of crop rotation, improper surface drainage, monoculture and excessive use of fertilizers, etc. Soil erosion drastically affects soil fertility and renders it useless.

2. Water Degradation

The degradation of natural resources of water like oceans, rivers and lakes have all been degraded by the pollutants being released into these water bodies from industrial and domestic waste. This is also affecting the life and sustenance of sea creatures and plants alike.

- Water-logging and soil salinity**:** In simple terms, waterlogging is the presence of an excess of water in the soil. The water table of the groundwater becomes too high to facilitate any agricultural activity in the soil. Improper irrigation practices coupled with an inadequate drainage system is the major cause of waterlogging. This, in turn, affects the salt content by drawing the salt up to the surface of the soil. The increased salt content has detrimental effects on agriculture. It severely affects plant growth and yields as the soil becomes vulnerable. These are some of the improper utilization and maintenance of our already limited natural resources which cause their degradation.

3. Atmospheric Degradation

The massive air pollution caused by vehicles, industries and other human activities has degraded the air quality in the atmosphere. Global warming and the depletion of the ozone layer are one of the major consequences of air pollution.

1.2.4 Other Causes of Natural Resource Degradation

- Pollution

In addition to the pollution of land, water and air, there are other types of pollution like noise pollution and light pollution which are causing the degradation of the earth's environment and its resources.

- Overpopulation

The world population is about to reach 8 billion in the year 2023. With the population explosion, the available natural resources are being consumed at an irreplaceable rate. Another major effect of an increase in population is the increase in the amount of contamination of land, air and water, which is leading to crashing ecosystems and vanishing flora and fauna. Hence, overpopulation is one of the major contributors to the degradation of natural resources.

- Overconsumption and Wastage

The irresponsible overconsumption and wastage of natural resources like minerals, water, oil, etc. are depleting the resources at a rate faster than the restoration of the same.

- Natural Causes

Natural calamities like earthquakes, tsunamis, hurricanes, wildfires, etc. damage natural resources and affect plant and animal life.

- Deforestation: and the destruction of the ecosystem leading to a loss of biodiversity.
- Excessive mining for minerals and oil.
- Technological and industrial development.
- Widespread erosion.
- Pollution and contamination of resources.

1.2.5 Effects of Resource Degradation

The effects of the degradation of natural resources are –

- Desertification – As a result of deforestation and soil erosion, many fertile lands once thrived with plants and wildlife are now barren and have turned into deserts.
- Water Scarcity – The increase in contamination of water bodies due to human activities is resulting in acute water shortages, which may even lead to world wars.

- Loss of Biodiversity – Cumulative effect of climate change, deforestation, overpopulation and pollution has caused great damage to biodiversity in the form of huge losses of plant and animal life, also leading to the extinction of several species.

- Climate Change and Ozone Layer Depletion – The degradation of natural resources is leading to global warming and climate change all across the globe. The ozone layer responsible for protecting the earth from harmful ultraviolet rays of the sun is fast depleting with the effect of air pollution.

- Loss for the Tourism Industry – The degradation of natural resources due to several types of contamination is leading to loss of greenery and biodiversity, causing a huge dent in the tourism industry.

- Economic Impact – The cost of restoration projects in place for replenishment and restoration of natural resource degradation has a great economic impact.

1.3 Slope

The physiography of the Dire Dawa Administration can be classified in to four major units:

a) Mountain ranges: These are mainly found in the southern part of DDA, and they have slopes above 45%, they have shallow soils and are mostly covered with scattered wooden shrubs.

b) Hills: These are found scattered all over the administration, and the hills have slopes ranging between 16 and 3%, have very shallow soils and are mainly covered mainly by stones and rock out-crops.

c) Valley bottoms and river terraces: These are mainly found at the foot of slopes of the mountain ranges and the river banks, and they have relatively fertile and deep soils. Their slope ranges from 0-30%. These are the units where the rain fed as well as the irrigated crop cultivations are concentrated.

d) Flat plains: these are mostly concentrated in the north eastern and north western part of the study area, they have slopes ranging from 0-3% and they mainly used as grazing and browsing areas for the livestock of the pastoral communities.

So based on the FAO slope classification, the Dire dawa City Adminstration slope can be classified in to six catagories as indicated in the figure below.

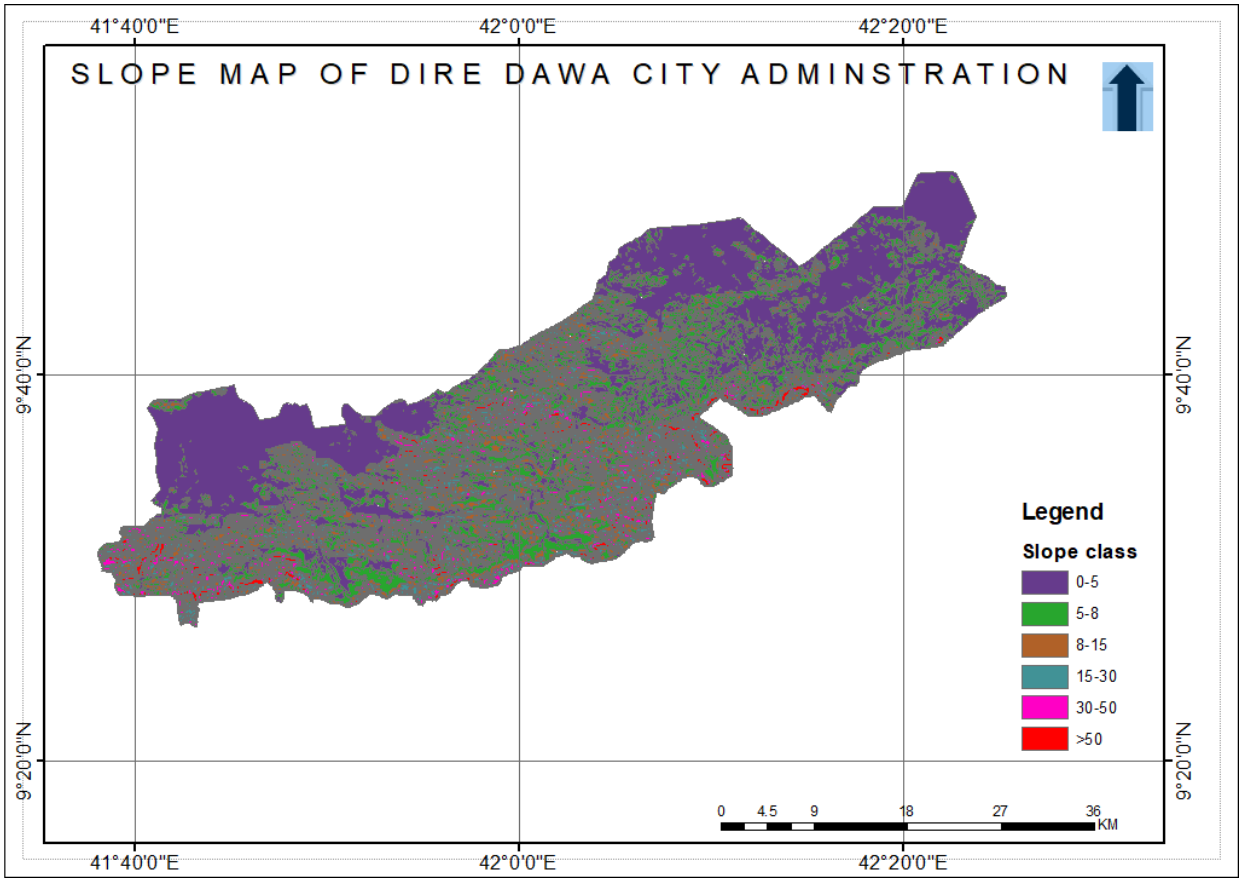


Figure 3: Slope map of Diredawa city

Table 1: Slope percentage of Dire dawa city

No	Slope class	Slope coverage in ha	Slope coverage in %
1	0-5	62770.45	40.49
2	5-8	40551.19	26.16
3	8-15	23796.7	15.35
4	15-30	15338.8	9.89
5	30-50	9213.17	5.94
6	>50	3327.83	2.17

	Total	**154998.14**	**100**

As we have seen from the tble above, more than 40.49% of the City Adminstration coverd from 0-5 % slope which nearly gentele land. While the least coverage about 2.17% of land coverd by >50% slope which very hilli land.

1.4 Climate

A recent study on the agro-ecology of Dire Dawa Administration has identified two major agro-climatic zones. These are Kolla (if it is between 500-1,500 masl) and Weyna Dega (if it is between 1,500-2,300 masl). The agro-climatic zones are areas that are reasonably large in size and that are defined by rainfall and altitude. Regardless of the amount of annual rainfall that a site receives, it is called Kolla and Weyna-Dega.

The rainfall pattern in the study area is characterized by small rains in Spring and big rains in summer. The rainy season is from February to March and from July to September and the dry season is from October to January. However, it is only the rain in the months of July and August that exceeds half the potential evapotranspiration (PET).

The mean annual rainfall in the city varies from 550 mm in the lowland to above 850 mm in the southern mountain range areas of the Dire dawa city Adminstration.

The temperature and moisture availability determines the length of growing period of crops in the region. So the temperature in the administration is very high. However, the monthly mean maximum temperature range from 28.2^0c-34.8^0c. Likewise, the monthly mean minimum temperature varies from 15^0c - 22.6^0c

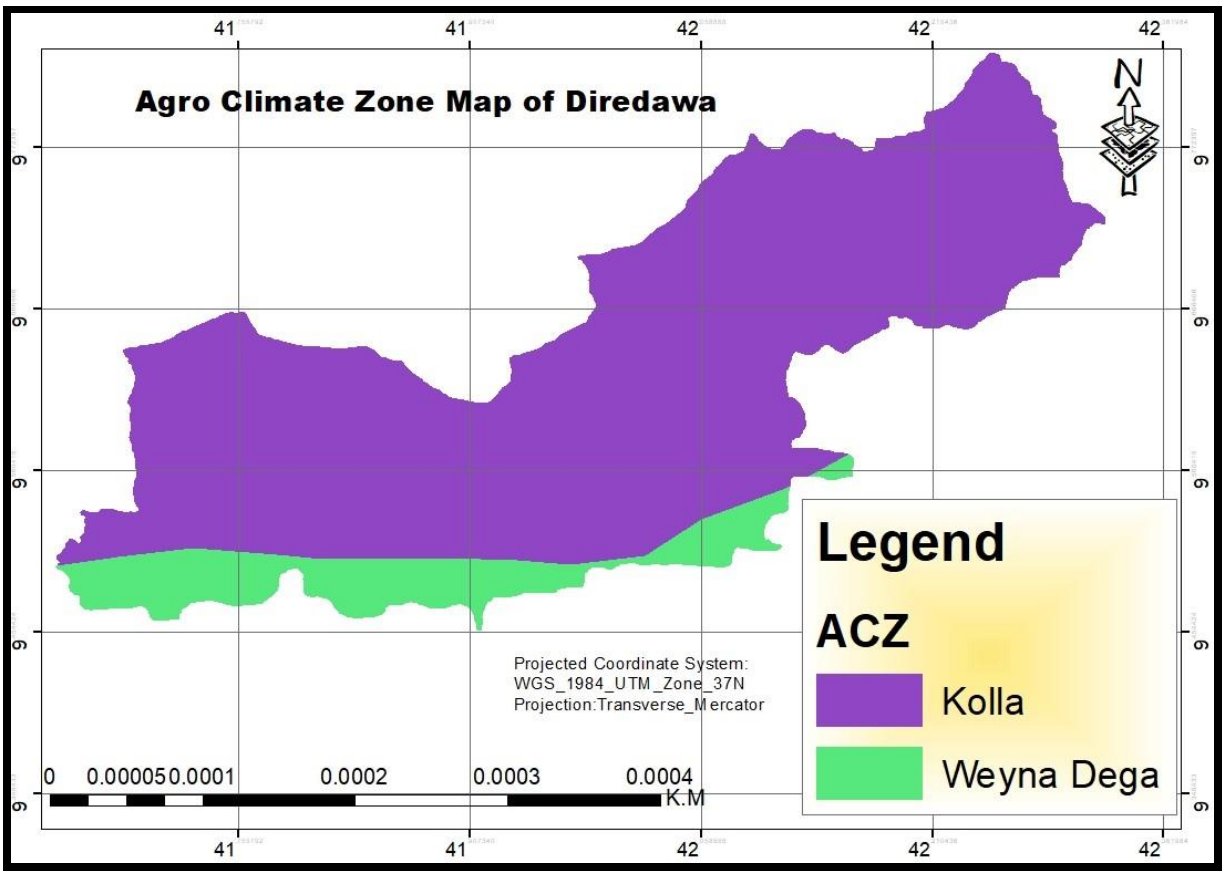


Figure 4 Agroecological map of diredawa

1.5 Major soils of Dire Dawa city Administration

The nature of the soil resource depends on the type of landforms, parent material, altitude, climate, geology and topography of the area. In this regard, shallow and infertile soils are the characteristics of the mountain and hills while deep and fertile soils are the major features of the valley bottoms, river terraces and flat plains of Dire Dawa Administration. A recent soil survey study of administration by the Water Works Design and Supervision Enterprise has identified a number of soil units. Among the identified soil units, the most important ones include cambisols, eutric vertisols (VRe), fluvisols, fluvisols, regosols, leptosols and arenesols.

a) Cambisols: This is the kind of soil which generally has good structural stability, water holding capacity and internal drainage. The soil is used for rain fed cultivation of

cereal; and in the case of Dire Dawa Administration, it is used mainly for sorghum production.

b) Eutric vertisols (VRe): This is the kind of soil which has developed on alluvial/ culluvium deposits. They are stony soils that have large surface cracks, gilgai and micro-reliefs. These kind of soils are moderately to strongly alkaline with PH values of 8.73 and 8.51 in the top and sub-soil, respectively. The main land use of the area having this kind soil is grazing/ browsing.

c) Fluvisols: These are young soils developed on recent alluvial deposits in periodically flooded places. These soils are inherently deep, fertile and are found on flat, easily workable land. Fluvisols are used as open shrub-lands dedicated for livestock grazing / browsing. To a lesser extent, they are used for crop production using flood irrigation.

e) Regoso**ls:** These are soils of unconsolidated materials. They occur on eroded uplands marked by the occurrence of the unstable rocky slopes and rock outcrops that are common on hilly and mountainous areas. It is characterized by a very limited amount of soil forming process due to the constant soil loss by water erosion or climatic conditions that retard soil formation. These soils are mostly under their natural vegetation (scattered to dense shrubs) where grazing/browsing is practiced.

f) Leptosols: These are soils characterized by their limited depth, weak development and continuous hard rock. These soils are covered with scattered shrubs and are used for grazing and browsing. In some places, the continuous erosion has left them without any cover. These soil types exist extensively in the Dire Dawa Administration.

g) Arenesols**:** These are weakly developed coarse textured soils. They are very permeable, poor in organic matter and nutrients, and easy to work with.

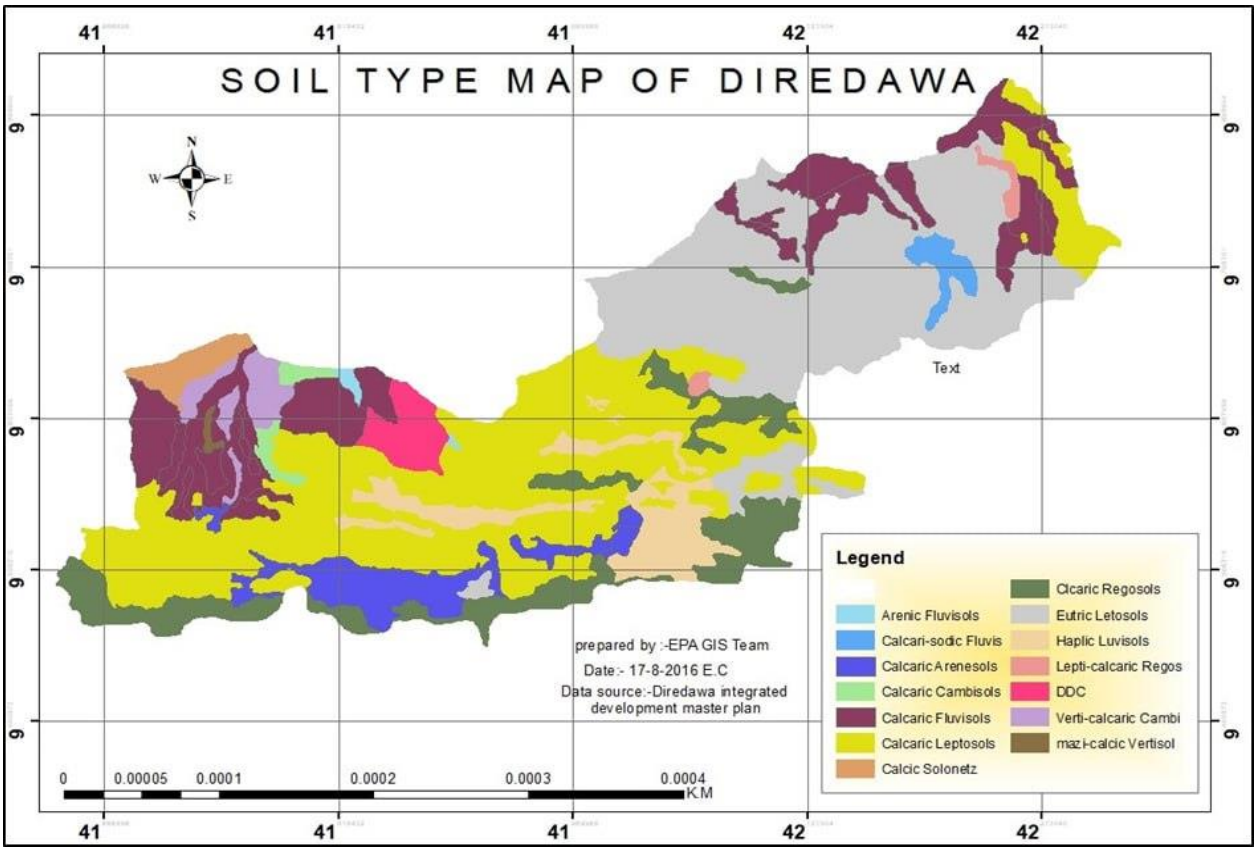


Figure 5: Soil map of Dire dawa City Adminstration

2. STATE OF LAND USE LAND COVER

Land is the essential component which provides us food, shelter, and fiber. It is renewable resource, but this essential resource is depleting through time due to the population pressure and natural hazards. Land use is defined as how the land is utilized by people and their habitats, usually with an accent on a functional role of land for economic activities, whereas land cover is a physical characteristic of the Earth's surface (Mariye etal 2020). Land use land cover (LULC) dynamics are a well-known, accelerating, and substantial process that is mostly driven by human activities.

Understanding land use land cover (LULC) change drivers at local scale is vital for development of management strategies to tackle further decline of natural resources. In connection to this, a study was conducted in Dire Dawa administration, Ethiopia to investigate the drivers for change in land use land cover and its impact on ground biomass and regenerations of woody plants.

According to the data of city adminstarion, 2024 the land use land cover change is indaicated as follows.

Table 2 Land use land cover obtained from Diredawa city Adminstraion , 2024

No	**Land use type**	**Coverage in ha**	**Coverage in %**
1	Forest and woodland	14930	7.57
2	Cultivated land	37499	19.02
3	Non cultivated land	N/A	-
4	Abaundaned land	45964	23.32
5	Investment land	-	-
6	Wet land	-	-
7	Water bodies	-	-
8	Degraded land	46755.3	23.7
9	Bush and shrub	12251	6.2
10	Urban area	4806	2.506
11	Rural settlement	284	0.144
12	Grass & graizing land	34564	17.54
	Total	**197,053.3**	**100**

Soil degradation is the loss of soil productivity quantitatively or qualitatively through various processes like erosion, acidification, salinization, nutrient depletion, and deterioration of soil physical properties; of which soil erosion is the most contributing process to unsustainable agricultural productivity in most developing countries.

Many soil and water conservation measures (SWC) have been carried out at individual or community levels in Ethiopia. Ethiopia identified the most common soil and water conservation practices in the area ridge), biological SWC practices (grass for structure stabilization and tree plantation) and Agroforestry practices (algae check dam, sifting cultivation). According to Zenebe et al. 2018 reviewed and summarized the most common SWC measures in Ethiopia by grouping them into three broad categories: farmland management, hillside management and gully rehabilitation/stabilization.

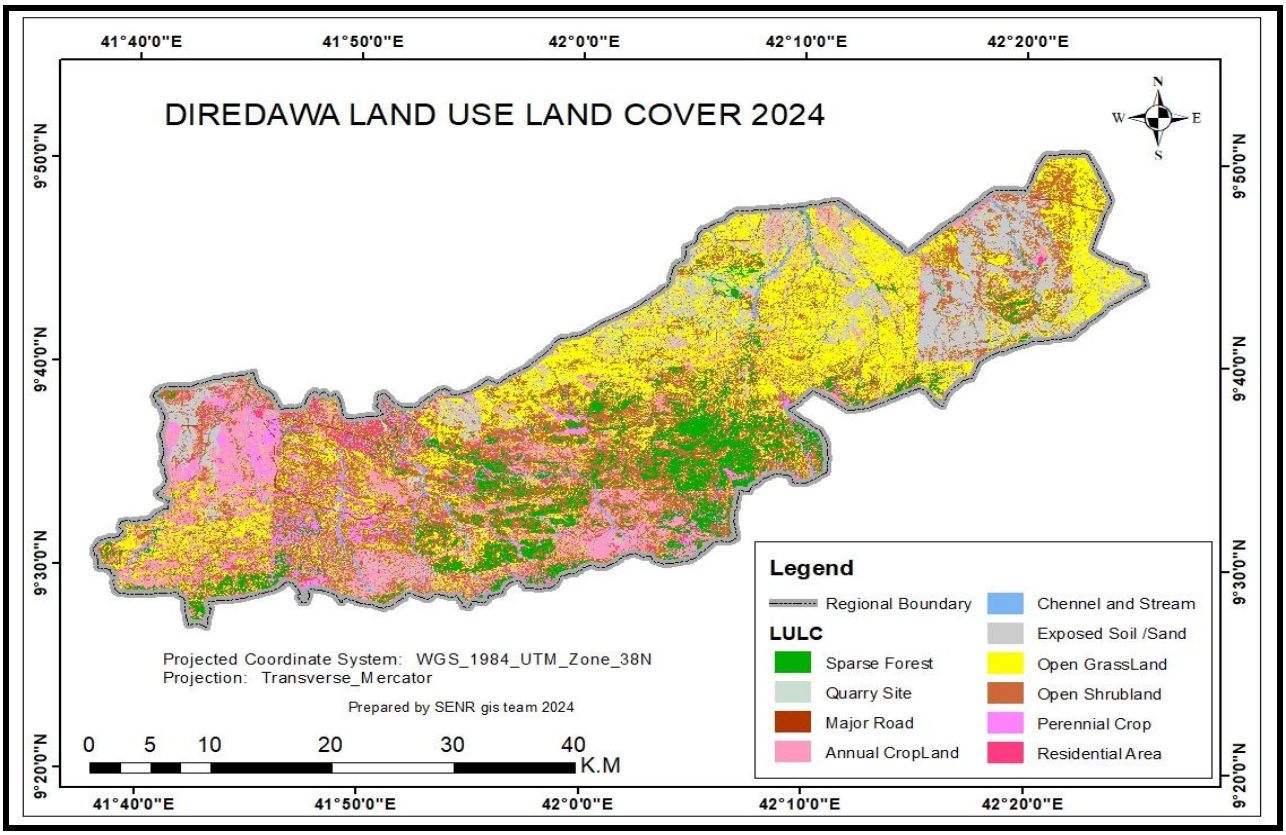


Figure 6:- Land use land cover map of Diredawa City Adminstarion

Table 3:-Land use land cover map analysis result of Diredawa, 2024

LULC_Class_Name	Area_Ha	Area_%
Road	505.57	0.33
Sparse Forest	15860.77	10.23

Quarry Site	378.69	0.24
Channel and Stream	2741.63	1.77
Exposed Soil /Sand	20090.89	12.96
Residential Area	4264.37	2.75
Perennial Crop	8158.27	5.26
Annual Cropland	17896.18	11.55
Open Grassland	43178.19	27.86
Open Scrubland	41920.16	27.05
Grand Total	154994.71	**100**

Physical and biological soil and water conservation measures

Many soil and water conservation measures (SWC) have been carried out at individual or community levels in Ethiopia. The study in Meket Woreda of North Eastern Ethiopia identified the most common soil and water conservation practices in the area such as physical structures like soil bunds, stone bunds, and soil-stone, bunds, check dam, hill side terraces while the agronomic practices includes area enclosure, traditional ditches, contour plowing, grass strips

The roles of soil and water conservation measures in reducing nutrient and soil losses, and hence increasing agricultural productivity have been reported by several researchers.

Types of soil and water conservation measures

There are different soil conservation practices include:- indigenous agronomic (fallowing, crop rotation, and intercropping), physical practices (traditional terrace, modern terrace, soil bund, and counter ploughing), and biological practices(Agroforestry, grass strips, cutting and carrying, traditional rotational grazing and haymaking).

Table 4: Selected SWC practices in Ethiopia categorized based on management types**.**

Farmland Management	Hillside Terrace	Gully Rehabilitation / Stabilization
Soil bund	Hillside terrace	stone check dam
Stone bund	Diversion ditch	Brushwood check dam
Stone faced soil bund	Stone faced trench	Gabion check dam
Double stone-faced soil bund	Micro -basin	Sediment storage dam
Fanya juu terrace	Bench terrace	Live check dam
Tied ridges	Semi-circular terrace	stone check dam
Bench terrace	Eyebrow basin	Gully reshaping and planting
Zai pit	Deep trench	sand/soil filled check dam
Trash line	Terrance and trench	Cut-off drains
Cut-off drains	Cut-off-drains	Diversion dicch
Waterways	Waterways	

Source: Zenebe et al. (2018)

2.1 IMPACT OF LAND USE AND LAND DEGRADATION

Land use and land cover change is widespread, accelerating, and significant processes driven by human actions but also producing changes that impact humans (Agrwal, etal 2002). These changes alter the availability of different biophysical resources including soil, vegetation, water, animal feed and others. Consequently, land use and cover change could lead to a decreased availability of different products and services for human, livestock, agricultural production and damage to the environment as well.

Soil erosion and land degradation in DDAC have reached to extreme stage. About 75 % of the council is severely degraded. The soil loss rate of 4- 32 tons/ha/yr is by far higher than the annual soil formation rate of 0.4- 0.5 ton/ha/yr resulting in continuous soil erosion and land degradation. These will lead to desertification which is already on dynamic process in DDAC. In some areas one can observe only bare land and exposed rocks. ecological degradation including desertification is wide spread. Poor cultivation practice and livestock production have highly contributed to soil erosion and degradation in the Council. Moreover, farming and

livestock production is subsistence among many due to low rainfall, poor grazing land, rugged and steep topography, poor soil characteristics.

According to Diredawa city Adminstration Bureau of Agricutre, 2022 the land impacted through land degradation is 46755.3ha, by abandunded land 45964 ha. In addition this Diredawa city Adminstration, more than 2100 ha of land was affected by salt and land productivity was reduced from 5-10% by different factors.

2.2 RESPONSE

Community effort through traditional soil conservation is not able to mitigate the situation. The last two decades effort of soil and water conservation through community mobilization has not shown expected results due to several challenges. The most important challenges in soil and water conservation as repeatedly discussed is lack of continuity, sustainability of the conservation system and absence of efficient over all coordination on one hand and the long term gestation period of soil and water conservation effort on the other. Associated with the land use and land degradation perspective, 31770.8ha of land was coverd by physical soil and water conservation measures,10052ha of land was coverd by biological soil and water conservation measures and about 380ha of land was protectd by area closure to relahbiltaed the degraded land in Diredawa city Adminstration.

Figure 7: Stone bunds

2.2.1 Physical measures*:* stone, soil bund and terrace, artificial water ways, culverts and drainage channels, check dams.

2.2.2 Biological measures*:* conservation based agricultural development, villages and homestead area tree plantation, tree protection and plantation in grave yard and mosques, river bank and water ways protection and plantation, plantation along tracks and paths, live fence plantation, wood lot plantation, plantation on soil conservation structures, grazing land management.

3. SATE OF FOREST RESOURCES IN DIRE DAWA CITY

Figure 8: Partial view of Natural and planation forest in Diredawa

Deforestation and forest degradation are serious environmental challenge in Ethiopia. Destruction of the natural forests of Ethiopia results directly in the loss of unaccounted plant and animal species as well as in a shortage of fuelwood, timber and other forest products. It also indirectly leads to more aggravated soil erosion, deterioration of the water quality, reduction of agricultural productivity, and to an ever-increasing poverty of the rural population (Mulugeta etal, 2011).

The trends & characteristics of forest vegetation of the city administration are significantly varied along different agro-ecologies of regions in terms of their vegetation types. The vegetation in the administration is characterized as arid and semi-arid vegetation which is highly variable, including cactus & thorn scrub, shrub and sparse grasses formations bounded by dry ever green mountain forest ecosystem in South and South West, and *Acacia-Commiphora* Wood Land Ecosystem in the Northeast and South part of the city.

Forest Cover

Dire Dawa Administration is one of the regions that have small forest resources coverage , i.e. 9.2% of the total land area. According to the bureau of city Adminstration, 2024 the natural forest coverage is 3.13% , planation forest 6.45% and bush and shurbs 7.81% while the degraded forest resource of the city about 3.2%. Over the last decades, as it was elsewhere in the country, the status and trends of forests in the region have been influenced by different factors.

The major reason include lack of strong institutions and poor enforcement of laws and regulation, socio-economic constraints; mainly livelihoods, agricultural expansion due to population pressure, little awareness and scarcity of skilled human power in the field and finance resources, challenges due to agro-ecology, mainly climate and relentless deforestation and forest degradation and also lack of knowledge and technology that are important to plan and implement sustainable forest sector development.

As a result of these, little of the natural vegetation/forest of the highland and indigenous Acacia species in the lowlands of the Administration remains today.

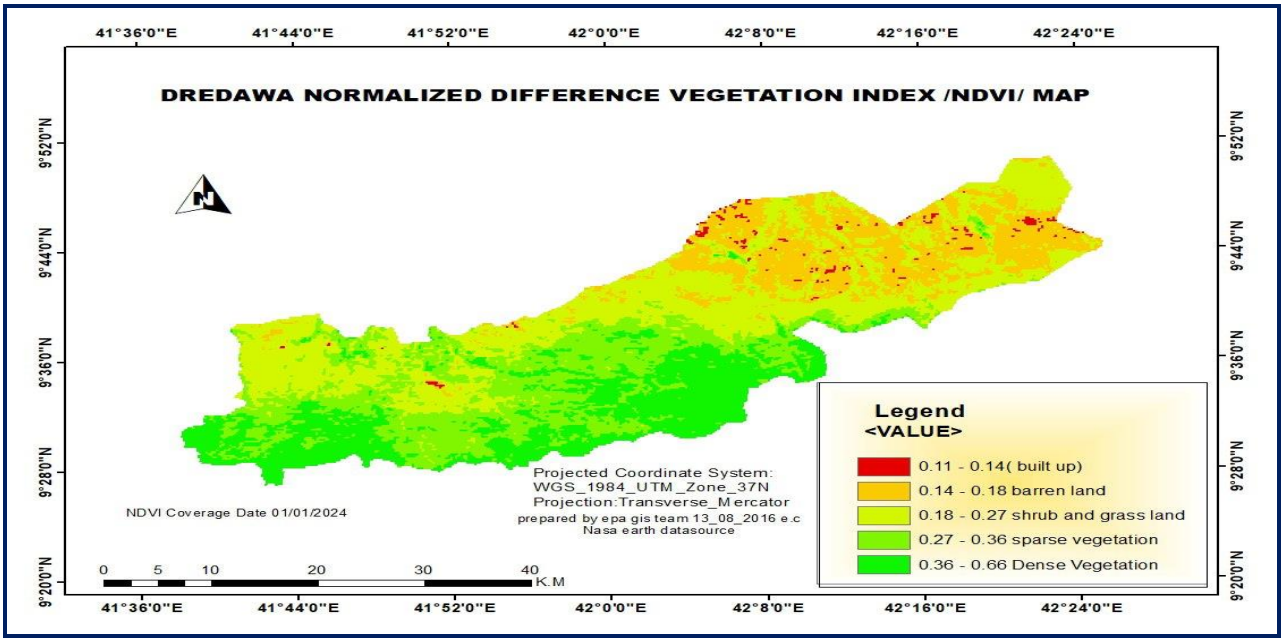


Figure 9: Dire dawa city Adminstaraion Normalized differential vegetation index

The Normalized differential vegetation index (NDVI) is standardized vegetation index which allows us to generate an image showing the relative biomass. The chlorophyll absorption in Red band and relatively high reflectance of vegetation in Near Infrared band (NIR) are using for calculating NDVI. An NDVI is often used worldwide to monitor drought, monitor and predict agricultural production assist in predicting hazardous fire zones, and map desert encroachment.

3.1 IMPACT

Forests of Ethiopia are highly affected by several natural and anthropogenic factors. Specifically, anthropogenic factors affect forests mostly through expansion of agricultural activity, settlement, deforestation, land fragmentation and invasive species introduction etc. To conserve the remnant forests and for further regeneration, forest management has been practiced through protecting forest areas from human and livestock interference. Forest provides livelihoods for millions of people worldwide, through provision of different products. However, their diversity and area coverage are highly declined through time. Deforestation, invasive species and land degradation are the main threats accelerated plant diversity loss.

Increasing food demands through intensive competition on the available natural resources are the root causes of increasing greenhouse gas emissions, massive deforestation, losses of flora and fauna species, and land degradation (FAO, 2016).

Loss of indigenous plant and animal species: - FGD participants explained that there were numerous plant and animal species in Zukuala forest ecosystem, currently those plants and animals species were distracted in alarmingly due to deforestation, through resettlement, population growth as well as unsecure land tenure. Zukuala natural high forests are encroached upon and cleared for cultivation or grazing by local people.

Run off /removal of top soils by erosion: - as the wood land and forest land of the surrounding area is converting to agricultural land, harvested for firewood and construction material, lead to loss of forest and Woody biomass in the study area and the vegetation coverage of the Zukuala forest ecosystem.

Negative impact on the environment as well as high run off and soil erosion. Due to Deforestation and degradation of forest and bushes in lower sides of the mountains, large dissect

gulls were created in the farm lands. This overall results on deter ration of soil quality leading to low productivity of crop.

Expansion of Invasive Alien Species-the rapid expansion of invasive alien species to the forest ecosystem was another prevailing impact as confirmed by FGD and key informants.

Lantana camara is the highly and widely invading alien species, can withstand any climatic shocks like drought and remain dominant on the area. It invades leading to extinction of indigenous species of bushes.

The variability in amount and distribution of rain fall: FGD participants perceive that the distribution of rainfall was decreased from year to year. Due to this problem the growing season was changed and correspondingly the temperature was raised highly. FGD participants associate this problem with the impact of deforestation and change in forest ecosystem services.

Destruction of water sources: FGD and key informant participants explained that the area was a potential to the water source but due to forest degradation and deforestation, numbers of water sources were dried. On the FGD, participants were clarified that the amount of different water source like springs and rivers deteriorate.

Extinction of medicinal plant: The participants of FGD explained that due to the degradation of forest ecosystem through agricultural purpose, the most beneficial medicinal plants are extinct like coso tree species.

In general, the depletion of forest resources contributes significantly to the climatic and physical changes of the environment (Bond,etal 2011). Due to the improper managenet of forest resources, the following impacts were applied 4961.4ha of forest land was degraded, about 131409 ha of land was affected b y moisture stress problem in the area.

3.2 RESPONSE

To reverse the forest degradation status of the rcity Adminstration, by aforstaion program more than 4% of land treated, 1.45% by restoration and 1% by partriciptory forest managemnet works (PFM) respectively.

Figure 10: Tree nursery in Adda kebele DDA

4. STATE OF WATER RESOURCES

4.1 Surface and ground water

Surface and ground water is the main water resource of the DDAC. For instance, the water supply for the two urban centres, Dire Dawa and Melka Jebdu, where more than 70 per cent of the population is concentrated depends on groundwater.

According to Diredawa city Adminstration water and sanitation Athourity 2024 report, about 41.41% of water source is obtaind from ground water and about 77.8% of water source is obtaind from surface water for people consumtion.

Groundwater resources are normally recharged through precipitation, and from streams that are in hydraulic connection with the aquifer system.

The main aquifers in the area are upper sandstones and limestone and alluvial deposits.

The escarpment of Dire Dawa area is the main recharge area of the groundwater system to the down thrown block. East–west trending step faults in the upper sandstones and limestones act interceptors of rainfall and surface water generated on the escarpment flowing perpendicular to

the faults in the south-north direction and drains in the groundwater system of the down thrown blocks in the main aquifers of (sandstones and lime stones).

There is a high possibility that the Dire Dawa groundwater basin main aquifer system (upper sandstones and lime stones) is composed of a confined and a semi-confined extensive aquifer system with constant recharge from the south.

The main confining layer is the volcanic rock (basalt), which has very low transmissivity, less than 5 m^2/day.

The main aquifer in the northern part of Dire Dawa plain may be artesian or confined with water level less than ten meters.

Under the surface water of Diredawa city Adminstraion, there area four seasonal rivers i.e two streams and two springs in the city. The water coverage of the community for city residence is 100% and 86% coverge for rural people. However, only 50% of the community could get access to safe drinking water. The total water use for household is 70% and for industry. The total demand of water in the area 97,200 m^3lday for drinking and other utility.

The main source of water pollution is dissolved elements such as Ca. Mg, Fe factory, informal settlement around well field.

4.2 Preliminary Assessment of Water Requirements

4.2.1 Irrigation Water Demands

The DDAC falls in the Awash River Basin. However, the watersheds are relatively small in drainage area. Furthermore, the area lies in water-scarce area. Irrigation schemes are categorized as large, medium and small scale. The followings criteria are used for classification of irrigation schemes in Ethiopia:

Table 5:- Scale of irrigation schemes

No	**Range of irrigation schemes**	**Area in ha**
1	Small scale	Under 200

2	Medium scale	200 - 3000
3	Large scale	Over 3000

All existing and on-going irrigation schemes in the Council fall in the small-scale category and the Irrigation and Drainage Team has identified about 1428 ha under modern irrigation and 611 ha under traditional irrigation. Moreover, phase I of the master plan study has identified 909 ha, 8139ha and 11211ha of small, medium & large scale irrigation projects respectively.

Table 6: Existing and Proposed Irrigation Schemes in the Dire Dawa AC

Type of Irrigation	**Irrigable Area (ha)**		
	Existing Schemes	**Proposed Schemes**	**Total**
Traditional	611	To be assessed	611
Small-scale	1428	909	2337
Medium	-	8139	8139
Large Scale	-	11211	11211
Total	**2039**	**20259**	**22298**

Note: most of the estimates on existing schemes and proposed potentials are very preliminary and are subject to change, as more information is gathered. The total water demand for irrigation has not been done so far.

4.2.2 Domestic Water Demand

The assessment of water supply for domestic and non-domestic uses is one of the major tasks in planning of water resources development. We compiled relevant information on the existing coverage of public water supply schemes for human as well as livestock consumption. It is estimated that about 67.3% of the urban population has access to potable water, while the rural population, which known exactly, is taken as about 39.6% by the most conservative estimates. Thus, a major share of the water allocated for domestic uses will go to the urban population, mainly to Dire Dawa town.

The preliminary estimate of domestic water demand has been made using an average per capita daily demand of 60l for urban population and 30l for the rural population. According to this estimate, total current annual water requirement of the urban population for domestic uses will be about 5.4 Mm^3, whereas the rural population would be about 1.05 Mm^3.

4.3 IMPACTS

The exsisting water of the area is polluted by different factories by informal settlement around the well filed by dissolved elements like Ca, Mg and Fe. Due to the above and other associated factors, more than 48600m3/day water shortage is happening in Diredawa city Adminstration.

4.4 RESPONSE

In regular time interval water reserveiors are treated, numbers of moisture conservation technologies were constructed in hilly lands of the city. Different types of seedling bed preparation and tree planation were established.

5. STATE OF MINERAL RESOURCES

Lime production: The principal raw material used for the production of lime is limestone. This raw material is a sedimentary rock mostly composed of carbonate minerals, particularly carbonates of calcium and magnesium. The commonly known chemical composition of limestone is calcium oxide (CaO), and carbon dioxide (CO2). However, small amounts of impurities such as silica and aluminum may be present in limestone mineral. As per the resource potential assessment study made by IPS, the major raw material required for the production of lime is available at the eastern outskirt and south part of Dire DawaCity.

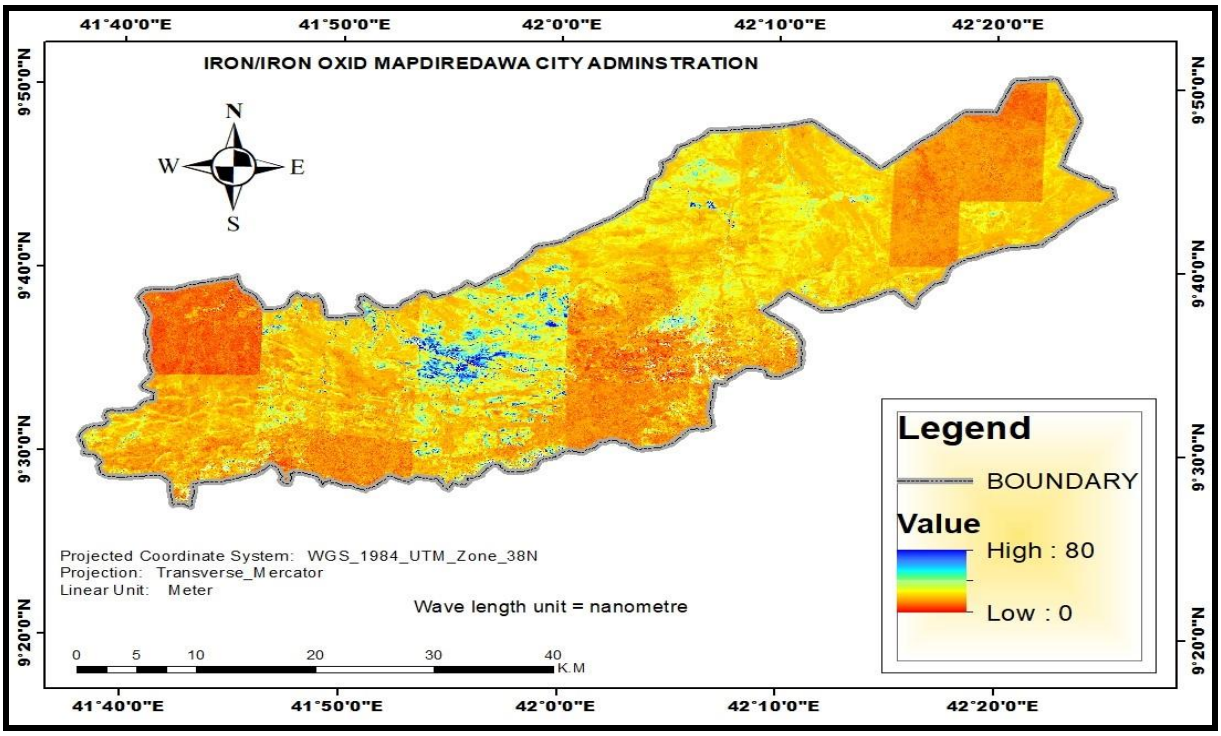


Figure 11 Iron Oxide distribution map of Diredawa city Adminstration

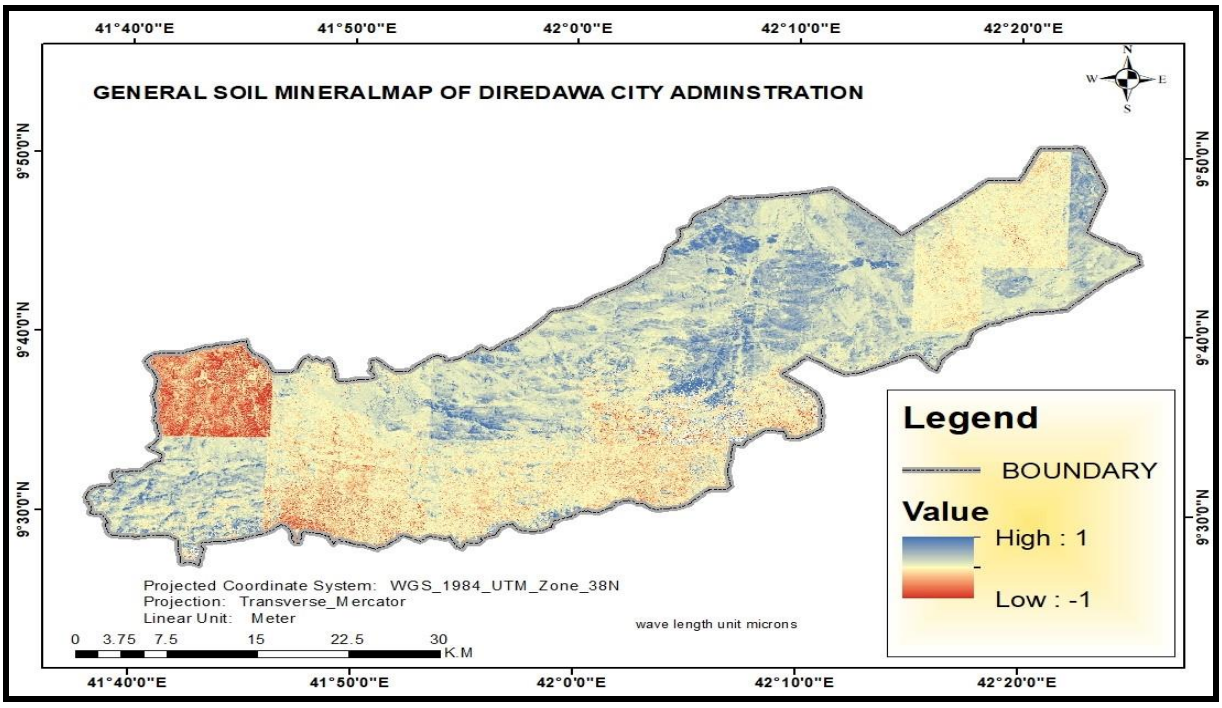


Figure 12 General soil Mineral map of Diredawa city Adminstration

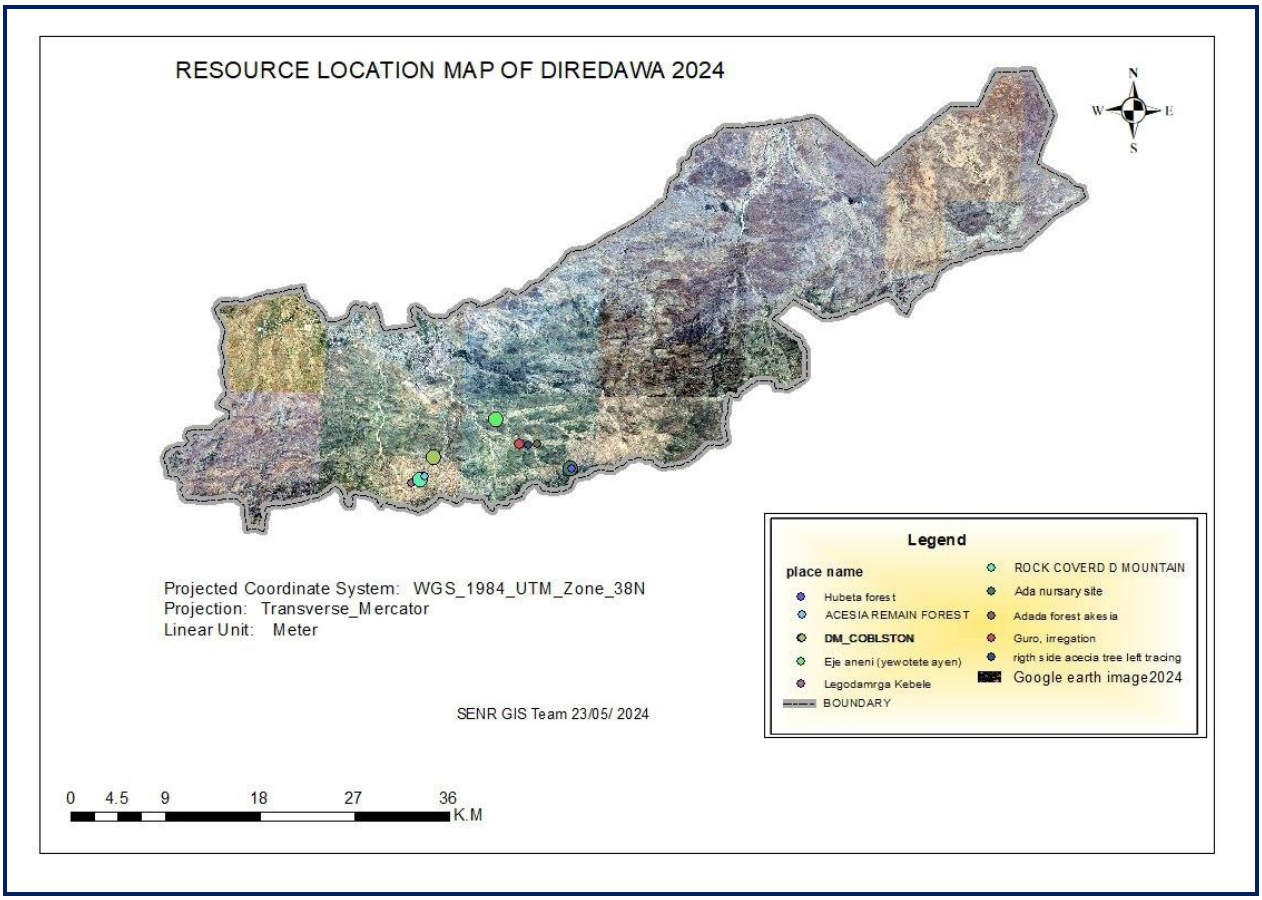


Figure 13 Resource location maps of Diredawa city Adminstration

Table 7 Collected GPS points of different areas oth the city Adminstraion

x	**y**	**z**	**PLACE DESCRIPTION**
41.84697	9.49014	1523	Legodamrga Kebele
41.85381	9.49322	1571	Rock Coverd D Mountain
41.85756	9.49625		Acesia Remain Forest
41.86606	9.06264	1519	Quairy Moutain
41.9467125	9.5227867	1623.77m asl.	Rigth Side Acecia Tree Left Tracing
41.954314	9.5241205	1660.23mas	Adada Forest Akesia
41.9831205	9.5029256	1821.089mas	Ada Nursary Site

41.9193341	9.5450296	1441.1mas	Eje Aneni (Yewotete Ayen)
41.9393454	9.5238933	1569.24m asl	Guro, Irregation
41.9837313	9.5023116	1845.28 mas	Hubeta
41.86606	9.51264	1519	Dm_Coblston

Figure 14 Stone and sand resources site in Diredawa

River Sand: The river sand is found abundantly in the large dry river streams such as Lege Goro, Lege Hare and Lega Dechatu, crossing Dire Dawa City. The deposit is composed of fragments of the metamorphic, sedimentary and volcanic rocks of the area.

Sandstone and River Sand: The Amba Aradam sandstone, which is composed of pure quartz and inter-bedded within the impure (rich in iron oxides), can be source of silica sand used for the production of sheet glass and container glass.

Lime: The raw materials for the production of lime are abundantly found near Dire Dawa City. Lime has a variety of uses, notably in the building, road making, and mining and sugar industries. Lime is produced by calcinations (heating to decomposition) of limestone and

sufficient energy is required for this purpose. Lime has various applications in steel, pulp paper, and chemical industries.

It is used in wastewater treatment and soil stabilization. The Dire Dawa Cement Factory is producing both hydrated and quick lime for sugar factory, caustic soda factories, and water treatment in the country upon request. If we compare the amount of lime produced for its various applications to the size of the availability of its raw material, we see that the full potential of the area is not utilized.

Figure 15: Quary site in Diredawa City

5.2 RESPONSE

5.2.1 Remedial Measures to Stop Natural Resource Degradation

Some of the measures to prevent the degradation of natural resources are as follows –

- Stop deforestation and promote the planting of more trees.
- Improve irrigation and agricultural practices.
- Stop overconsumption by reducing over-cultivation, mining, fishing and other such practices.

- Government Regulations and policies should be created to save precious natural resources and restore biodiversity.
- Punish and penalize industries contributing to pollution.
- Efforts to Reduce Consumption of natural resources.
- Recycle, Reuse and Reduce waste generation.
- Create Awareness by educating people about natural resource preservation and helping them understand their responsibility towards nature and saving the planet.

The mining and mining income tax laws and regulation constitute the following particular proclamation and regulation.

1. Mining Proclamation No.52/1993, with its amendment proclamations (Proclamation Number 22/1996 and 118/1998)
2. Mining income tax proclamation No.53/1993, with its amendment proclamation No. 23/1996, and
3. Mining Regulation No. 182/1994, with its amendment i.e Mining (Amendment) Regulation No. 27/1998. The most recent of the mining laws the Mining Operations Proclamation No. 678/2010' was enacted in 2010/11. The associated new Mining Operations Regulation is currently under drafting by the Ministry of Mines to ensure efficient licensing and license administration procedures.

6. RECOMMENDATION

Land degradation is one of a serious agricultural problem that posed severe threat to current and potential food production and the livelihood of peoples in Ethiopia. The shortage of land, rapid growth of population and demand for increased food production intensified the pressure on the land and aggravated the process of land degradation..

- Integrated land use and development planning and policy reform are suggested to encourage the on-going and planned ecosystem restoration, degraded land rehabilitation, and biodiversity conservation intervention in Diredawa forest resources in the region.
- An effective watershed management plan and practice should be employed at the landscape level by prioritizing the sub-watershed for conservation and management based on degradation level.
- Implement integrated soil and water conservation efforts. For example, gully rehabilitation check dam construction work.
- Implement monitoring and support systems to ensure that mining and road construction projects do not negatively impact the environment before they are put into operation.
- Encourage various non-governmental organizations to engage in rehabilitation of affected areas.
- Raising public awareness on environmental issues and land degradation
- Encourage nursery establishment for seedling raise to cover the degraded land
- Re-forestation program is an immediate requirement to protect the destruction of forest resources. Here, a single re forestation program that can be used as a model and organized by either the government or nongovernmental organizations have a sound contribution on forest protection and recovery processes in the area.
- Creating awareness among the society regarding to optimum utilization of the forest resources and conservation systems by concerning bodies and NGOs who could play a per amount role in rehabilitation and minimizing deforstaion and forest degradation in the region.

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