DETERMINATION OF SOIL EROSION IN ERDEMLI MICROCATCHMENT USING GEOGRAPHIC INFORMATION SYSTEM (GIS)

Zaniar Jamal SALIH

Master Thesis

Department of Soil Science and Plant Nutrition

Supervisor: Prof. Dr. Alaaddin YUKSEL

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REPUBLIC OF TURKEY
BINGOL UNIVERSITY
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This thesis was approved unanimously by the following jury in the date of 16/01/2017

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In the name of ALLAH.

First of all, I would like to thank THE ALLAH, who gave me this chance to study and finish my master degree.

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Bingöl 2017

DEDICATED TO

- My dear love and faithful wife, Sara, who always encourages me
- My sweet daughters, Zin & Ziw
- My Father and Mother, they are Candles that burn to lit my life
- My sweet Kind Sisters, Rezan, Kharman, and Khelan
- All Human Beings to inspire them to depend on the mother nature

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LIST OF SYMBOLS AND ABBREVIATIONS

%	: Percent
°C	: Centigrade Rating (Degree Celsius)
$CaCO_3$	: Lime (Calcium carbonate)
GIS	: Geographic Information System
GPS	: Geographic Positioning System
WEPP	: Water Erosion Prediction Project
Cm	: Centimeters
DS	: Desisimens
Dw	: Distilled Water
EC	: Electrical Conductivity
FAO	: Food and Agriculture Organization
G	: Gram
GDREC	: Green Deal Renewable Energy Company
Hr	: Hour
Ha	: Hectare
HNO_3	: Nitric Acid
K	: Potassium
K_2O	: Potassium dioxide
Kg	: Kilogram
Km	: Kilometer
Km^2	: Kilometer square
M	: Meter
Mm	: Millimeter
N	: Nitrogen
Na	: Sodium (Exchangeable Sodium)
$NaHCO_3$	: Sodium Bicarbonate
NaH_2PO_4	: Sodium Phosphate Mono Basic

NPK	: Nitrogen, Phosphorous and Potash
µS	: Microsymens
MNHRP	: (Murat Nehri Havzası Rehabilitasyon Projesi) Murat River Basin Rehabilitation Project
P	: Phosphorus
ANOVA	: Analysis of Variance
PH	: Soil Reaction (Hydrogen Ion Concentration)
P_2O_5	: (Available Phosphorus) (Diphosphorus penta oxide)
POX	: Peroxide
Ppm	: Part Per Million
UNESCO	: United Nations Educational, Scientific and Cultural Organization
UTM	: Universal Transverse Mercator
Texture Class	: Include (Soil Sand, Silt and Clay)
$K_2Cr_2O_7$	: Potassium Dichromate
H_2SO_4	: Sulfuric Acid
Ml	: Milliliter
Meq	: Mill equivalent

COĞRAFİ BİLGİ SİSTEMLERİ (CBS) KULLANARAK ERDEMLİ MİKROHAVZASINDA TOPRAK EROZYONUNUN BELİRLENMESİ

ÖZET

Bu çalışmanın amacı yaklaşık 8397.16 ha bir alana sahip Bingöl-Erdemli mikrohavzasının, toprak erozyon durumunu ve bazı toprak özelliklerini belirlemektir. Bu amaçla Erdemli mikrohavzasının 1/25000'lik topoğrafik haritası sayılaştırılmış ve bu alana ait yükseklik grubu, eğim, arazi kabiliyet ve toprak haritası yükseklik modeli kullanılarak caoğrafi bilgi sistemli kullanılarak yeniden oluşturulmuştur. Haritaların sınıflandırılmasında ArcGIS 10.1 programı kullanılmıştır. Toprak örnekleri 0-30, 30-60 cm, 60-90 cm ve 90-120 cm derinliklerinden alınmıştır. Araştırma alanındaki 7 köye (Erdemli, Bahçeli, Dışbudak, Gökdere, Kıran, Suvaran ve Yumaklı) ait alanda 80 toprak profili açılarak bu noktalardan toplam 291 toprak örneği alınmıştır. Araştırma kapsamında topraklarda, tekstür, pH, elektriksel iletkenlik (EC), organik madde, toplam azot (N), kireç ($CaCO_3$), yarayışlı potasyum (K), yarayışlı fosfor (P), ve sodyum analizleri yapılmıştır. Toprak analiz sonuçları ve arazi etüt çalışmalarına göre, araştırma alanında erozyon probleminin olduğu belirlenmiştir. Sonuçlara ek olarak jeolojik toprak erozyonu direnci, çok şiddetli, şiddetli, orta şiddetli ve az şiddetli olara derecelendirilmiştir. Bununla birlikte araştırma alanı toprakları, az kireçli, düşük elektriksel iletkenlik, orta organik madde içeriği, nötr pH düzeyi, yeterli düzeyde azot, fosfor ve potasyum içermektedir. Araştırma alanı jeolojik olarak metamorfik ana kaya yapısında sahiptir. Bu ana kaya üzerinde, killi, killi tın, kumlu, kumlu tın, kumlu killi tın ve siltli tın bünyeli toprakların oluştuğu belirlenmiştir.

Anahtar kelimeler: Mikrohavza, toprak erozyonu, Coğrafi Bilgi Sistemleri (CBS).

DETERMINATION OF SOIL EROSION IN ERDEMLI MICROCATCHMENT USING GEOGRAPHIC INFORMATION SYSTEM (GIS)

ABSTRACT

The objective and the aim of this study to determine some soil properties and soil erosion of the Microcatchment and of the watershed working area of about (8397.16) hectares in Bingol–Erdemli Microcatchment. This objectives and aim, Erdemli research Micro catchment with the scale 1/25.000 digital elevation model was created by the digitization of topographic maps, by using this digital elevation model of soil erosion, elevation, aspect, land, land capability, and slop use maps were re –created. The classification of maps was used Arc GIS 10.1 programmer. Soil samples were taken from depths, of (0-30 cm, 30-60 cm, 60-90 cm and 90-120 cm). In study area a total of 80 landscapes were opened in the area of 7 research villages (Erdemli, Bahçeli, Dışbudak, Gökdere, Kıran, Suvaran and Yumaklı) and a total of 291 soil samples were taken from these points. Within the scope of the study, were analyzed that, soil texture, pH, electrical conductivity (EC), organic matter, total nitrogen (N), lime ($CaCO_3$), available potassium (K), available phosphorous (P), and sodium (Na). According to soil analysis results and field survey studies, it was determined that there is soil erosion problem in the research area. In addition to the results, geological soil erosion is rated as resistance, very severe, severe, moderate, and less severe. Nevertheless result of soil analysis contains of that less lime, low electrical conductivity, medium organic matter content, neutral pH level, sufficient nitrogen, phosphorus and potassium. To study in this area, the geological structure is composed of metamorphic bedrock. It is determined that clay, clayey, sandy, sandy loam, sandy clayey and silty loam are formed on this bedrock.

Key words: Microcatchment, Soil Erosion, Geographic Information Systems (GIS).

1. GENERAL INTRODUCTION

Soil is a covering containing various minerals, living organisms, organic materials, air and water. Approximately 45% of the ideal soil mass is composed of mineral, 25% air, 25% water and 5% organic matter. The present day as nutrition of mankind is the most important and basic needs, as well as all over the world, our country come not presented insufficient natural sources to population growing rapidly enough, balanced and health measures should be taken to adequately feed. Our country agricultural growing due to the ongoing intensive farming and irresponsible use since the territory century unable to provide the needs of brotherhood and whereas agricultural land is shrinking continuously existing agriculture to meet the nutritional needs of a growing world population with land units has emerged a higher throughput through requirements of the agricultural land. High efficiency is essential and of agricultural input conscious use of agricultural land in order to achieve a sustainable production. Agricultural input use and made on issues such as tillage unconscious, unlike uncontrolled and sometimes the expected key benefits achieved as a result of intensive applications, taking the higher yield requirements emerged, to achieve a sustainable production of high-data of agricultural land and agricultural inputs must consciously use. Trim input strength and tillage as unconscious when fixture issues, uncontrolled and unlike intensive applications result in sometimes the expected key benefits achieved, land resources and environmental contamination, contaminated agricultural and in poor yield potential, in some cases the cause to became agricultural land partially or totally unavailable (Enas 2016).

Soil, the so-called bedrock, is first broken down by physical activity, then partly separated by chemical events and loosened and grounded (Kantarci 2000).

Erosion is the detachment and transportation of material from a surface. It takes place whenever the eroding or driving forces exceed the resisting forces. Erosion is the detachment and transportation of soil material by erosion agents (Ellison 1946).

Soil erosion is been caused by the action of water, wind, grazing animals and human activity (DEFRA 2005). Water erosion is more common in wet regions with a slopping mountainous terrain results in a loss of the topsoil reach in humus, and lead to incline in long-term productivity. Soil erosion causes loss of soil productivity and deposition of sediments which may pollute surface, underground water resources, clog streams, reservoirs, and estuaries (Hillel 1998).

The increased erosion is damaging lands, polluting streams and reducing the storage capacity of reservoirs. In the Kurdistan region of Iraq, little amount of research has been conducted to evaluate the extent of soil erosion and examine the relation between soil erodibility and other soil indices. The progress in understanding the mechanism of erosion and developing techniques are to control the attentively of vital importance (Muhammad 2013).

Erosion is one of the biggest ecological problems, which threaten our national reserves for our country as well as the whole World. Turkey is located in Southern West/ Middle Asia- North Africa zone, where is under high erosion effect and mostly become desert. Due to the erosion, the amount of earth moved into the seas, dams and lakes is detected about 500 million tons according to sediment measurement which applied in 26 basins in our country (ÖZEL et al. 1998).

Global annual soil erosion is occurring at a much higher rate than soil replenishment (Favis-Mortlock 2008). Rivers and Streams are the means by which the soil is been transported. Eventually, large amounts of soil deposits in local lakes and reservoirs will result in watersheds becoming prone to flooding. This erosion results in the destruction of prime cropland and forests. Annual soil erosion results in losing more than ten million hectares of viable croplands worldwide (Pimental et al. 1995).

A variety of natural sources causes soil erosion. During rain events, sheet erosion caused the detachment and removal of soil. During this process, the soil particles are been transported in an uncondensed, thin sheet of water. First, falling rain droplets cause soil to detach and ultimately erode from overland flow, better known as splash erosion. This process is most commonly observed on level terrain, under rainfalls of high intensity, and in areas with very little groundcover. When rain falls, its energy dissipates by striking

vegetation before hitting the ground. If vegetation is not present, the falling rain droplets exert maximum force on the bare soil. Water-induced soil erosion is also influenced by the gravitational effect of water flowing in rills (Barthes and Roose, 2002). A rill is a thin opening in the ground (similar to a small streambed) that transports runoff during and after rain events. After rain events, the water that does not permeate the ground surface induces overland flow. This runoff typically occurs after rain events of high magnitude or after the ground has been already saturated. Small ponds and puddles form on the ground surface and ultimately fill to capacity and overtop, which causes concentrated overland flow. The focusing of the flow increases the likelihood of soil erosion, which produces rills. The detachment of soil in rills has directly related to the hydraulic shear stress of flow and the critical shear stress of the soil particles (Nearing et al. 1989).

The water been transported through the rills increases and becomes more concentrated, gullies are formed. A gully is a more severe form of rill erosion, which cannot be remove through normal tillage practices. A gully is defined as an area where channels at least 30 cm deep (NSW Department of Primary Industries 2012). Allow running water to erode and transport soil. Upon formation, gullies are narrow with vertical sidewalls; however, the transported water allows for widening and lengthening, in addition, wind greatly influences soil detachment. Typically, in level, dry areas with little vegetation, high wind causes unprotected soil to be blown away. The small grain of soil particles are easily been transported, leaving behind the larger grain soils (sands), cobbles, and boulders. By eroding the finer silts and clays, the sandy soil is more susceptible to water induced soil erosion. The fine soil particles that are been suspended in the air by wind come back to the ground surface and detach more soil particles upon impact (Wolfe and Nickling., 1993).

Another natural source of soil erosion is glaciations. Glaciers erode the ground surface as they move over the land, and drastically change the landscape. Deep valleys, lakes, and narrow hill peaks are common landforms created through glacial geomorphology. As a glacier moves over the ground surface, sediment is relocated. As opposed to water and wind-induced soil erosion, glacial erosion is not limited to fine grain soil particles. Glaciers abrade and pluck soil, cobbles, boulders, and bedrock, as they move over the ground. The eroded material is then been deposited elsewhere, when the glaciers move along their paths. Additionally, the human activities are known to greatly accelerate the

rate of erosion. Soil erosion increases through the destruction of natural vegetation and the alteration of the ground contour (Meeuwig 1970).

The roots of vegetation physically hold the soil together. Without the roots, the detachment of soil through overland runoff is more easily been achieved. Moreover, the leaves of plants shield the ground from direct contact from rain droplets. The low-lying vegetation helps to shield the ground surface from wind erosion. As the ground surface is been altered, the erosion potential increases. Farmers practice crop rotation and no-till practices to minimize the amount of soil erosion in fields. Global Assessment of Soil Degradation (GLASOD) determined that 1,643 million hectares of land erode due to human influences on wind-induced and water-induced soil erosion (Morgan 2005).

Through the aforementioned natural sources of erosion, rills are been formed in the soil. Once a rill becomes deep enough to interfere with tillage practices, it becomes a gully (Poesen et al. 1996). The in Terrill erosion occurring is primarily due to the rainfall intensity and slope (Meyer 1981).

Both rills and gullies aid in the transport of sediment and overland runoff. The sediment is been transported from the rills and gullies to streams, rivers, and reservoirs. Through human interactions the erosion potential in rills and gullies might be greatly decreased (Lucas 2012).

Objectives

The objectives of this thesis are:

1) Using the Rainfall, Digital Elevation Model (DEM), Soil Type Map, and Land Cover Map, build the Soil Erosion Map (SEM) and calculate the soil loss rates On the Erdemli Microcatchment for the following two cases:
    a. Annually, check the average of soil loss rates
    b. Soil loss rates caused by typhoon “Maemi”
2) Analyze the spatial distribution of soil erosion in the Erdemli Microcatchment
3) Using the annual average soil loss rate on the Erdemli Microcatchment
4) Estimate the life expectancy for the dead storage and whole storage of the Erdemli Microcatchment reservoir.

2. LITERATURE REVIEW

2.1. Introduction

According to the objectives, the following topics are been reviewed in this chapter: soil erosion modeling in the Erdemli Microcatchment using the Geographical Information System (GIS).

2.2. Soil Erosion Models

Soil erosion and sedimentation by water involves the processes of detachment, transportation, and deposition of sediment by raindrop impact and flowing water (Foster and Meyer., 1977; Wischmeier and Smith., 1978; Julien 1998). Major forces originate from raindrop impact and flowing water.

Figure 2-1 shows the mechanisms of soil erosion, in which water from sheet flow areas runs together under certain conditions and forms small rills. The rills make small channels, when the flow is concentrated, that causes some erosion, and as a result, some materials might be transport, within these small channels. A few soils are very susceptible to rill erosion. Rills gradually join together to form progressively larger channels, with the flow eventually proceeding to some established streambed. Some of this flow becomes great enough to create gullies. Soil erosion may be unnoticed on exposed soil surfaces even though raindrops are eroding large quantities of sediment, but erosion might be dramatic where concentrated flow creates extensive rill and gully systems.

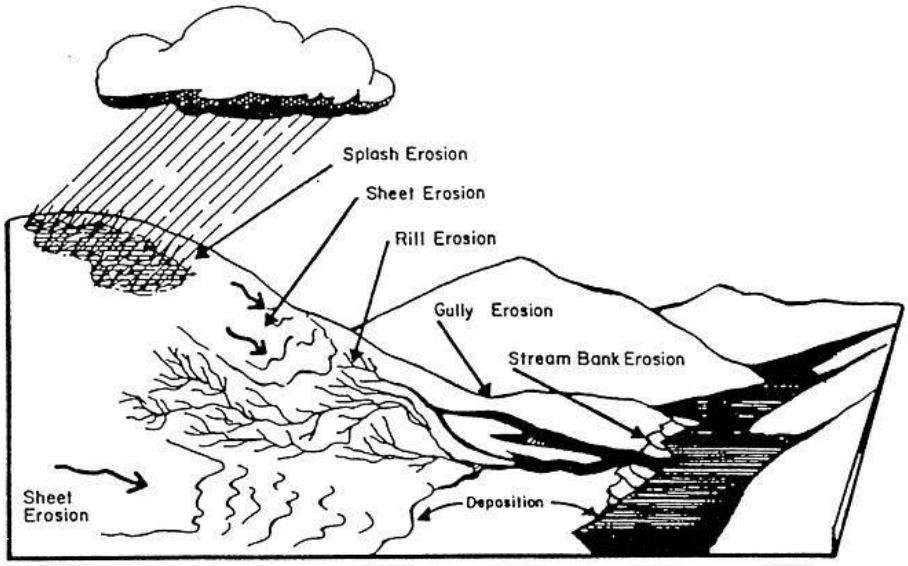

Figure 2.1. The mechanisms of soil erosion (USACE 1985)

Wildemeersch et al. (2011) Soil erosion might be define as the process of dispassion, passage, and detachments of the particles of soil. This process as seen on two different faces and effects: one affects water, called water erosion, and the other is called wind (Mass passage- or- Mass movement). The erosion that is caused by human acts and activities is another different act or process that affects soil and displace it is called tillage or tillage erosion.

Yüksel et al. (2008) the soil erosion is the most serious environmental problem in watershed areas in Turkey. The main factors affecting the amount of soil erosion include vegetation cover, topography, soil, and climate. In order to describe the areas with high soil erosion risks and to develop adequate erosion prevention measures in the watersheds of dams, erosion risk maps should be been generated considering these factors. Remote Sensing (RS) and Geographic Information System (GIS) technologies were been used for erosion risk mapping in Kartalkaya Dam Watershed of Kahramanmaras, Turkey, based on the methodology implemented in Coordination of Information on the Environment (CORINE) model.

Yüksel (2002) Survey in Kahramanmaraş Ayvalı Dam Precipitation Basin Hydrological and physiographic characteristics of the basin, different the physical properties of the soil, land use patterns and determine these data as WEPP And GIS environment, the surface

flow condition in the basin and Sediment yield determination and accordingly a model basin planning in the work he has done to ensure that, representation of the soil profile work area in the form of three different land use (agriculture, pasture, forest) And four different hosts 12 clay loams (Clay stone, Sandstone, Serpentine and Limestone) pasture lands Profile, 36 soil profiles from agricultural areas and 52 soil from forest areas Profile, a total of 100 soil profiles are opened, so that each profile is different Soil samples (0-20 cm, 20-50 cm and> 50 cm), were have collected and analyzed of some hydro physical properties of the soils. Research area Erosion and sedimentation by using GIS (Geographic Information System) and WEPP (Water Erosion Prediction Project) technology. Different land uses the estimated amount of soil loss arising from the examination on the form, Forest 1.32 tons / ha / year in the field, 23.95 tons / ha / year in agricultural areas, in pasture areas 4.69 Ton / ha / year and is calculated as. Assessed according to land capability classification the forest area in the basin area should be 7272.70 ha, 945.2 ha of this area has been used in gardening.

Karagül (1996) Trabzon Söğütlü the use of different land uses in the river basin investigated how it affects certain properties of the soil. Because of the research, found that the soil was susceptible to erosion and that the highest dispersion ratio was agriculture and the lowest dispersion ratio in forest soils, according to this result, the conversion of forest areas to pasture and agricultural areas erosion tendency.

Gay et al. (2009) Water erosion is a natural built phenomenon, takes place when the organic matter content is lost, topography is affected, and the covering vegetation is exaggerated by intensive fall of rains. Human Being’s activities also might have their effect in this regard.

Okatan et al. (2001) Ayvalı Dam in Kahramanmaras Kızıldere Precipitation Basin The soil erosion tendency values depend on the soil's hydrophobic properties they investigated change. In order to determine basin characteristics Arc Info, they used software. According to the results obtained the surface of the soil Aggregation ratio, erosion ratio, dispersion ratio, and colloid moisture content ratio of the land in the basin is susceptible to erosion.

Şeker et al. (2004) the soil of two widespread soil series in Büyük Menderes Basin Investigated some of the chemical, physical and hydrological properties of the source. Jammed and in uncompressed horizons volume weight, pore size distribution, total porosity, and the saturated hydraulic conductivity values are determined and these values are associations were evaluated statistically. It has been determined that the borders of the profiles are especially at depths of 40-50 cm, volume in these horizons The decrease in the amount of macro pores is observed they have revealed.

Yüksel et al. (2008) In Turkey, especially in the semi-arid and arid Mediterranean regions, soil erosion is one of the major threats to soil conservation and water resources. Soil erosion and sedimentation reduce the economic life of dams through the inflow and deposition of soil particles. In addition, sedimentation results in dramatic environmental impacts on water quality and aquatic habitat. According to GDREC, over 345 million tons of sediment enter the rivers, lakes, dams, and seas per year in Turkey. Therefore, sustainable management and conservation of such expensive investments and their watersheds are crucial for the long term quality of life and the national economy.

Tüfekçioğlu (1995) In a study conducted by the Ordu Melet River, and south Significant differences with respect to skeleton content between the eyes only with a probability of 0.05 errors find, the average degree of covering of woody and herbaceous species, Soil% sand, % clay, % Silt, % Organic matter values and soil reaction south and north-facing the significance of the difference is not significant with the probability of error of 0.05.

Erol and Hızal, (2006) Determination of the hydrophilic Soil properties, Changes due to factors that are effective in soil formation they have investigated. The research result reveals that the hydro physical soil Properties of the parent material are usually characterized by the decomposition products of the parent material and same Due to topographical factors, considerable elevation and Influenced by changes, With the reason that the plant cover is weak in semi-arid conditions The effect of land use has been limited. Elevation and depth steps affect the hydro-physical properties of the soil, general Climate conditions. Land use patterns are based on hydro-physical it has not been effective on the properties at large. Likewise, climate and topographic especially physical dissociation conditions are prevalent due to factors, Chemical decomposition Conditions

are weak, but this is due to the hydro-physical properties of the soil they were been found to have a significant effect on the changes that took place.

Caravaca et al. (2001) in a study by Composted Organic Waste While the clay content of the soil was been found to increase by 13% in excess soil, fresh organic it has been found that the addition of waste increases the stability of the water-resistant aggregate by 17%.

Aksoy (1998) investigated the soil formation processes in Amanos Mountains with 17 different He has taken samples by opening a soil profile at the spot and has identified the profiles in detail. Physical, chemical and mineralogical analysis of soil samples and field studies Classification is been done in the result. When researcher classifies soil Taxonomy and FAO / UNESCO 2 different soil classification system. According to soil taxonomy, the soil in the study area is been composed of Spodosol, Mollisol, Alfisol, Inceptisol and Entisol, then according to FAO / UNESCO, Podzol, Acrisol, Luvisol, Phaezem, Cambisol and Regosol.

Thurow (1991) Infiltration by compressing the soil through hoofs of grazing animal's capacity.

Fisher and Binkley, (2000) found that the amount of soil organic matter, the texture of soil and Structure, aggregation, soil reaction, decomposition rate of mineral substances, sandy Cat ion exchange capacity of soils, infiltration, hydraulic permeability, bulk weight as well as on the physical and chemical soil properties.

Aydin (2009) Gümüşhane Torul dam basin has basin characteristics (Basin Size, basin sequence, average slope, basin view status, average height, stream Home drainage network characteristics) using Arc Info software. The GIS facilities and its characteristics might been obtained more easily and quickly than conventional methods.

Göl (2002) some soil properties and land use type in Çankırı Eldivan region. According to the results been obtained, according to the soil properties, volume weight, hydraulic conductivity, and total nitrogen and organic matter has changed. In addition, the investigator's volume weight, hydraulic permeability, field (North, south) of the total nitrogen and organic matter values differences.

Erol et al. (2009) On different forms of land use in Isparta Darı Deresi Basin in a survey they did; The humidity value of the forest soil is two other uses Found 5% more important than sekline, the humidity values of the organic matter and The amount of organic matter changes due to soil monotonous change, humidity It is also effective on the equator, if the clay rate in the same way is higher than the humidity They also stated that their attachments would be high.

Göl (2002) in a study conducted in Çankırı Eldivan region, Investigated the effect of some chemical and physical properties of soil. Emerging According to the results of the survey, hydraulic permeability, volume weight, the amount of organic matter and total nitrogen varied according to land use, whereas Hydraulic permeability, bulk weight, organic matter, field capacity and total nitrogen and the amount of it has changed significantly according to the view.

Göl and Dengiz (2007) Çankırı Eldivan Karataş land use in Bağı Deresi Basin, in order to reveal the change in land cover, topographical, Geological and standalone maps were examined and as a result of the survey in 1955 14.5% Rose to 35.8% of black pine forest areas, damaged corpses, in agricultural areas decreased by 5.7%, 1.8% and 15.8%, respectively.

Göl et al. (2004) Land use patterns in Çankırı Eldivan Region and surface soil nematode and investigated the relationship between hydraulic conductivity and the hydraulic conductivity and field capacity they have changed significantly according to the view.

Yüksel et al. (2008) the amount of soil erosion is been mainly affected by vegetation cover, topographic features, climatic variables, and soil characteristics. The human activities and large-scale developments alter the vegetation cover, impact upon the soil erosion rate. Topographic features such as ground slope, slope length, and shape most affect rill and in Terrill erosion. The most important climatic variables are rainfall amount and precipitation intensity, which are been called rainfall erosivity. Besides, temperature is another important climatic variable since it affects the vegetative materials which are been used in mulching to control erosion. Soil erodibility is mainly been affected by aggregate stability, texture, depth, organic matter, and stoniness. Assessing the soil erosion rate is essential for the development of adequate erosion prevention measures for

sustainable management of land and water resources. Geographic Information System (GIS) technologies are valuable tools in developing environmental models through their advance features of data storage, management, analysis, and display. The Remote Sensing (RS) technology is been used to provide the land use/cover information by using digital image processing techniques. There have been many studies on modeling soil erosion by utilizing RS and GIS technologies.

2.3. Geographic Information System and Soil Erosion Modeling

A Geographic Information System (GIS) is an arrangement of computer hardware, software, and geographic data that people interact with to integrate, analyze, and visualize data; identify relationships, patterns, and trends; and find solutions to problems. The system is designed to capture, store, update, manipulate, analyze, and display studied data and used to perform analyses (ESRI, 2005). GIS have been used in various environmental applications since the 1970s; however, extensive application of GIS to hydrologic and hydraulic modeling and flood mapping and management did not begin until the early 1990s (Moore et al., 1991; Vieux and Gauer, 1994; Maidment and Djokic, 2000). The ability to represent elevation in terms of topographic surfaces is central to geo morphological analyses and thus to the importance of representing topography using DEM. It is through the distribution of soil that the land surface changes over the long term and so the ability to link sediment transfer with DEM changes (Schmidt et al., 2000). The redistribution of sediment will drive the long-term landscape change, which in turn will affect the hydrological processes acting within and over individual hill slopes (Brooks and McDonnell, 2000).

Soil erosion is been affected by the spatial topography, vegetation, soil properties, and land use. A GIS is a very useful tool to deal with the large number of spatial data and the relationship from various sources in the erosion modeling process, there are some advantages of linking soil erosion models with a GIS such as the following:

1) The possibility of rapidly producing input data to simulate different scenarios. A GIS provides an important spatial/analytical function performing the time-consuming geo referencing and spatial overlays to develop the model input data at various spatial scales (Sharma et al. 1996).

2) The ability to use very large catchments with many pixels, therefore the catchment could been simulated with more detail (De Roo 1996).

3) The facility of displaying the model outputs. Visualization might use to display and animate sequences of model output images across time and space. Therefore, the visualization enables objects might use to view from all external perspectives, and to invoke insight into data through manipulability visual representations (Tim 1996).

In soil erosion prediction, GIS application is increasing more and more. There are several examples for the integration of GIS with erosion models: (De Roo et al. 1989) combined ANSWERS with GIS technology; (Mitchell et al. 1993) linked AGNPS with GIS. (Molnár and Julien., 1998) compared soil loss erosion to different grid cell size. They concluded that large grid cell sizes underestimate soil losses because of the terrain slope effects. They suggest that a correction factor is needed to solve the underestimation of soil loss in the macro scale.

3. MATERIALS AND METHODS

3.1. Materials

3.1.1. Research Area (General description of Erdemli Microcatchment)

Erdemli Microcatchment located within the borders of the central district of Bingöl province; Bahçeli, Erdemli, Dışbudak, Erdemli, Gökdere, Kıran, Suvaran and Yumaklı villages are included. Erdemli Microcatchment starts from the exit of the Bingöl Central District and extends to the border of Palu District and is located in the center of the town of province. The microcatchment elevation ranges from 980 meters to 2175 meters. The average elevation is 1550 m, the annual average precipitation is 831 mm, the number of snowy days is 117, and the number of snow covered days is 76.

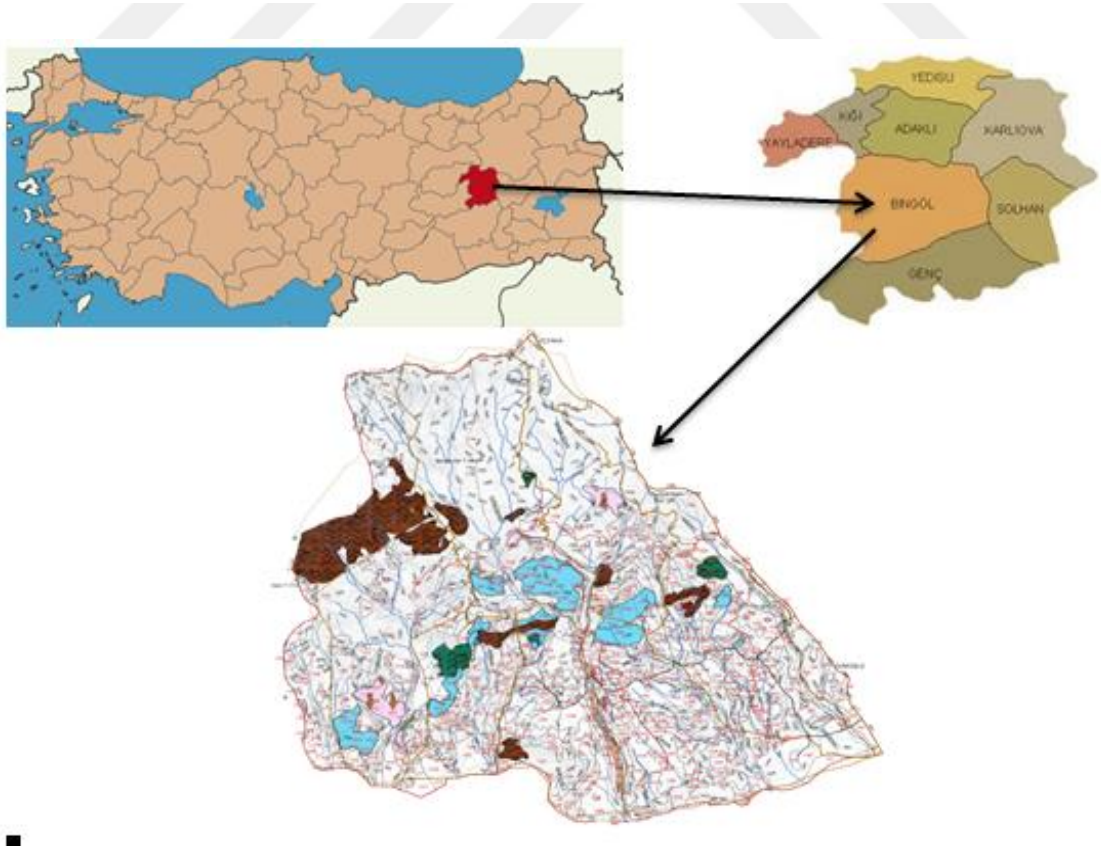

Figure 3.1. Map of the City, Central District Map, Microcatchment Map, and work area map

When used in accordance with the land capability class Microcatchment with appropriate climatic and ecological conditions for agricultural and livestock production it is estimated to be an increase in animal production in the region with agricultural inputs. The study area is 8397.16 ha wide and average Height is 1550 meters. 37 S to UTM According to 616099; 4292204 West, 622568; 4293483 East, 620512; 4296098 North and 626821; 4288318 is located in the southern coordinate.

Figure 3.2. General view of the study area (MNHRP-Erdemli Microcatchment Plan 2016)

3.1.2. Climatic characteristics and Working Area

Determining the climate feature of Erdemli Microcatchment Developed by Erinç and the amount of precipitation Based on the proportion of high temperature "Rainfall Activity Index" used, for this purpose, the Central District of the Erdemli basin Meteorological data obtained between 1980 and 2012 (Annual precipitation amount and mean maximum temperature values) the climate and vegetation type of the basin was determined. 33 years of the basin adapted to the form Index value obtained from annual meteorological data 44.4 mm / ° C. According to this result Erdemli microcatchment it has been determined that it is a humid climate type. The vegetation cover defined by the type of humid climate is the type of Moist Mountain Forest.

3.1.2.1. Climate Features

Determining climatic characteristics of Erdemli microcatchment "Rainfall Activity Index" used. The precipitation efficiency index was developed by Erinç and the amount of precipitation is obtained by dividing the altitude by the high temperature (MNMRP 2016).

In order to determine the climatic and vegetation type of the Erdemli microcatchment, the index value of the basin is "44.4 mm / °C" and the climate type is "humid climate type" using 33 (1980-2012) years' meteorological data of Bingöl Central District. The vegetation cover defined by the humid climate type is the "humid zone forest" type (Table 3.1, 3.2).

Erinç Rainfall Activity Index Calculator

According to the form: $Im = P / T_{om}$

I_m: Rainfall Activity Index

P: Annual precipitation (mm)

T_{om}: Annual average high temperature (°C) is defined.

Annual precipitation amount of Erdemli Basin is 831.5mm,
The annual average high temperature is 18.7 °C.
According to this; If the annual activity Index = 831.5 / 18.7 the result is 44.4mm / °C.

Table 3.1. Erdemli Microcatchment Precipitation or Rainfall Activity Classes (MNHRP-Erdemli Mikrhavza Planı 2016)

Climate Type	Precipitation	Plant cover
Full Dry (FD)	I<8	Desert
Dry (D)	8<I<15	Desert - Step
Semi-Arid (SA)	15<I<23	Step
Semi-Moist (SM)	23<I<40	Park View Arid Zone Forest
Moist (M)	40<I<55	Moist Mountain Forest
Very Moist (VM)	55<I	Very Moist Zone Forest

Table 3.2. Erdemli microcatchment Meteorological Observation Values (MNHRP-Erdemli Mikrohavza Planı 2016)

LATITUDE: 38 K LONGITUDE: 40 D ELEVATION: 1250 m TIME: 1980-2012 (33 yearly) STATION: Center		WORKING AREA METEOROLOGICAL VALUES												
Parameter	Observation (year)	Months												Yearly
		January	February	March	April	May	June	July	August	September	October	November	December	
Max. Average of Temperatures (°C)	33	1.6	2.9	9.6	17.4	23.6	30.2	35.2	35.1	30.1	21.9	12.4	4.9	18.7
Min. Average of Temperatures (°C)	33	-7	-6	-0.3	5.8	9.7	14.1	18.1	17.1	11.6	7.1	1.2	-3.4	5.6
Average Temperature (°C)	33	-3.3	-2.2	3.7	10.9	15.8	21.7	26.3	25.8	20.2	13	5.5	-0.3	11.4
Average Pressure (hPa)	2	902.6	899.2	901.4	899.2	899	896.2	894.9	895.4	899.1	903.1	904.2	904.2	899.8
Average Humidity (%)	33	72.1	71.8	66	62.4	57.2	44.9	38.6	38.6	44.5	59.7	68.8	73.2	58.1
Total Precipitation Average (mm)	33	102.1	120.4	116.1	112.6	69	17.8	3.6	2.7	10	67.7	103.3	106.2	831.5
Average Wind Speed (m / sec)	33	0.6	0.6	0.9	1.1	1	1.1	1	0.9	0.8	0.6	0.6	0.5	0.8
Average Cloudiness	31	5.2	5.4	5.1	5	3.7	1.7	1	1	1.4	3.3	4.3	5.3	3.5
Number of Snowy Days	33	21.8	21.2	9.8	0.5	-	-	-	-	-	-	1.5	9.8	10.7

As shown in Table 3.2, the meteorological values of survey area over 33 years are shown. According to this, the minimum temperature average is the month with -7 °C and the average annual minimum temperature is 5.6 °C.
The maximum temperature average is 35.2 °C, the highest in July, while the annual maximum temperature average is 18.7 °C.
The temperature average was -3.3 °C, the lowest in January, and the highest in July at 26.3 °C. The annual temperature average is 11.4 °C.
Moisture average was 73.2%, the highest level in December, and 38.6% in July and August. The average annual humidity is 58.1%.
The average rainfall averaged 120.4 mm, the highest level in February, while the lowest level in August with 2.7 mm, the average annual precipitation is 831.5 mm.

3.1.2.2. Water Balance

Thornthwaite climate classification, precipitation with temperature and evaporation and evaporation is based on. Thornthwaite somewhere there is much rainfall before it evaporates the soil is saturated and there is an abundance of water. That is why the climate of the place is moist. Otherwise, in areas where precipitation is low before evaporation, it does not accumulate and the soil cannot give the plants the water they need. Like this A water shortage occurs in places and the climate of these places becomes dry (Anonim 2009).

According to Thornthwaite method, using Bingöl meteorological measurement values the climate type of the research area was been investigated. According to this method, the chart of water balance was drawn and drawn. The water balance is shown in Table 3.3. And the graph it is given in Figure 3.3.

In Figure 3.3, the working area water balance is shown. Accordingly, water the diagram of Balance is defined under 4 chapters.

Chapter one: It is the portion with more water. It runs from October to the beginning of May. If the rain is too much, Evaporation is less than rainfall.

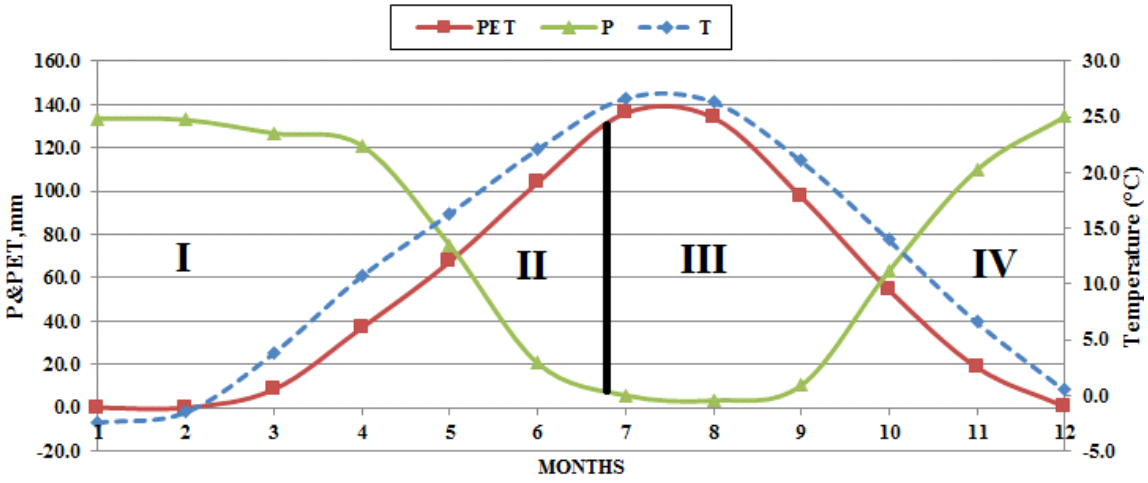

Figure 3.3. Water Balance (Demir et al 2015)

Chapter two: It is the section that shows the water that is spent. Precipitation with the beginning of May and evaporation is increasing. As a result, the water required for evaporation is covered from the floor reserve. This process will not change until late June continues.

Chapter three: It is the part showing the water openness. Towards the end of June in the ground reserve, Water shortage occurs when the water is been depleted and this process until October continues. The water deficit was found to be 529 mm (Demir et al 2015).

Chapter Four: The stored water continues to run until the beginning of October, the amount of rain increases again with the beginning of October and evaporation is been reduced. In this period the ground reserves start to fill up again because the rainfall is much before evaporation. It the period lasts until the end of November (Demir et al 2015).

In Table 3.3, the working area is a water table Shown. Accordingly, the amount of water stored in November, December, March and April 100.0 mm while it is 0 mm in January, February, June, July and August. Rainfall when we look at distribution according to the period, the maximum rainfall is 120.4 mm in February and 116.1 Mm in March. Months with the lowest rainfall are 3.6 mm and July While August is the month with 2.7 mm. The annual rainfall is 831.5 mm. Water clearance 163.3 mm with the most in July, from the beginning of October to the end of May it is not open. The annual water shortage is 424.2 mm.

Table 3.3. Work area water balance (according to Thornthwaite method) (MNHRP-Erdemli Mikrohavza Planı 2016)

WORK AREA WATER BALANCE													
Parameter	Months												Yearly
	January	February	March	April	May	June	July	August	September	October	November	December	
Temperature	-2.9	-1.9	4.1	11.2	16.4	22.4	26.8	26.1	20.5	13.7	6.1	0.2	11.9
Temperature Index	0.0	0.0	0.7	3.4	6.0	9.7	12.7	12.2	9.0	4.6	1.4	0.0	59.8
Corrected (PE) (mm)	0.0	0.0	9.4	43.4	81.0	131.2	166.9	150.9	97.3	49.4	14.1	0.1	743.7
Precipitation (mm)	102.1	120.4	116.1	112.6	69.0	17.8	3.6	2.7	10.0	67.7	103.3	106.2	831.5
Storage Water Monthly Change (mm)	0.0	0.0	0.0	0.0	-12.0	-88.0	0.0	0.0	18.3	89.2	0.0	0.0	-
Storage Water (mm)	0.0	0.0	100.0	100.0	88.0	0.0	0.0	0.0	0.0	18.3	100.0	100.0	-
Real Evapotranspiration (mm)	0.0	0.0	9.4	43.4	81.0	105.8	3.6	2.7	10.0	49.4	14.1	0.1	319.5
Water Opening (mm)	0.0	0.0	0.0	0.0	0.0	25.4	163.3	148.2	87.3	0.0	0.0	0.0	424.2
Water Excess (mm)	0.0	0.0	106.7	69.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	106.1	282.0
Surface Flow (mm)	26.5	13.2	59.9	64.5	32.2	16.1	8.0	4.0	2.0	1.0	0.5	53.1	503.8
Humidity Ratio	0.0	0.0	11.3	1.5	-0.1	-0.8	-0.9	-0.9	-0.8	0.3	6.3	1,061.0	-

3.1.3. Geological Structure and Description of the study Area

The general geological structure of the microcatchment consists of the metamorphic mainland. The land that develops on these mainland is generally deeply structured, Sandy clay loam and sandy clay textured with no drainage problem, Unsalted, mostly non-limes, medium level of organic matter, it has been determined that pH has a characteristic close to neutrality. It has been observed that there is no restrictive strain in terms of plant breeding. The geologic mainland and earth map are presented on the echo and the related pictures are given below.

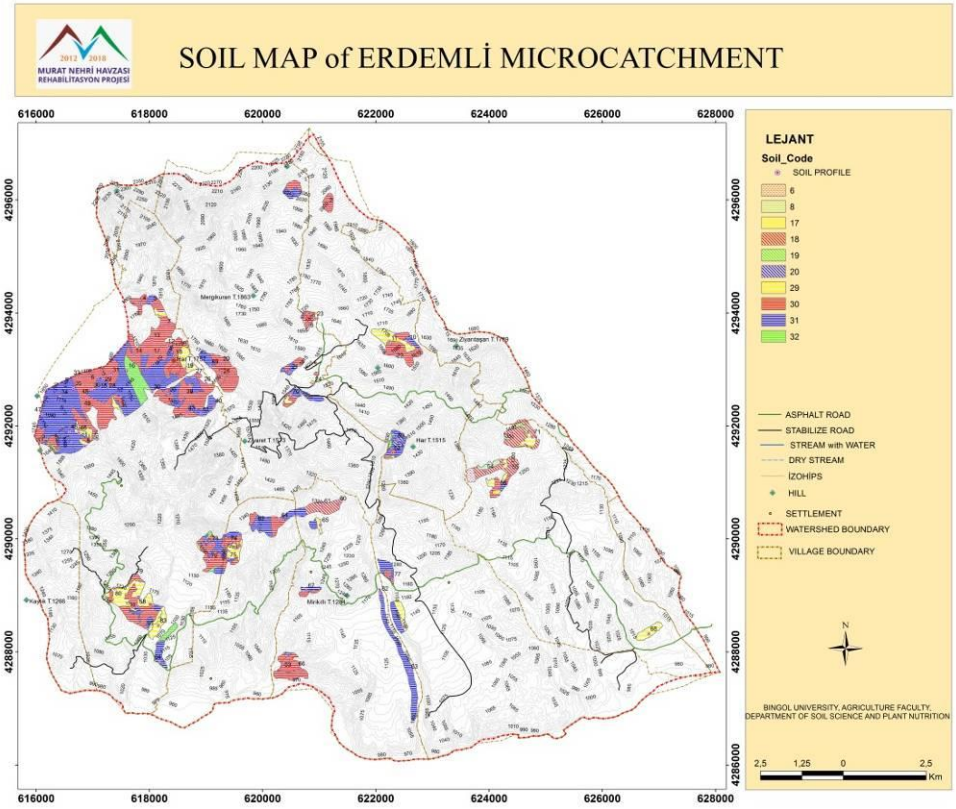

Figure 3.4. Work area of study geological map or soil map

As seen in Figure 3.4, In the upper sections of, Bahçeli, Erdemli, Dışbudak, Gökdere, Kıran, Suvaran and Yumaklı villages, while tuff is seen.

Figure 3.5. An Overview of the Basin

Figure 3.6. Basin Erosion Soil

Figure 3.7. Landing Profile

Figure 3.8. Oak Tree under Cover

Figure 3.9. Water resources in the region

Figure 3.10. Stream view from Erdemli Microcatchment

Figure 3.11. Section of the soil profile up to the main floor

Figure 3.12. The section of the soil profile up to the main floor

Figure 3.13. Geological bedrock, serpentine, marble (MNHRP-Erdemli Mikrohavza Planı 2016)

Figure 3.14. Anakay (MNHRP-Erdemli Mikrohavza Planı 2016)

3.1.3.1. Land Capability Classification

Table 3.4. Classification of land capability

USAGE FORM	LAND CAPABILITY CLASSIFICATION
Best land group in agricultural production	I. Land Classes
Good and medium land group in agricultural production	II. Land Classes
Medium land group in agricultural production	III. Land Classes
Insufficient land group in agricultural production	IV. Land Classes
Private class land group	V. Land Classes
Meadow, pasture, shrub land and forest land groups	VI. Land Classes
Meadow, pasture, shrub land and forest land groups	VII. Land Classes
City, Industry, tourism and others groups	VIII. Land Classes

Classification of land capability as shown in Table 3.4 is shown. It is according to classification, according to area forest, pasture and embroidered agriculture eligibility ratings. In the classification system mentioned, all the land on earth is been classified as class eight Examined separately. In the study area, I, II, III, IV, VI, VII class Six classes were found and studied. In the classifications specified in Table 3.4, the first four land classes without resorting to management techniques if used, is been considered as the area where agricultural production might be done. Other the areas within the four land classes are embroidered with agriculture and agricultural production Indicates unsuitable areas.

As could be seen in Figure 3.15, Class I. landmarks are Agricultural land that can be counted. They are alluvial and colluvial soils that are well drained, thin and medium-bodied, with slopes close to flat. To cultivate all kinds of plants as long as the climate is favorable it is possible.

II. Class facilities, coarse or poorly drained fields, Stony Deep-shallow, mildly moderate abrasion of colluvial and highland soils the affected units are in this class. Rough structure, poor drainage, stiffness, slight slope and shallowness can be problematic in these classes (Anonim1974). These problems High efficiency can be obtained from these class facilities by eliminating or reducing the effect.

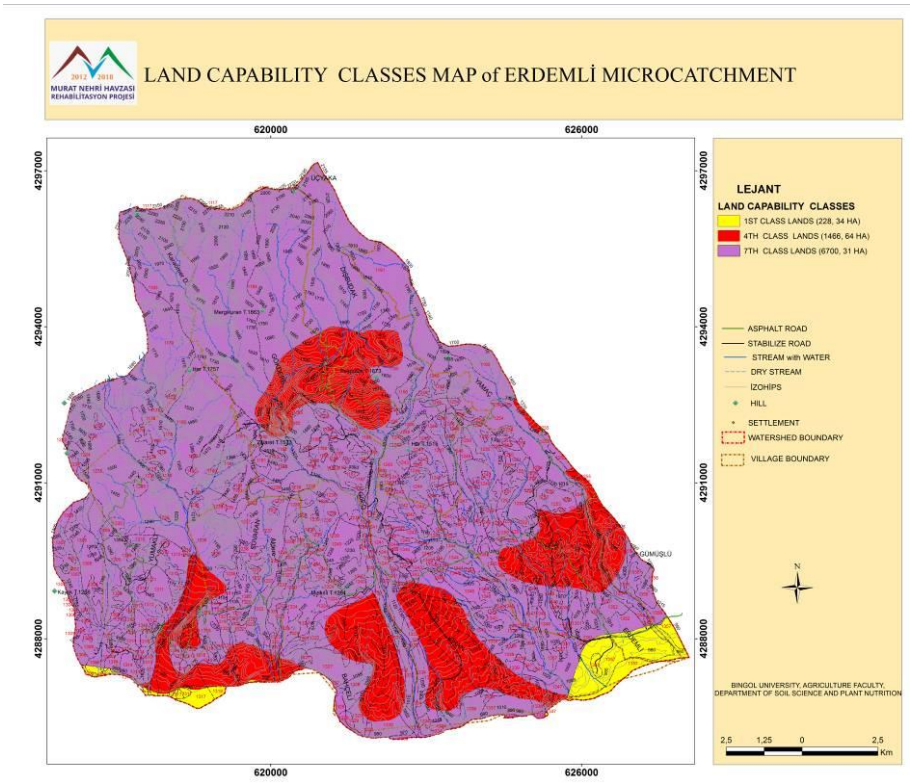

Figure 3.15. Work area land capability classification map

III. Class weather, slightly inclined, moderately abrasive and stony land. Your plant preferences Good selection and protection measures must been taken in agricultural lands.

IV. Class weather, poor drainage, salt-alkali and poorly drained and erosion hazard underground, thinned and cultivated by special methods of special plants. Most of the agricultural land in Turkey is these lands. This class is very dense if measures are taken, agriculture could be taken every 5-6 years, the best use is pasture and forest use.

VII. It is composed of high-grade stones with steep inclination with classical features, poorly drained, severe erosion, and saline-alkaline bases, Suitable for pasture and forest but unsuitable for agriculture Forests and meadows.

VII. Class fields, grasslands and even forests are difficult, steep fields, hills and generally Erosion-prone soil.

3.1.3.2. Erosion

Approximately 27.7 million hectares of cultivated agriculture in our country, 21.7 million hectares of meadow and pasture 21.2 million hectares of forest, Bush and shrubbery available. From the beginning of the Republic Agricultural land pasture and the forest area increased by 2.5 times. Agriculture whiles the number of businesses increased by four times to exceed 4 million. Previously 77 decares per household this amount has decreased to 59 decares / household today when the land is falling (Doğan 2011).

The amount of erosion determined in the land under various uses and percent values are it is like, in 59% of the agricultural areas (16.4 million hectares) Pasture Areas Forest in 64% (12.8 million hectares) and 54% of makings (12.6 million hectares) (Doğan 2011).

Table 3.5. Erosion area in Turkey (ha) (Doğan 2011)

Erosion Grade	Embroidered Trim Suitable II-III-IV. Class Land	Incompatible V-VI-VII. Class Land	TOTAL	%
Medium	13,780,260	1,812,215	15,592,475	27.4
Severe	2,077,270	26,257,668	28,334,938	49.6
Very Severe	1930	13,219,548	13,221,478	23.0
TOTAL	15,859,460	41,289,431	57,148,891	100
Wind Erosion	465913	-	465913	-

The map of erosion areas in Turkey is been shown in Table 3.5. According to this, in Turkey, and severe erosion is seen in half of the unsuitable areas and the area of severe erosion is 28 million hectares. 15 million hectares of area with moderate severe erosion 13 million hectares of land are very severe erosion. In our country, wind erosion in the areas suitable for embroidered agriculture is effective on 465913 hectare.

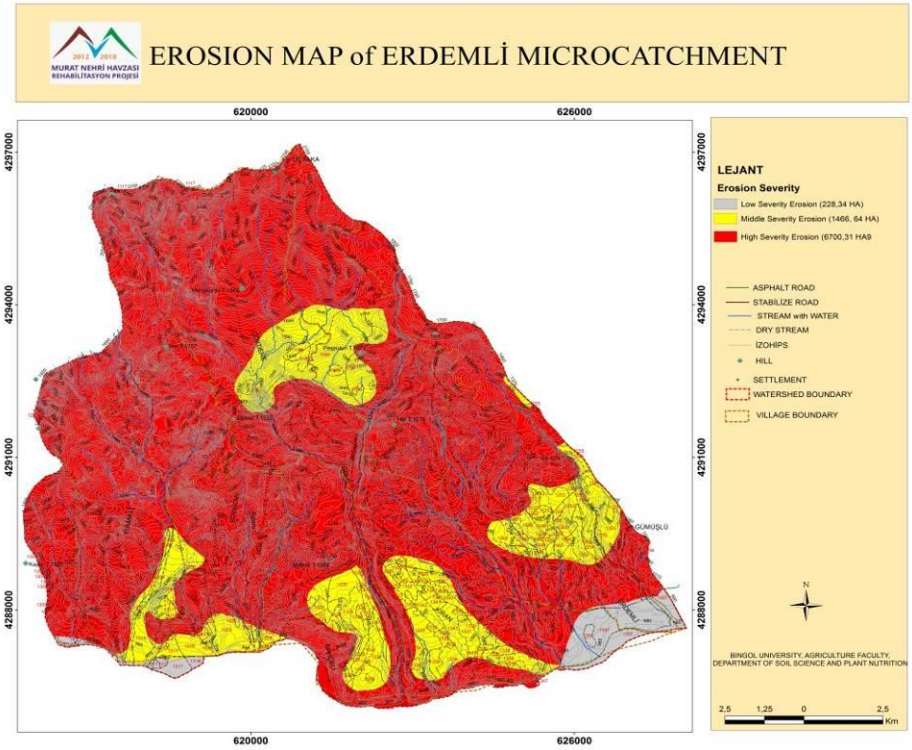

Figure 3.16. Study area erosion map

In Figure 3.16, the erosion scale map given according to 228.34 ha Low severity erosion in the area, Middle severity erosion in the area of 1466.64 ha and 6700.31 ha High severity erosion is seen in the area. Erosion lands in the study area it is been shown in figure 3.17.

Figure 3.17. Erosion lands in the study area

3.1.4. Microcatchment Plant Covering of the Study Area

Within the basin, forests, pastures and agricultural lands are included, as a forest vegetation, generally oak trees (Quercus sp), Juniper, Shimmering Poplar, Wild Pear, Bird etc. were determined. Wines such as walnut, apple, pear, quince etc. and wheat, barley, alfalfa, etc. are included in agricultural land. In the pasture areas, it was determined that various feed plants, especially given, were been found. Plant cover lands in the study area it is been shown in figure 3.18

Figure 3.18. Cover lands in the study area

3.1.5. Hydrological Situation of the Study Area

Microcatchment generally has a sufficient drainage network, the stream density value is 1.25, the drainage density is 3.25, the basin width is 9.93 km and the basin length is 16.51 km.

Figure 3.19. Stream view from Erdemli Microcatchment

Figure 3.20. Water Resources in the Region

3.1.6. Crop Production of the Study Area

Erdemli Microcatchment in the agricultural areas in the villages of cool climate cereals, Feed plants and garden plants are grown. These include wheat, barley and alfalfa as well as apples, Walnut and bond gardens are at the forefront.

The inferiority of the feed plants seeds grown in the region causes the yield to be low. As a result, animal feeding does not reach the desired level.

Small scale vegetable production is being carried out in the villages within the basin. Tomatoes, cucumbers, peppers, beans and aubergines are the most common species. Local varieties are common as well as in fruit. Cultivation techniques are primitive; yields are extremely low because no modern inputs are used. Fresh produce that meets daily needs even harder, dried for more winter use, canned and pickled. There is a significant amount of technology, knowledge and skill that prevents access to the potential for both vegetable and fruit production.

Traditionally, the Fruit farming is been done in the region are walnut, apple, pear, cherry, and quince etc. species. However, because the species used are not certified and vaccinated, their yields are also very low. Because the farmers of the region do not have enough knowledge, training and skills about modern gardening techniques and agricultural practices, they cannot harvest the desired level of crops.

Because of the studies carried out in the microcatchment, general conditions of the existing wet and dry agricultural areas in the village basis have been determined and presented in the study conducted, there are 3200 total agricultural lands in Erdemli Village, 1200 of which are irrigated agricultural land and 2000 are dry agricultural land.

In Gökdere Village, there are 1000 total irrigated agricultural lands and 750 of these are processed. In the village, there is also 1200 dry agricultural land.

In Kıran Village, there are a 1500 total agricultural land, 600 of which are irrigated agricultural land and 900 are dry agricultural land. While 500 acres of irrigated land are been processed, 400 of them are processed.

In Yumaklı Village, there are a 2700 total agricultural land including 1500 arable agricultural land and 1200 arable agricultural land. In 1100 of irrigated agricultural land and in 600 of dry agricultural land are processed.

In Suvaran Village, there are 2900 farming areas, of which 1600 are irrigated agricultural land and 1300 of which are dry agricultural land. While 1300 of irrigated agricultural land is been processed, 700 of the dry agricultural lands are being processed.

In Bahçeli Village, there are 1900 total agricultural land, 1000 of which are irrigated agricultural land and 900 of which are dry agricultural land. While 600 of the irrigated agricultural land are been processed, 300 of the dry agricultural lands are being processed.

There are 1900 total agricultural lands in the Dışbudak Village, of which 800 are irrigated agricultural land and 1100 are dry agricultural land. When 600 acres of irrigated land are processed, 500 acres of dry land are processed.

When the purchases of agricultural inputs in Erdemli microcatchment villages are been examined, it is determined, that all 65 families residing in Erdemli Village use animal manure and not all of them are stockpiled. It has been determined that 65 people in the village took the seeds from the birds, some did not produce the seeds themselves, and some went to this path because they were inadequate to produce the seeds. Ten of the parents are also been diagnosed with pesticides against diseases and insects.

It has been determined that all 85 families residing in Gökdere Village are using animal manure and not all of them are been stockpiled.

It has been determined that all 75 family members residing in Kıran Village use animal manure and not all of them are been stockpiled. It has been determined that 65 people in the village took the seeds from the birds, some did not produce the seeds themselves, and some went to this path because they were inadequate to produce the seeds. Twenty-Three of the parents are among those who use pesticides against diseases and insects.

It has been determined that all 50 family members who reside in Yumaklı Village use animal manure and not all of them are been stockpiled.

It has been determined that all 40 families residing in Suvaran Village use animal manure and not all of them are been stockpiled. It has been determined that 22 family members in the village took the seeds from the birds, some did not produce the seeds themselves, and

some applied this way because they were inadequate to produce the seeds. Fifteen are also among the determined families that use pesticides against diseases and insects.

It has been determined that all 52 family members who reside in Bahçeli Village are using animal manure and not all of them are been stockpiled.

It has been determined that all 45 family members residing in Outbudak Village use animal manure and not all of them are been stockpiled. It has been determined that 35 family members in the village took the seeds from the birds, some did not produce the seeds themselves, and some applied this way because they were inadequate to produce the seeds.

The state of the agricultural machinery, equipment and equipment in the microcatchment has also been determined and added to the report. As a result of the examinations made, Erdemli Village has eight family tractors, eight family tractor scissors, three family spraying tools, 5 family sorters.

In Gökdere Village, there are seven families' tractors, seven family tractor scissors, two family sprayers, two families have weed mower, In Kıran Village, there are six family tractors, six family tractor scissors, four family spraying tools, and three family weeding machines, In Yumaklı Village has Ten family tractors, Ten family tractor scissors, four family spraying machines, and two family weeding machines, In Suvaran Village, there are 5 families' tractor, 5 family tractor scrapers, 4 family spraying tools, and 3 family weeding machines, In Bahçeli Village, there are 10 family tractors, 10 family tractor scissors, 3 family spraying tools, and 4 family weeding machines, and in Dışbudak Village has 6 family tractors, 6 family tractors, 4 family sprayers.

When we look at the production of fruits and vegetables in Microcatchment villages, In Erdemli Village, 300 root apple trees gave 50 kg per tree, while 30 kg per tree per cherry trees were been purchased. Looking at vegetable production, it was determined that the most common tomato and pepper production was done in the village.

While it was determined that 400 root apples were found in Gökdere Village, 40 kilograms of product per plant were identified from pear trees detected in the village.

Looking at vegetable production, it was determined that the most common tomato and cucumber production was done in the village.

In Kıran Village, 350 kilograms of cherry wood per tree per 25 kg yield was determined, while 20kg of tree head was found in the walnut trees detected in the village. Looking at vegetable production, it was determined that the most common tomato and pepper production was been done in the village.

In Yumaklı Village, it was determined that yield of 60 kg of tree head from 250 stem apple trees, 30kg of wood perch were identified from the walnut trees found in the village. Looking at vegetable production, it was determined that the most common tomato and bean production was been done in the village.

In Suvaran Village, it was determined that 300 kg of cherry trees yielded 15 kg per tree, 20 centimeters per tree per plant was identified from 100 plum trees in the village. Looking at vegetable production, it was determined that the most common tomato and pepper production was been done in the village.

While it was determined that 50 kg yield of tree head was obtained from apple trees in Bahçeli Village, 40 rootstocks per plant were identified in 100 root pear trees in the village. Looking at vegetable production, it was determined that the most common tomato and pepper production was been done in the village.

In the village of Dışbudak, it was determined that yield of 60 kg of tree head was obtained from 200 root apple trees, 40 rootstocks per plant were identified in 100 root pear trees in the village. Looking at vegetable production, it was determined that the most common tomato and pepper production was been done in the village.

Varieties used for fruit production in Microcatchment and their productivity were determined as final and added to the report. While all of the villagers were producing type of apple, Starking and Golden apples, it has been determined local walnut production is been done in Kıran and Yumaklı Villages and that the yield is moderate.

The production of field crops, in Microcatchment, examined and recorded in the report. In Erdemli Village, 750kg / da yield is been obtained from irrigated wheat, while 1200kg

/ da yield is obtained from harvest. In dry agriculture, barley and vetch production is been done.

In Gökdere Village, 800 kg / da yield is obtained from irrigated agriculture, while 1500 kg / da yield is obtained from cultivated arable land. Barley production is been done in dry agriculture.

In Kıran Village, 500kg / da yield is obtained from irrigated agriculture, while 1000kg / da yield is obtained from arable land. In dry agriculture, weed production is been done.

In Yumaklı village, 700kg / da yield is been obtained from irrigated agriculture, while 1200kg / da yield is obtained from arable land. In dry agriculture vetch and barley production is been done.

In Suvaran Village, 650kg / da yield is obtained from irrigated agriculture and 1500kg / da yield is obtained from cultivated arable land. Barley production is been done in dry agriculture.

In Bahçeli Village, 750kg / da yield is been obtained from irrigated wheat, while 1300kg / da yield is obtained from harvest. Barley production is been done in dry agriculture.

In the village of Dışbudak, 800 kg / da yield is been obtained from irrigated wheat grown in irrigated agriculture while barley is produced in dry agriculture.

The varieties used in the production of field crops obtained in the scope of the Microcatchment project and their productivity in the report wheat and clover produce is produced in all of the villagers.

3.1.7. Animal Production of the Study Area

Livestock breeding in the region within the Murat River Basin is of vital importance for rural areas. In the upper parts of the arboretum, pasture areas are been faced with early and heavy grazing pressures. Pasture starts in early spring especially in pasture areas until the end of autumn and the natural resources of pasture areas grazing on its capacity are under extreme destruction. In Erdemli Microcatchment, it is seen that in the villages,

small cattle ranching has been widespread and in recent years there has been an increase in cattle livestock.

The animal shelters in the villages are primitive, non-hygienic, with low ceilings, made of stone, mud brick, or mummified, with an earthy, small window (often without windows), airless. In addition, health and nutritional problems arise in animals, since inhabited animals spend approximately 6 months of winter months in these barns. All sides of the shelters are tightly been closed with the concern of protecting animals from cold. Cattle, sheep and even wings are been kept together at the shelters. There is no clean and continuous drinking water inside. Animal owners carry the water outdoors or bring animals out for water. In particular, the supply of water by removing the animals that are been closed during the winter from the very hot stalls to the freezing cold leads to serious problems. The amount of water given in every way is well below the animal need.

Animal nutrient sources include pastureland and pastureland species, Wheat and barley straw and oak branches by cutting leaves. In addition, alfalfa seeds are been planted in small parcels which are watery in village settlements. Nevertheless, there is a good quality feed plant in Erdemli Microcatchment. Therefore, it could been said that for animal production, "less input-less output" approach is adopted. In other words, the producer makes a minimum expense for livestock production, and consequently a low yield. Pasture / pastures are of great importance in animal feeding. The animals, which are scattered in these areas where the snow melts, are grazed around the villagers for about 1 month, and the spring is started at the beginning of summer. Families in the country also migrate to the plateau, milk processing is been done here, and animals benefit from fresh flora. At the beginning of autumn, the animals returning to their habitat graze around the village for a month and are closed to the stables at the beginning of winter. Winter is the biggest problem in quantity and quality in production. Straw and other low-quality roughage do not respond to daily nutritional needs, animal spending on energy and mineral reserves in the body. This causes them to become weak, unhealthy animals that have suffered loss of live weight at the end of the winter. Nutritional deficiencies also lead to the problem of not giving birth; many animals cannot give calves every year. Dry hay stored for bad drying causes feeding animals, and storage caused by mold, which leads to littering, at least digestive disorders. During the winter months,

ambiance mainly in the indoor air closes the appetite of the animals and affects the animal health very negatively.

Erdemli Microcatchment villagers are been benefited from veterinary services for small cattle and bovine animals, especially for parasite control and vaccinations. Bingöl Provincial Directorate of Agriculture and Headquarters of the Provincial Directorate of Agriculture, vaccination services for animal diseases are been provided. However, some of the baskets in the basin seem to have a reluctance to make some vaccinations that are not included in the state vaccination campaigns and that are optional.

In the marketing of animal products in the microcatchment, it is been seen that they are usually made through intermediaries that sell to local traders, brokers and butchers, occasionally come to the villages and collect live animals or sell animal products themselves or transfer them to animal traders for a certain commission.

3.1.8. Study Area Socio-Economic Status

Bingöl Province ranks are 72nd in the order of Socio-Economic Development Index (SEDI). At the same time, Turkey is among the less developed ones in terms of Socio-Economic Development Index. Approximately 44% of the total provincial population, which is 265514 by 2013 adrese based census, lives in rural settlements and the remaining 56% lives in cities. Bingöl Province consists of eight Districts including Central District, 4 Beledges, 318 Villages and 723 Mezra.

In the province of Bingöl where Erdemli Microcatchment is also located, due to the limited employment opportunities, the population of the working age migrates abroad with other illicit goods, especially Bingöl city center, in order to provide job opportunities. It is been observed that migrations to rural areas, which are of great importance in Bingöl due to the lack of central population in the villages in the villages, have resulted in the search for a temporary-seasonal employment area, especially for male labor, to other cities, regions and even international areas. For this reason, with the activities to carry out in Erdemli Microcatchment, the rural migration has be prevented from one side and the other side will be able to reverse the migration and localize the workforce.

Given the educational situation in the microcatchment, it was determined that all the villages in the district had schools. In Erdemli village 90% of the men are literate, 70% of the women are illiterate. In Gökdere village, 100% of the men and 70% of the women, 90% of the men are in the village of Kiran and 75% of the women are in the village. In Yumaklı village are 90% of men and 80% of women in the village. In Suvaran village, 90% of men are 65% of women, 80% of men and 80% of women in Bahçeli village and 90% of men and 70% of women are illiterate in the Dışbudak village.

When we look at the physical atlas of the villages, it is been seen that all the villages in the microcatchment have electricity, the village roads are stabilized in 6 villages, the village is asphalt, the irrigation facilities are inadequate, all the villages have sewerage, Erdemli, Gökdere and Kiran villages have health care centers It was determined that it was inadequate in the villages and that all the villages had telephones.

When income distributions of the villagers in microcatchment are been taken into account, it is seen that the main source of income in the microcatchment villages where animal husbandry activities are not developed very much is agriculture and agricultural activities contribute 90% annually in Erdemli Village. This ratio is 80% in Gökdere and Bahçeli, 70% in Kıran and Dışbudak, 65% in Yumaklı and 60% in Suvaran.

3.1.9. Study Area Property and Cadastral Status

A total of seven villages are located in Erdemli Microcatchment, have been carried out land cadastre works according to the law numbered 766 and the titles of the landowners have been given. In general, the land is been divided into small pieces and agricultural activities are carried out on it.

In addition to the number 766 in other villages outside the village of Haziran, cadastral works under Law No. 6495 are in progress.

Table 3.6. Study area ownership and cadastral status (MNHRP-Erdemli Mikrohavza Planı 2016)

Village Name	Village Total Agricultural Area (ha)	Number of Family in the East			Number of Family with Soil			Leasing Producer	Partnering Producer	Cadastral Status	
		Grounded	Landless	Total	Less than 10	11-25 decares	More than 26 times			Forest Cadastre 0-none, 1-yes, 2-Construction	Land Cadastre 0-no, 1-exist, 2-Construction
Erdemli	1200	60	5	65	40	5	-	-	-	0	1
Gökdere	1000	75	10	85	40	15	-	-	-	0	1
Kiran	900	70	5	75	30	20	-	-	-	0	1
Yumaklı	950	40	10	50	20	10	-	-	-	0	1
Suvaran	1100	35	5	40	15	15	-	-	-	0	1
Bahçeli	900	52	0	52	20	25	-	-	-	0	1
Dışbudak	750	45	0	45	15	10	10	-	-	0	1

3.1.10. Working Area Management Plan and Separation Project Plan

The calculations for the management plan and current land use in microcatchment are been given below in table (3.7)

Table 3.7. Current Land Use (MNHRP-Erdemli Mikrohavza Planı 2016)

Land Use Type	Area (ha)	Percent (%)
Broken Forest	1700.51	20.25
Sandy Area	210.58	2.51
River	0.48	0.01
Forest Soil	5079.07	60.49
Efficient Forest	449.68	5.36
Residential	107.93	1.29
Agriculture	848.91	10.11
General total	8397.16	100

3.2. Methods

The thesis research is been carried out in the office, the field, the laboratory and to be findings-evaluation studies in four stages.

3.2.1. Office Work

Before you start your field work, Maps for field detection created. In the study area, open to humid and cool air masses from the north at the same time, the effective height winter because of the factor of cold summer is hot and dry. Workspace in the villages Livestock breeding is common Together with the bovine in recent years it is been observed that there is an increase in animal husbandry.

Map of research area 1 / 25.000 Scale topographic maps Digital elevation model by digitizing Created. This digital elevation Model, Elevation, soil, erosion, land capability and land Usage maps are been created and reused Classification was made. This classification Arc GIS 10.1 program was been used when processing. Different from the maps obtained Preliminary land in time Studies have been done and appropriate sample areas for the field of the research Today, Geographic Information Systems (GIS) and Remote Sensing software with manual as long as the process could take a shorter time, more accurately and easily could be done. To the study area processing of cartographic materials belonging to Interpretation of Remote Sensing and Geographical Information Systems soft wares used. Topographic in the digitization and processing of maps, air without analyzing his photographs, Arc GIS 10.1 in the preparation of soil databases Software was been used, 1 / 25.000 scale maps of the study area Bingöl University Remote Sensing and Geographical Information Systems Application and Research Center.

3.2.2. Land Surveys

Studies carried out during the bureau phase and preliminary field surveys to be tracked the roads are planned as follows.

3.2.2.1. Selection and Selection of Soil Sampling Sites

The working area soil is the soil specified in the figure 3.16 according to sampling pattern was been taken. 80 ground profiles have been opened in the field, 0-30 cm, 30-60 cm, 60-90 cm, 90-120 cm, a total of 291 samples were taken from the depths and analyzed, soil sampling is shown in (Figure3.21) below.

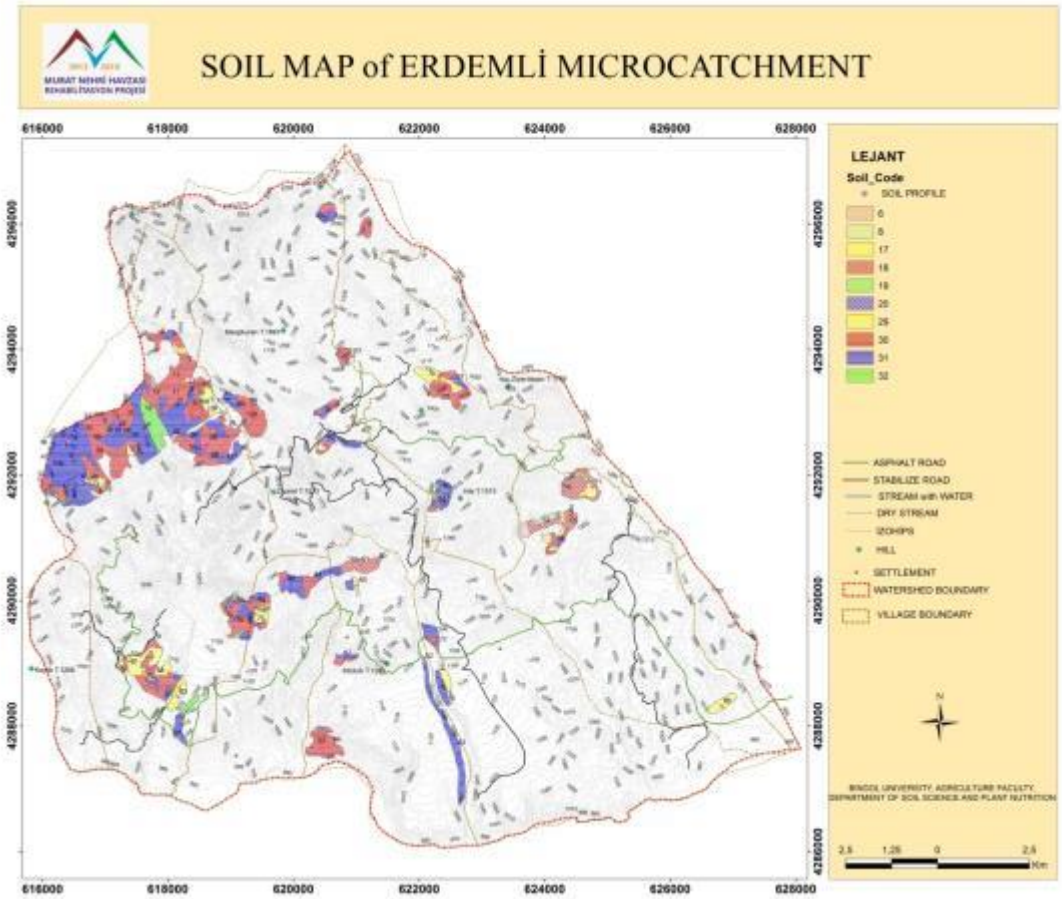

Figure 3.21. Work area soil sampling map

The soil profiles were been excavated at a depth of 120 cm. The cross section of the soil profile to be inspected and the layers and boundaries were determined. Determine layer boundaries in order to mark each layer boundary the bars were struck. In the layer sample, One from each identified layer 1.5-2 kg soil samples was been taken. Examples are polyethylene bags and lead pencil profiles the number and profile depth of the bags have been closed by writing the depth. Every soil scraped Profile cards are prepared for

the profile, Information about the soil profile, land, location, Altitude information is been written on these cards. Excavator in opening profiles used.

3.2.3. Laboratory studies

A Soil samples taken from the study area, Bingol University Faculty of Agriculture Department of Soil Science and Plant Nutrition, has been analyzed in soil analysis laboratory.

Preparing Analyzes of Soil Specimens

Soil specimens that have been degraded brought to the laboratory environment 1 m^2 laid on papers and air-dried Dried up until the end of the day. Dry soil Specimens were pounded in the air to 2 mm Screened and ready for analysis.

Construction of Soil Analyzes

3.2.3.1. Physical Analysis

Soil-water coverage analysis: 50 g of soil was been taken and fired at 105 °C. For 24 hours dormant and kiln dry soil weights were calculated.

Soil texturing (structure): Soil sand, silt and clay will be determined by the Bouyoucos franksiyon hydrometer method (Bouyoucos, 1951).

Soil specimens were sieved from 2 mm sieves and 50 g Weighed and placed in 500 ml beakers, to provide dispersion, 10 ml of 10% Kalgon (Sodium HexametaPhosphate) and 100-150 ml of distilled water then the mouths Closed, and left for a day. The next day, the solution is been quantitatively mixed when the mixing process is finished quantitatively 1250 ml Bouyoucos cylinder Followed by 1000 ml of pure water completed. After this, the hydrometer is immersed Up to 1130 ml pure No liquid particles in the bottom of the cylinder with the liquid mixer disk The mixture was stirred 15-20 times Then hydrometer cylinder 40 Seconds Value reading performed and the suspension temperature immediately measured. Then the 40^{th} second was checked for two hours and again after two hours Hydrometer reading was done. After both readings, also liquefy

with a thermometer Temperature was measured. The values read are % clay, % silt, % sand by calculating the rates Texture class of the soil was determined from the texture triangle (Soil Survey 1993).

Saturation with water (saturating clay): Saturation mud, the conductivity of the soil and to determine the determination of soluble ions made (Richards 1954). Second 100 g of sieved Weighed and placed in porcelain bowls. Automatic the burette is been zeroed and pure water is added into the burette. The water in the porcelain bowl Drop to found while the drop was been added. Continue this process the soil becomes muddy and then became well saturated with water. This process the amount of water consumed when it was over being recorded (Bower and Wilcox 1965).

3.2.3.2. Chemical Analysis

Soil reaction (pH): The soil is been mixed with water or saturated is hydrogen Ion activity is been measured by the pH meter (Horneck, 1989). PH meters are electrodes or electrodes potential awareness; they work based on measurement. Weigh 100 g of sieved soil from a 2 mm sieve Placed in porcelain bowls and added with pure water. This mixture is continuous mixed with soil it is been expected to collapse and clarify the water. Electrode on top the pH of the soil was been measured by immersing it in clear water (U.S. Salinity Laboratory 1954).

Electrical Conductivity (EC): The saturation mud is a closed one Stored in the container the EC meter and the electrical conductivity (EC) value was measured. The read resistance is converted to electrical conductivity and then Salinity by calculation Percentage determined (Richards 1954).

Calcium Carbonate ($CaCO_3$): The Scheibler Calcimeter soil with dilute hydrochloric acid CO_2 released from the carbonates by reaction Keeping the gas in a closed tube by measuring the volume and using this volume Calculation of lime content of soil is based on principle (Allison, 1965). 1 gram of ground sieved from a 2 mm sieve was weighed Calcimeter is placed in the bottle. We previously prepared hydrochloric acid Solution was been placed in the Calcimeter tube and the Calcimeter it is left in the bottle. The Calcimeter Tube is been adjusted to zero and the basement of hydrochloric acid with soil

provided, after entering the acid and soil reaction in the Calcimeter vessel, the volume and then the percentage of lime was calculated (Çağlar 1949).

Organic substance determination (Organic matter O.M): Jackson (1967) modified by Walkley-Black acid digestion method. Soil potassium dichromate and sulfuric by reacting with acid The organic carbon in potassium dichromate Oxidation and the amount used for oxidation The remaining potassium dichromate standard Triturated with Iron Sulphate, to detect the carbon found and Matter The principle of finding the quantity is. Sieved from 0.5 mm sieve 1 gm Weighed Soil and the weighed soil was been placed in 500 ml Erlenmeyer flasks. More than 10 ml of potassium dichromate was been added. The soil is been completely dissolved with chromate solution after soaking Then 20 ml of concentrated sulfuric acid was added and for 1 minute Shaken. After this process, the Erlenmeyer was preheated at 150 °C. Adjusted hot-plate put on and heated for 1 minute. Solution in brine reddish After the end of heating When the solution in the mound is brick red, it is left to cool and some Because the color of soil solids is dark 10 ml more potassium dichromate The desired color is obtained. The solutions which are then been allowed to cool 200 ml of purified water were added and then 12-13 drops of barium diphenylamine sulfate were added to make it shake and mix in a light form. Then the automatic burette was titrated with the Iron Sulphate solution and the color is purplish-Navy blue and 1-2 after the drop was added, the color was green. It is rich green an expended iron the sulfate solution is noted and the organic matter calculations done (Ülgen ve Ateşalp 1972).

Phosphorus: Phosphorus in the soil sodium bicarbonate solution Extra with The sample prepared by Reading of the absorbance of the solution by spectrophotometer and Prepared on the same terms as the value read with readings of standard solutions Constitutes the principle of comparative method (Olsen et al. 1954). For phosphorus storage 5 Weighed soil and placed in plastic shake cups of 125-150 ml. 100 ml of sodium bi carbonate was been added. The mouths of plastic shaking vessels it was been tightly closed and shaken for 30 minutes Followed by Whatman 42 filter paper the filtrate was poured into 5 ml and transferred to 25 ml balloons put on. Then 5 ml of ammonium molybdate was been added. Then pure was been brought up to about 20 ml line with water and 1 ml of tin chloride solution was added Complete with pure water up to the

balloon line. The resulting solution Spectrophotometer and the amount of phosphorus were obtained in ppm (Olsen et al. 1954).

Potassium stock: The potassium in the soil is extracted with ammonium acetate solution Potassium flame passing through the solution Principle of reading in photometer Creates (Carson, 1980). For potassium analysis, 10 g of soil was weighed and 100 ml for potassium analysis, 10 g of soil was weighed and 100 ml pine Placed in bottles. Add 25 ml of 1 N ammonium acetate pH adjusted to 7.0 placed and waited overnight. The pellet was been washed with 100 ml of filter paper filtered out and then 3 times more thoroughly with 25 ml of ammonium acetate washed all the soil. Solutions prepared after this step were read on a fluorescence meter and the potassium values were determined (Pratt 1965).

3.2.4 Data Evaluation

3.2.4.1. Geographic Information Systems (GIS)

Soil and water resources management, in agricultural practices and environmental studies Spatial analyzes are extremely important. As is known, for agricultural purposes or in environmental work, or in general Research on resource management and in practice, point samples are of great importance. With GIS, facilities taken to better point samples, the number of point samples representing the area concerned. What will take frequently, for spatial distribution of samples GIS is extremely helpful Vehicle. With this tool, points could been converted into spaces and spatial analyzes applicable (Gedikoğlu 2000).

Today, Geographic Information Systems (GIS) and Manual with Remote Sensing software as long as the process can take a shorter time, more accurately and easily, processing of cartographic materials belonging to the study area and Interpretation of Remote Sensing and Geographic Information Systems software. In the digitization and processing of topographic maps, without analyzing the aerial photographs, in the preparation of soil databases ArcGIS 10.1 software is used.

4. RESEARCH FINDINGS AND DISCUSSIONS

Soil samples from the study area were been analyzed and the findings are examined in two parts. The first part will describe the basin characteristics while the second part is the basin soil characteristics the section we will evaluate.

In the section called Basin characteristics, Topographic characteristics obtained from geographic information systems (GIS) Relief and inclination crackers, the size of the basin area. In the soil properties section, there are 80 profiles in total the data of 291 soil samples taken were been analyzed and finalized.

4.1. Basin Characteristics

4.1.1. Basin Area (Size)

The total area of Bingöl Erdemli Microcatchment is (8397.16) hectares... micro catchment area with average sediment There is a relationship between productivity (Lee 1980). Basin area, hydrological relations, Socio-economic characteristics, Management and land classification. Working in small basins in basin planning gives more important results than working in large basins.

4.1.2. Basin Shape

The watershed pattern is different, as the basin area grows, the watershed sequential waters' abandonment of the basin, Drainage system and hydrological properties. In delicate long basins, the waters are draining more lately, the risk of flooding and flooding is less. The working area is been shown in figure 4.1. Basin length (L) and basin width (B) are has been shown by the letters. Length of the basin to combine the two farthest points the width while determining is the width of the basin to combine the distant two points. Accordingly,

The basin length 16.51 km, the basin width is 9.93 km, the basin circumference is (4.171 km) the stream density value is 1.25, the drainage density is 3.25 and the area is 8397.16 ha.

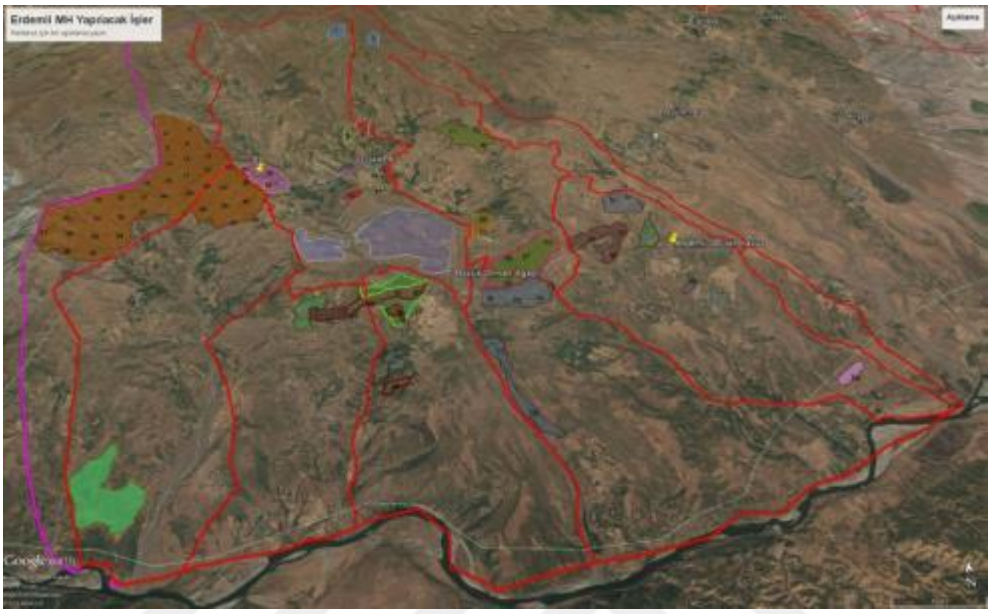

Figure 4.1. Work area shaped

4.1.3. Form Factor

The form factor is been defined as the ratio of rainfall to oil is a basin characteristic that affects the speed and time of arrival. The average width of the basin varies with the length of the basin Obtained by division (Özhan 2004).

According to the form;

F: Form factor

B: Width of basin (km)

L: Basin length (km)

$F=B/L \quad \rightarrow F=9.93/16.51= 0.60 \quad \rightarrow$ Form factor =0.60 (4.1)

The length of the basin, the outlet of the waters in the basin point and the source side of the basin is been calculated as the horizontal distance between the farthest points. The form factor in one basin is usually less than 1. The form factor is 1 when the average

width of the basin is equal to the length of the basin. If the basin width is greater than the length, the form factor is greater than 1. For example; Severe in basins with small form factor the probability that oil will cover the entire long axis (L) in the basin, Area is less than a pothole, which has the same but large form factor (Aydın 2009). Basin command influences length and width form factor accordingly. The basin form factor affects the danger of flood and flood in the basin. As the basin area and form factor become smaller, the risk of flood and flood is decreasing.

4.1.4. Shape Factor

It is calculated by the ratio of the length of the basin length to the basin area (Özhan 2004).

According to the form;

SH: Shape factor
A: Area (km^2)
L: Basin length (km)

$SH=L^2/A \rightarrow SH=16.51^2/83.9716=3.24$ Shape factor=3.24 (4.2)

This factor has a great value. This feature, which resembles the form factor, is based on the relationship between the watershed area and its length. As the area grows, the shape factor shrinks, as the length increases.

4.1.5. Circularity Ratio

Circularity rate is been used to determine the shape of the basins. Having the perimeter of the basin of the basin area divided by the area of an area (Özhan 2004).
According to the form;

Rc: Circular Ratio
A: Area (km^2)
BC: Basin circumference (km)

$$RC=\frac{4\pi A}{Bc^2} \rightarrow \frac{4*3.14*83.9716}{(4.171)^2} \rightarrow RC=60.62 \quad (4.3)$$

Hızal (1984) Homogeneity in terms of geological structure in small basins, ranging from 0.6-0.7 and basin shapes there is a great resemblance between the two. On the other hand, a relatively heterogeneous geological structure This ratio is longer for Representing the basin pattern could vary from 0.4 to 0.5 (Aydın 2009). The rate of circularity considered is equal to the perimeter of the square an apartment resemblance rate.

4.1.6. Elongation Ratio

The area is been found by the ratio of the diameter of an area equal to the basin area to the basin length.

According to the form;

E: Elongation rate

A: Basin area (km^2)

L: Basin length (km)

$$E = \frac{2\sqrt{A/\pi}}{L} \longrightarrow E = \frac{2\sqrt{83.9716/3.14}}{16.51} \quad \text{Elongation rate} = 0.62 \qquad (4.4)$$

4.1.7. Average Slope

The inclination in the topographic features is of great importance both in terms of hydrological and water erosion. The average slope of the basin is and therefore the hydrograph of the stream a significant effect on peak current formation (Aydın 2009). Land slope refers to the degree of roughness of the land, Land slope erosion; soil depth, Soil texture, surface flow, Land use and plant cover because it affects many features such as. Also in grading land classification used as basic data (Çepel 1995).

In Figure 4.2 and table 4.1 as you can see Work area slope map and workspace spatial distribution of slope groups and percentages are been shown. Accordingly, in the 0-12% slope group is 2301.57 ha, in the 13-20% slope group is 1392.38 ha, in the 21-40% slope group are 3087.45 ha, in the 41-60% slope group is 1279.04 ha, and in the 60% and more than the slope group 336.72 ha has space.

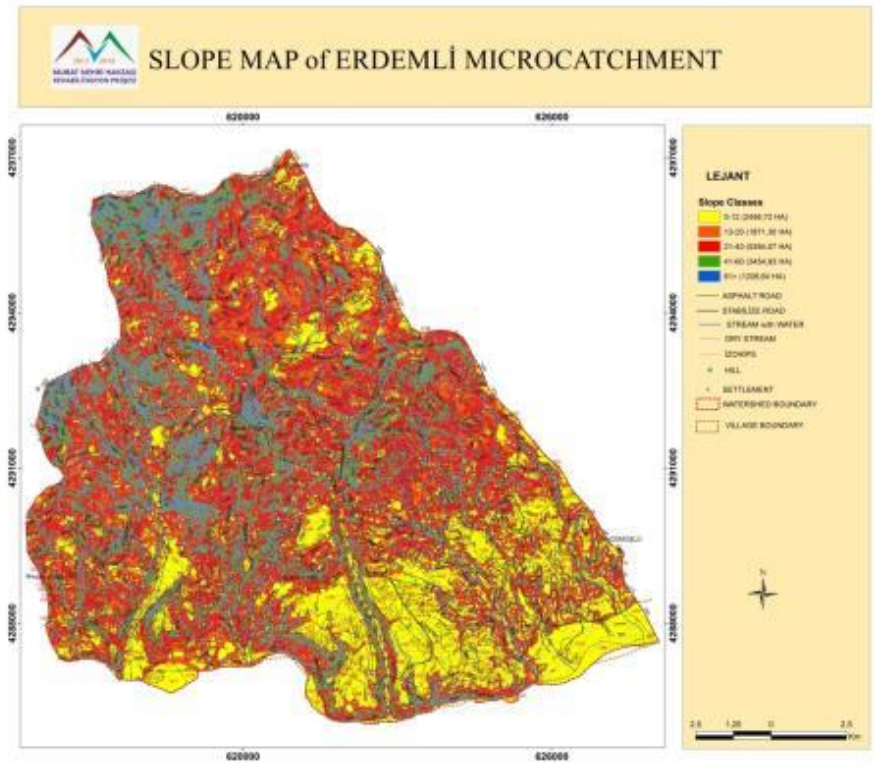

Figure 4.2. Work area slope map, Erdemli Microcatchment slop map

Workspace microcatchment in general it seems to have a slightly inclined topographic structure. Between 0-12% slope of microcatchment approximately 27.41% of the area and for agricultural activities, seem to have an appropriate topography. In addition, the area between 13-20% slopes is about 16.58% the area between 21-40% slopes is about 36.77% the area between 41-60% the slope is 15.23% and the area between 60% and more the slope is 4.01%.

Table 4.1. Working area slope group distribution (MNHRP-Erdemli Mikrohavza Planı 2016)

DISTRIBUTION OF WORKING AREA GRAINS		
Slope Group (%)	Area (ha)	Rate (%)
0-12	2301.57	27.41
13-20	1392.38	16.58
21-40	3087.45	36.77
41-60 and more	1279.04	15.23
60 and more	336.72	4.01
Total	8397.16	100

4.1.8. Working Area Aspect or looks Situation

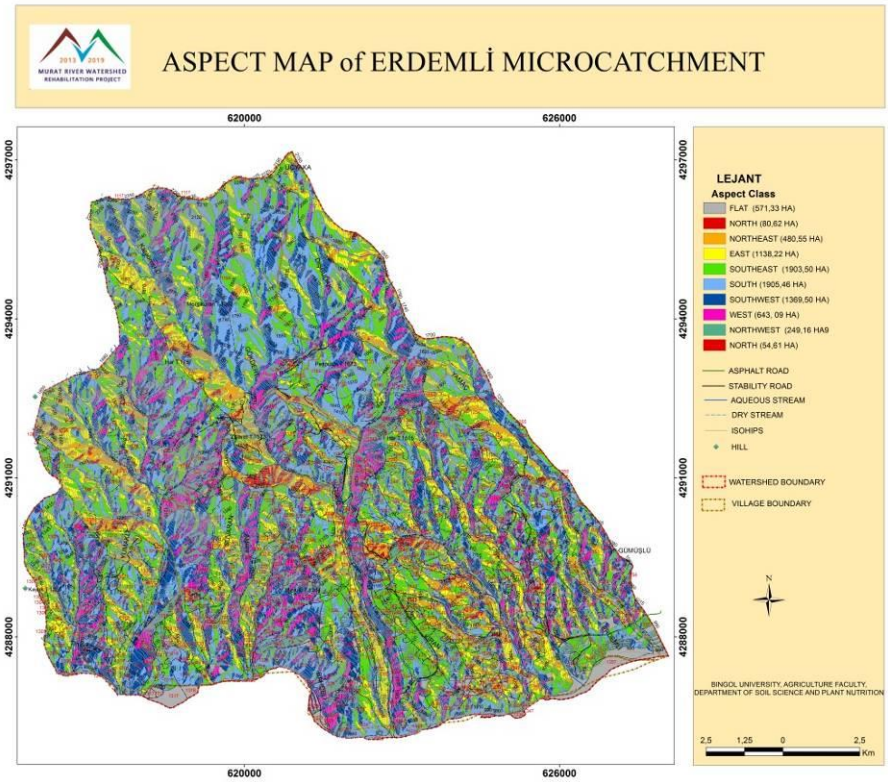

Figure 4.3. Working area look or aspect map, Erdemli Microcatchment Look map

Table 4.2. Working area look or aspect distributions (MNHRP-Erdemli Mikrohavza Planı 2016)

WORKING AREA LOOK OR ASPECT DISTRIBUTIONS		
View	Area (ha)	Rate (%)
FLAT	571.35	6.80
NORTH	135.29	1.61
NORTHEAST	480.6	5.72
EAST	1138.27	13.56
SOUTHEAST	1903.91	22.67
SOUTH	1905.86	22.70
SOUTH WEST	1369.58	16.31
WEST	643.12	7.66
NORTHWEST	249.18	2.97
TOTAL	8397.16	100

The study area map is been shown in Figure 4.3 And the study area distribution table is in table 4.2 shown According to this, Total area of 571.35 ha and 6.80% of the area, North and northeast-facing area 615.89 ha Area and 7.33%, eastern and southeastern facing area 3042.18 ha Area and 36.23%, south and south-west viewing area 3275.44 ha Area and the rate of 39.01% and the western and north-west viewing area 892.3 ha Area and 10.63% respectively. According to the vineyard map, the North-South It is been observed that in general, all the balances are distributed in a balanced manner.

4.1.9. Average Height (Elevation)

Table 4.3. Distributions of microcatchment or working area elevation (MNHRP-Erdemli Mikrohavza Planı 2016)

Height (meters)	Area (ha)	Rate (%)
960-1000	453.01	5.39
1000-1250	3554.75	42.33
1250-1500	1875.06	22.33
1500-1750	1354.44	16.13
1750-2000	710.44	8.46
2000-2250	401.96	4.79
2250-2370	47.50	0.57
TOTAL	8397.16	100

The highest point on the basin boundary is the height of the maximum height of the basin, Height at basin outlet is the minimum height.

The work area, height map is been shown in Figure 4.4, and the table of distributions according to the working area increase are shown in table 4.3. According to the information, the highest share in the study area is 1000-1250 meters With a height of 3554.75 ha and a rate of 42.33% The area with the largest share in the third row is 1250-1500 meters 1875.06 ha area at the height and the rate of 22.33% in the area, With a height of 1500-1750 meters and an area of 1354.44 ha and a rate of 16.13% With a height of 1750-2000 meters, with an area of 710.44 ha and a rate of 8.46% The area with a height of 960-1000 meters is 453.01 ha and a rate of 5.39% With a height of 2000-2250 meters, with an area of 401.96 ha and a rate of 4.79%. The area and in the last place with the highest height and covering the least space They are areas with an area of 47.50 hectares with a height of 2250-2370 meters and a ratio of 0.57%.

Figure 4.4. Shows the spatial distribution of the class that contains the height map display and percentage in Table 4.3.over.

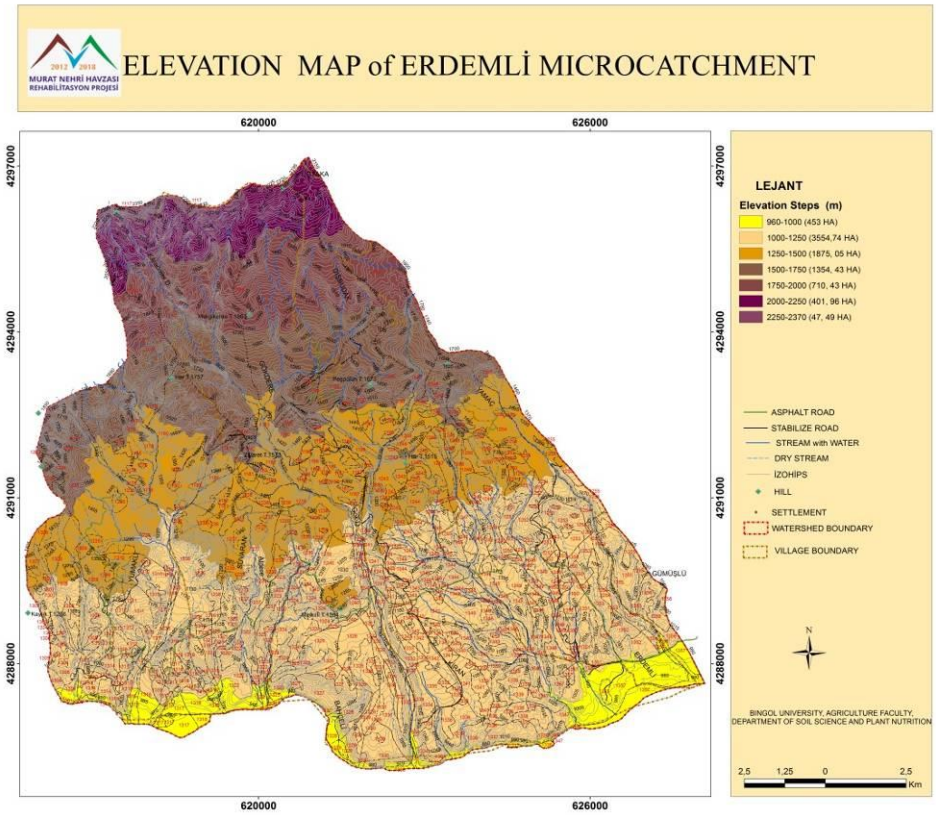

Figure 4.4. Work area height or elevation map, Microcatchment the Height Map

4.2. Descriptive Statistics of Working Territories

4.2.1. Descriptive Statistics

From the 80 points previously determined in the study area, 0-30 cm, 30-60 cm, 60-90 cm and 90-120 cm depth of soil samples taken from various physical and chemical analyses were been carried out. Analysis of physical and chemical properties of soils the results are shown in Tables 4.4, 4.5, 4.6 and 4.7.

In Table 4.4, the clay content at 0-30 cm depth of the working area soil. the average content is 29.1%, the sand content is 42.3% and the silt content is 28.5%, PH 5.9-8.2 while the mean pH value is 7.1, EC 108.0-1507.0 µS /cm (0.1-1.5 dS / m), while the mean EC value was 430.3 µS / cm (0.43 dS / m), Organic matter content varies between 0.4% and 5.8% while the average is 2.1%, The content of lime ($CaCO_3$) varies between 0.4% and 30.6% while the average is 2.1%, Potassium (K_2O) content varies between 26.2-488.3 ppm while the average is 190.4 ppm, The content of phosphorus (P_2O_5) is between 1.6 and 100.6 ppm it was determined that the mean value was 11.4 ppm, Total

nitrogen (N) content varies between 0.0% and 0.8% while the average is 0.1%, The content of sodium (Na) is between 16.1 and 291.5 ppm it was determined that the mean value was 76.9 ppm.

All of the statistics of Erdemli Microcatchment samples in the significance level (0.05)

Table 4.4. D escriptive statistics of the study area (Erdemli Microcatchment) (0-30 cm)

	Clay	Silt	Sand	pH	EC	O.M	$CaCO_3$	K_2O	P_2O_5	Total N	Na
Unit	%	%	%		µS/cm	%	%	ppm	ppm	%	ppm
Average	29.1	28.5	42.3	7.1	430.3	2.1	2.1	190	11.4	0.1	76.9
Standard Error	1.1	0.7	1.4	0.0	28.1	0.1	0.4	11.6	1.4	0.0	4.3
Standard deviation	10.1	6.6	13.2	0.4	251	0.9	3.7	104	12.8	0.1	39.1
Sample Variance	102.7	44.8	176.8	0.2	63340.5	0.8	13.8	10882.8	164	0.0	1532.1
Minimum	2.8	8.7	10.4	5.9	108.0	0.4	0.4	26.2	1.6	0.0	16.1
Maximum	59.0	44.0	84.1	8.2	1507.0	5.8	30.6	488.3	100.6	0.8	291.5

(Clay %)t-test and z-test (observed value 25.687)>t-test (critical value 1.960)=significant.
(Silt %) t-test and z-test (observed value 38.156) >t-test (critical value 1.960)=significant.
(Sand %)t-test and z-test (observed value 28.458)>t-test (critical value 1.960)=significant.
(PH) t-test and z-test (observed value 132.595) > t-test (critical value 1.960) = significant.
(EC) t-test and z-test (observed value 15.293) > t-test (critical value 1.960) = significant.
(O.M %)t-test and z-test (observed value 20.084)>t-test (critical value 1.960)=significant.
($CaCO_3$%)t-test and z-test (observed value 5.242)>t-test (critical value1.960)=significant.
(K) t-test and z-test (observed value 16.330) > t-test (critical value 1.960) = significant.
(N) t-test and z-test (observed value 8.476) > t-test (critical value 1.960) = significant.
(Na) t-test and z-test (observed value 17.582) > t-test (critical value 1.960) = significant.
(P) t-test and z-test (observed value 8.012) > t-test (critical value 1.960) = significant.

As shown in Table 4.5, the clay content at 30-60 cm depth the average content is 28.2%, the sand content is 44.7% and the silt content is 27.0%, PH 6.2-8.3 while the average pH value is 7.1, EC 109.3-829.0 µS / cm (0.1-0.82 dS / m) while the mean EC value was 372.7 µS / cm (0.37 dS / m), Organic matter ratio varies between 0.2% and 5.8% while

the average is 1.6%, The content of lime ($CaCO_3$) varies between 0.4% and 38.0% while the average is 3.3%.

Table 4.5. Descriptive statistics of the study area (Erdemli Microcatchment) (30-60 cm)

	Clay	Silt	Sand	pH	EC	O.M	$CaCO_3$
Unit	%	%	%		µS/cm	%	%
Average	28.2	27.0	44.7	7.1	372.7	1.6	3.3
Standard Error	1.3	0.8	1.8	0.0	18.0	0.1	0.6
Standard deviation	11.8	7.0	15.9	0.5	158.2	0.8	5.8
Sample Variance	141.3	49.3	255.5	0.2	25045.2	0.7	33.9
Minimum	2.7	8.9	11.0	6.2	109.3	0.2	0.4
Maximum	64.7	42.6	82.8	8.3	829.0	5.8	38.0

(Clay %) t-test and z-test(observed value 20.856)>t-test (critical value 1.960)=significant.
(Silt %) t-test and z-test (observed value 33.742)> t-test(critical value 1.960)= significant.
(Sand %)t-test and z-test(observed value 24.554)> t-test (critical value 1.960)=significant.
(PH) t-test and z-test (observed value 121.935) > t-test (critical value 1.960) = significant.
(EC) t-test and z-test (observed value 20.670) > t-test (critical value 1.960) = significant.
(O.M %)t-test and z-test (observed value 16.645)>t-test (critical value 1.960)=significant.
($CaCO_3$%)t-test and z-test (observed value 5.087)>t-test (critical value1.960)=significant.

As seen in Table 4.6, the clay content of the study area is 60-90 cm deep the average content is 25.7%, the sand content is 46.9% and the silt content is 27.3%, pH 6.2-8.1 while the average pH value is 7.1, EC 101.0-867.0 µS / cm (0.1-0.86 dS / m) while the mean EC value was 352.4 µS / cm (0.35 dS / m), Organic matter content varies between 0.4% and 5.8% while the average is 1.5%, The content of lime ($CaCO_3$) varies between 0.5% and 46.6% while the average is 4.4%.

Table 4.6. Erdemli Microcatchment descriptive statistics (60-90 cm)

	Clay	Silt	Sand	pH	EC	O.M	$CaCO_3$
Unit	%	%	%		µS/cm	%	%
Average	25.7	27.3	46.9	7.1	352.4	1.5	4.4
Standard Error	1.4	1.0	2.0	0.0	18.8	0.1	0.9
Standard deviation	11.7	9.0	16.8	0.4	157.7	0.8	8.3
Sample Variance	138.1	82.1	282.5	0.2	24892.8	0.8	69.8
Minimum	1.5	8.7	13.8	6.2	101.0	0.4	0.5
Maximum	50.7	72.0	89.7	8.1	867.0	5.8	46.6

(Clay %)t-test and z-test (observed value 18.309)>t-test (critical value 1.960)=significant.
(Silt %) t-test and z-test (observed value 25.195)> t-test (critical value 1.960)=significant.
(Sand %)t-test and z-test (observed value 23.381)>t-test (critical value 1.960)=significant.
(PH) t-test and z-test (observed value 120.579) > t-test (critical value 1.960) = significant.
(EC) t-test and z-test (observed value 18.692) > t-test (critical value 1.960) = significant.
(O.M %)t-test and z-test (observed value 14.537)>t-test (critical value 1.960)=significant.
($CaCO_3$%)t-test and z-test (observed value 4.417)>t-test (critical value1.960)=significant.

In Table 4.7, the clay content of the study area is 90-120 cm deep the average content is 24.6%, the sand content is 47.8% and the silt content is 27.5%, pH 6.2-8.4 while the average pH value is 7.2, EC 71.9-1036.0 µS / cm (0.071-1.0 dS / m) while the mean EC value was 381.5 µS / cm (0.38 dS / m), While the proportion of organic matter content varies between 0.1% -5.8% while the average is 1.4%, The content of $CaCO_3$ varies from 0.0% to 54.1% with an average of 5.4%.

Table 4.7. Erdemli Microcatchment descriptive statistics (90-120 cm)

	Clay	Silt	Sand	pH	EC	O.M	$CaCO_3$
Unit	%	%	%		µS/cm	%	%
Average	24.6	27.5	47.8	7.2	381.5	1.4	5.4
Standard Error	1.3	1.0	2.0	0.0	23.3	0.1	1.3
Standard deviation	11.0	8.4	16.5	0.5	186.5	0.9	10.4
Sample Variance	122.2	70.7	274.0	0.3	34795.2	0.8	109.4
Minimum	2.8	8.6	13.0	6.2	71.9	0.1	0.0
Maximum	65.1	44.9	87.7	8.4	1036.0	5.8	54.1

(Clay %)t-test and z-test (observed value 17.823)>t-test (critical value 1.960)=significant.
(Silt %) t-test and z-test (observed value 26.162)>t-test (critical value 1.960)=significant.
(Sand %)t-test and z-test (observed value 23.131)>t-test (critical value 1.960)=significant.
(PH) t-test and z-test (observed value 103.929) > t-test (critical value 1.960) = significant.
(EC) t-test and z-test (observed value 16.364) > t-test (critical value 1.960) = significant.
(O.M %)t-test and z-test (observed value 12.193)>t-test (critical value 1.960)=significant.
($CaCO_3$%)t-test and z-test (observed value 4.138)>t-test (critical value1.960)=significant.

4.3. Physical and Chemical Analysis Results and Evaluation of Soil Specimens

4.3.1. Soil Texture

The solid phase of the soil is composed of clay, silt and sand sized materials. The quantities of these various sizes of materials in soil mass and their relative proportions represent the texture of the soil. In other words, the texture of the proportions of the particles in the soil mass, Shows the thickness and thinness of the solid materials that make up the land (Atalay 2006).

Texture is a basic soil characteristic, Total porosity, pore size distribution, Penetrometer (hardness) distribution, water retention capacity, and hydraulic conductivity, affecting many static and dynamic properties of the soil (Erşahin 2001).

Sandy soil is 70% by weight, and fractions that are more sand is covering the earth. Clay soils 35% by weight or mostly soil containing 40% clay fraction. A pile of dirt, sand, silt and clay particles is a mixture of light and heavy reflecting the characteristics of the land equally is defined as a soil texture (Özhan 2004).

All of the physical and chemical properties are favorable for plant growth. Food-air economies are good they have a high water holding capacity. Between sandy and clayey Loamy soil physical and chemical Are ideal soil for properties maintenance. These soils provide an optimum growth in vegetation (Çepel 1996).

The soil texture triangle is used to determine the soil texture classes. However, it is also possible to determine the soil texture by hand. Accordingly, a soil sample having a clayey structure they generally form smooth surfaces and they give a plastic feeling of elimination and at the same time they take shape very easily. A soil with a silicate structure the sample leaves a fuzzy feeling and soaped. Soils with sandy and clayey structure Due to the proportion of sand inside It leaves a rough feeling and depends on its size They can easily be felt between the fingers.

Depending on the depth of field in the study area Clay contents increased while silt and sand content decreased. Working ground in terms of soil structure they are different within themselves. The loamy soil covers a large part of the work area. Equal amounts of sand, clay and silt are contained within it. They have the desired physical properties in terms of plant growth. Water holding capacities of such soil, pore structures, Water balances, ventilations and structures are very good. They are the best soil in terms of agricultural purpose and plant growth. They do not clog when they get excess water. Suddenly they do not harden when they are dry and come with easy pan. They do not adhere to scrap and other tools during soil release and tillage. If the chemical structure is good and the plant is in sufficient level if they carry nutrients, their yields are very high.

Water saturation (saturating clay) value in the working area soil is 36% to 68.2%. Percentage of water saturation with soil texture classes Change in direct proportion (Kantarcı 2000), are shown in figure 4.5, 4.6, 4.7.

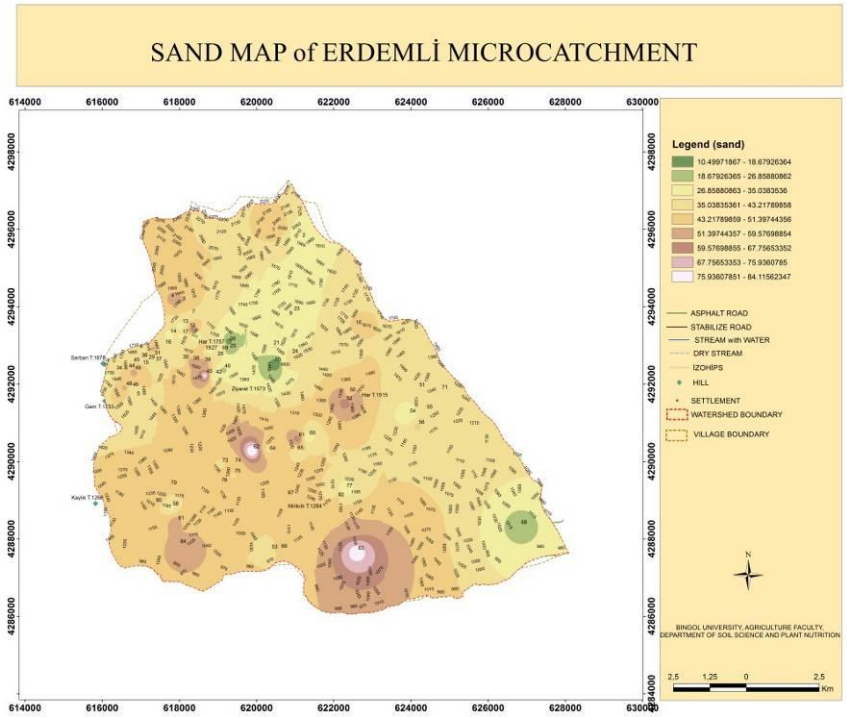

Figure 4.5. Sand Map of Erdemli Microcatchment

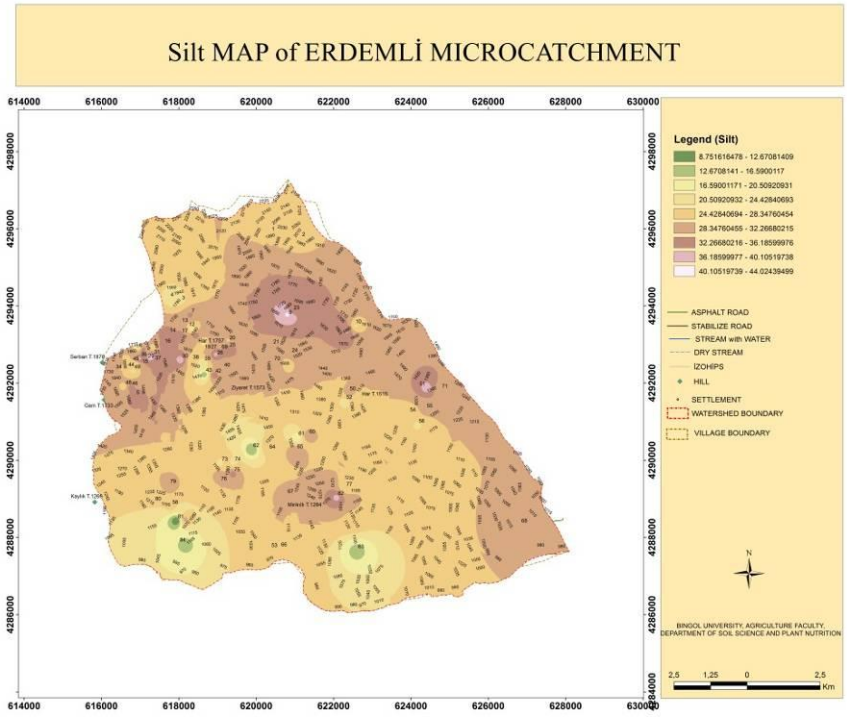

Figure 4.6. Silt Map of Erdemli Microcatchment

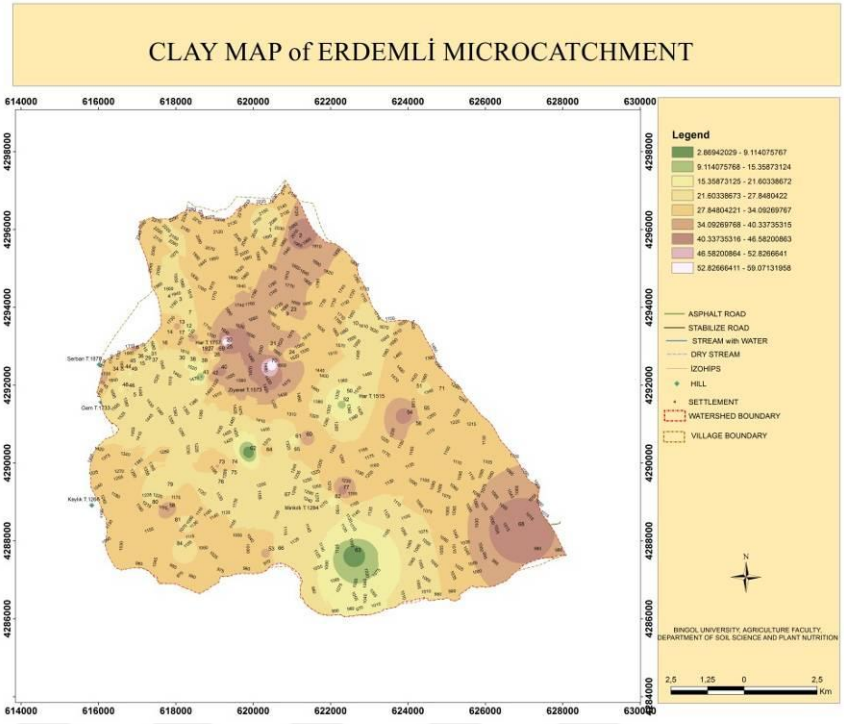

Figure 4.7. Clay Map of Erdemli Microcatchment

4.3.2. Soil Reaction (pH)

The acid or alkali reaction of the soil solution is been defined as soil reaction. The soil reaction is been expressed by the pH gradient. The abbreviation for the Latin potential hydro genii expression, pH The Turkish counterpart is been called the hydrogen power (Kantarcı 2000).

Soil reaction is physical and chemical properties and biological properties of Factors play an important role. Indeed, microorganism activity and accordingly the soil water and air capacity, intake of plant nutrients, Nitrification, the flow of aluminum ions Play an active role in Thus, plant development Are directly or indirectly affected (Çepel 1996).

Soil reaction classes' soil with a pH value of seven in its genus is neutral; Values below seven are acid, Soil values above seven indicate alkalinity. The pH ranges between 3-4 soils are very strong acids, Soils valued between 10 and 11 are been classified as very strong alkaline (Kantarcı 2000).

Table 4.8. Classification according to pH limit values (Ülgen and Yurtsever 1995)

PH LIMIT VALUES TABLE	
Boundary value	Evaluation
<4.5	Strong acid
4.6-5.5	Medium acid
5.6-6.5	Light acid
6.6-7.5	Neutral
7.6-8.5	Light alkali
>8.5	Strong alkali

The pH values of the study area soil, were been determined by Ülgen and Yurtsever (1995). According to Table 4.8 prepared according to this, the working area is the pH value of the soil PH that does not change depending on the depth values change between 5.9 and 8.4, According to Ülgen and Yurtsever (1995) Neutral soil covers 47.5% of the total area. Slightly acidic soils accounted for 38.7% Acidic soils account for 8.7% of the area and slightly alkaline Constitute 5% of the area in the soil. The study area of the resulting data has revealed that agriculture is the most suitable area for the pH of soils.

The soil reaction is in mild acid output areas it could be said that these are the areas where the soil treatment is done. Indeed, the pH of the parasites under zero soil treatment was measured as 4.8, they measured the pH of the parasites under conventional soil treatment to 5.0 (Erşahin 2001). Acid-derived fertilizers used in fertilization of soils Cause acidification of the soil (Kantarcı 2000), shown in figure 4.8.

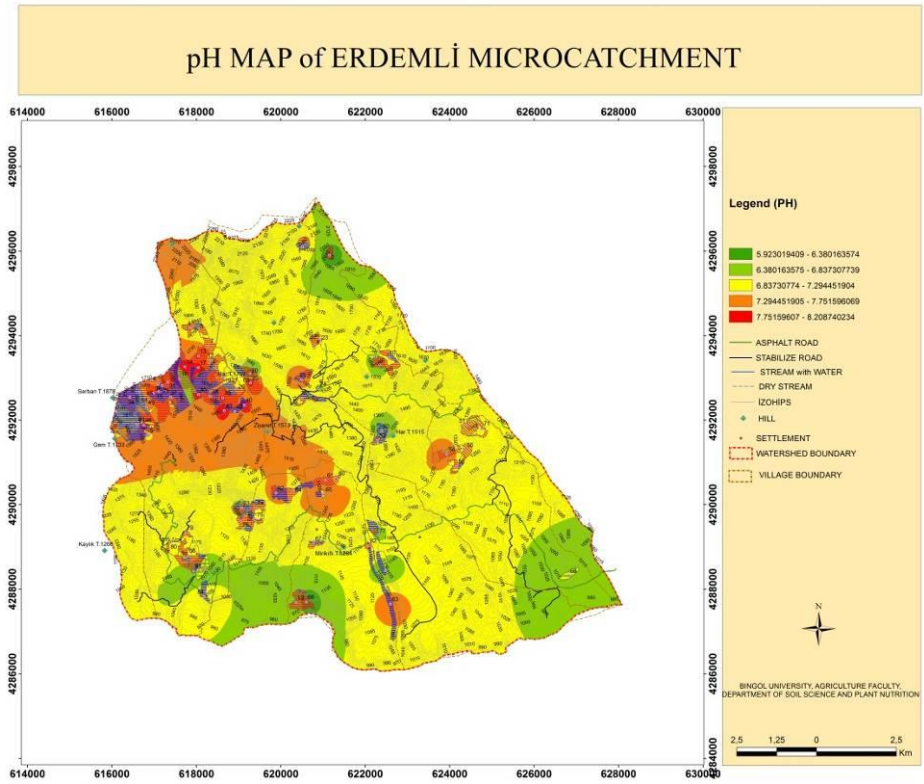

Figure 4.8. pH Map of Erdemli Microcatchment

4.3.3. Electrical Conductivity (EC (ds / m)), Salt (%)

Table 4.9. Classification of salinity according to limit values (Richards 1954)

SALINITY BORDER VALUES TABLE (%)	
Boundary value	Evaluation
0.00-0.15	Without salt
0.15-0.35	Lightly salted
0.35-0.65	Medium salted
0.65+	Very salty

The work area lands, EC values to Richards (1954). According to Table 4.9 prepared to Electrical conductivity (EC). The value in the working area soil is 71.9-1507 µS / cm. While the salt value of the soil varies between 0.002% and 0.02%, According to this study area is that all of the soil is unsalted and the amount of salt in the soil depending on the depth. The results of the analyses that have not changed have come to the end, shown in figure 4.9.

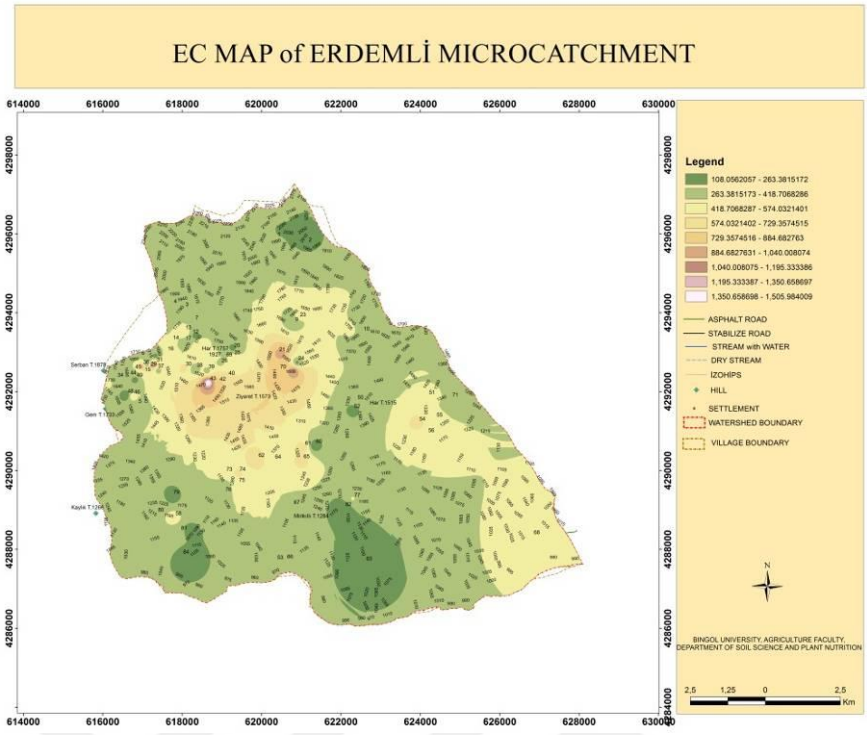

Figure 4.9. EC Map of Erdemli Microcatchment

4.3.4. Calcium Carbonate (% $CaCO_3$)

The main source of calcium in the ground is calcareous main materials, Calcium-containing minerals and organic substances.

Table 4.10. Classification according to lime limit values (Ülgen and Yurtsever 1995)

Lime ($CaCO_3$) BOUNDARY VALUES TABLE (%)	
Boundary value	Evaluation
0-1	Very little limy
1-5	Less limy
5-15	Medium limy
15-25	Much limy
>25	Very much limy

Average annual precipitation in the study area Higher than many parts of our country Most of the land is little lime. The lime content of the study area soil ranged from 0.0% to 54.1% According to Ülgen and Yurtsever (1995), the land has been evaluated according

to table 4.10. According to this, 92.5% of the land is less calcareous and 2.5% are medium-lime, and 5% are over-calcareous. There is no lime problem in 95% of the working area soil. As the depth increases, the amount of lime in the soil becomes minimum the results of analyses that were been made at the level were finally revealed, shown in figure 4.10.

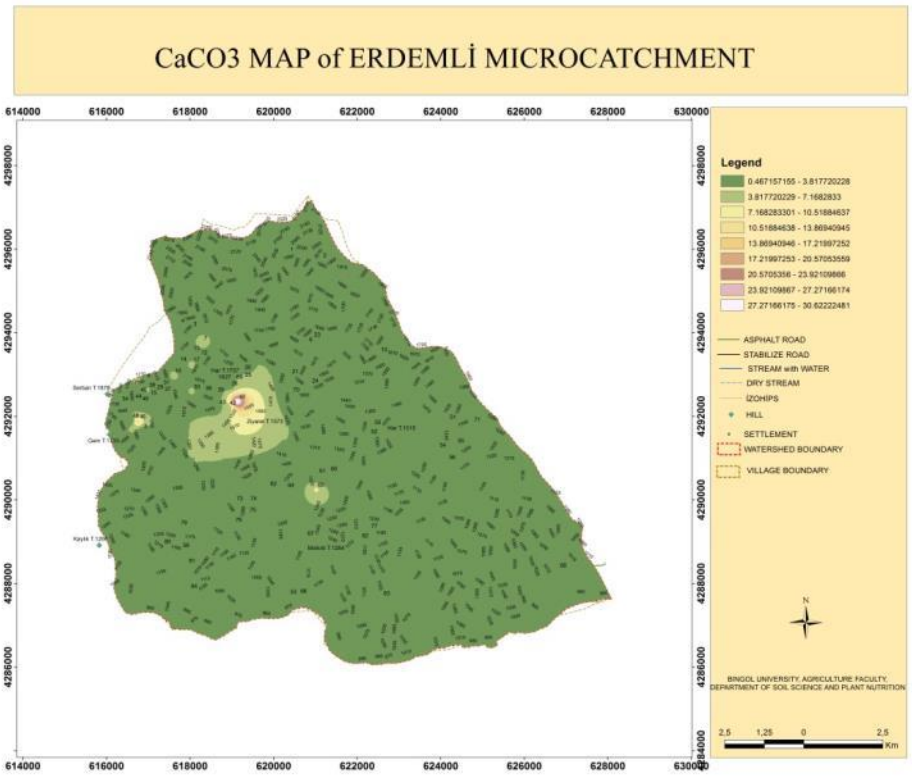

Figure 4.10. $CaCO_3$ Map of Erdemli Microcatchment

4.3.5. Organic matter (%)

Work area soil organic matter values According to Table 4.11 prepared according to Ülgen and Yurtsever (1995). Accordingly, the study area is composed of organic matter Coverage varies between 0.1% and 5.8%, 51.2% of the soil in the study area contains less organic matter, 41.2% are very few, 6.2% are in the middle and 1.2% is good. As the depth increases, the organic matter in the soil and the analysis of the best amount of organic matter in the soil at 0-30 cm was the final result, shown in figure 4.11.

Table 4.11. Classification of organic matter according to boundary values (Ülgen and Yurtsever 1995)

ORGANIC MATTER LIMIT VALUES TABLE (%)	
Boundary value	Evaluation
0-1	Very little
1-2	Little
2-3	Medium
3-4	Good
>4	High

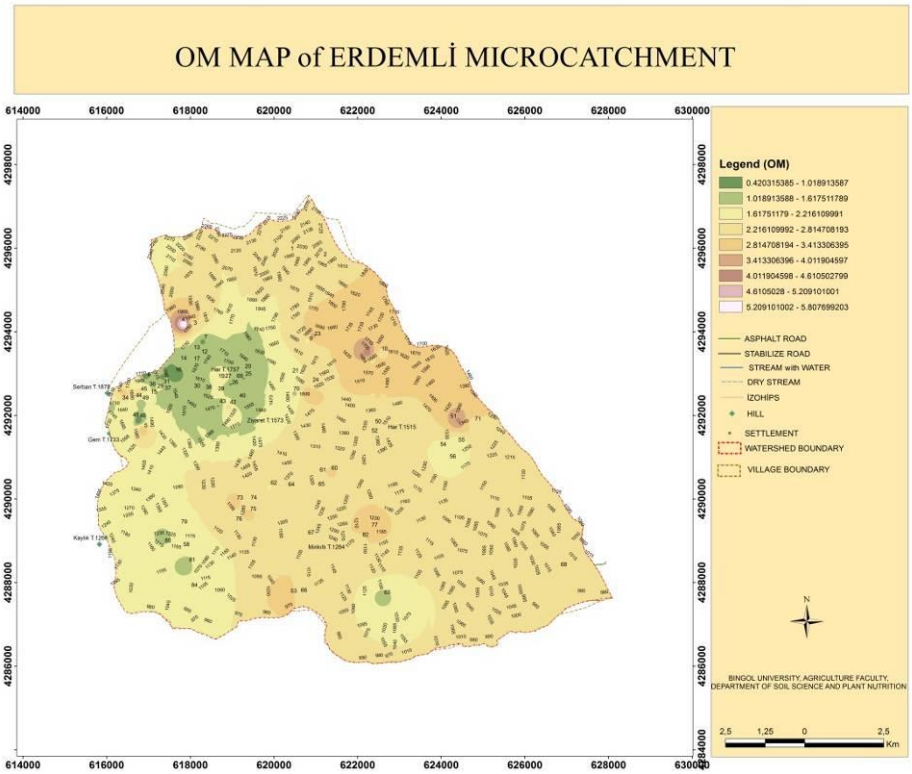

Figure 4.11. Organic Matter (O.M) Map of Erdemli Microcatchment

4.3.6. Phosphorus (P_2O_5)

Phosphorus (P) for plant growth and development is one of the important elements required.

Table 4.12. Classification of phosphorus (P_2O_5) according to limit values (Ülgen and Yurtsever 1995)

PHOSPHORUS (P_2O_5) BOUNDARY VALUES TABLE (ppm)	
Boundary value	Evaluation
0-3	Very little
3-6	Little
6-9	Medium
9-12	Good
>12	High

Work area soil phosphorus (P_2O_5) values Prepared according to Ülgen and Yurtsever (1995) were been assessed according to Table 4.12. Accordingly, the phosphorus content of the study area soil it varies from 1.6 ppm to 100.6 ppm, 20% of the soil in the study area has a high phosphorus content, 18.7% good, 12.5% moderate, 27.5% low and 21.2% very little. Decrease for phosphorus in the soil as the depth increases and the analysis of the best amount of phosphorus in the soil at 0-30 cm was the final result, shown in figure 4.12.

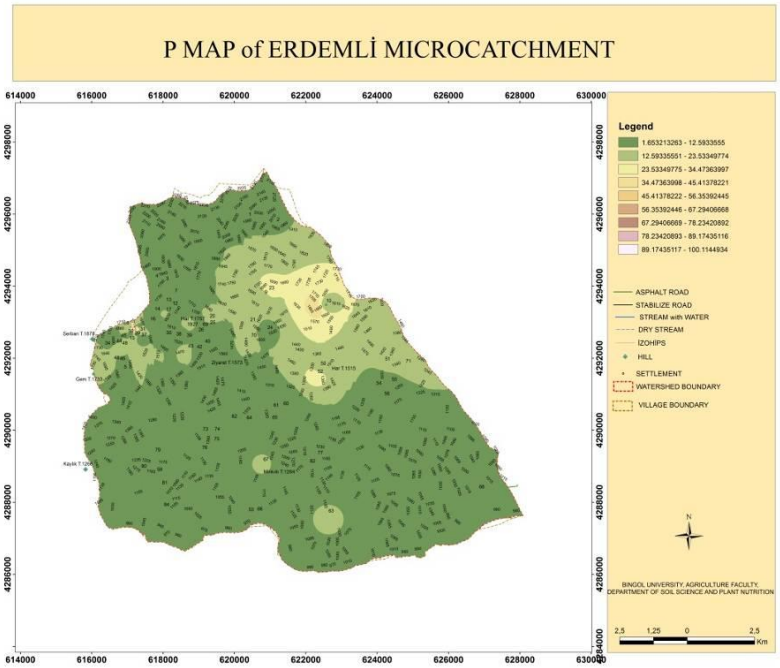

Figure 4.12. Phosphorous (P) Map of Erdemli Microcatchment

4.3.7. Potassium (K_2O)

Table 4.13. Classification of potassium (K_2O) according to limit values (Ülgen ve Yurtsever 1995)

POTASSIUM (K_2O) BOUNDARY VALUES TABLE (kg / da)	
Boundary value	Evaluation
0-20	Little
20-30	Medium
30-40	Enough
>40	Much

Work area soils potassium (K_2O) values Prepared according to Ülgen and Yurtsever (1995) Evaluated according to the table 4.13 Accordingly, the potassium area of the study area soil It varies from 26.2 ppm to 488.3 ppm, 46.2% of the soils in the study area had higher potassium content, 11.2% is adequate, 21.2% is medium and 21.2% is little. Decrease for potassium in the soil as the depth increases and the analysis of the best amount of potassium in the soil at 0-30 cm was the result, shown in figure 4.13.

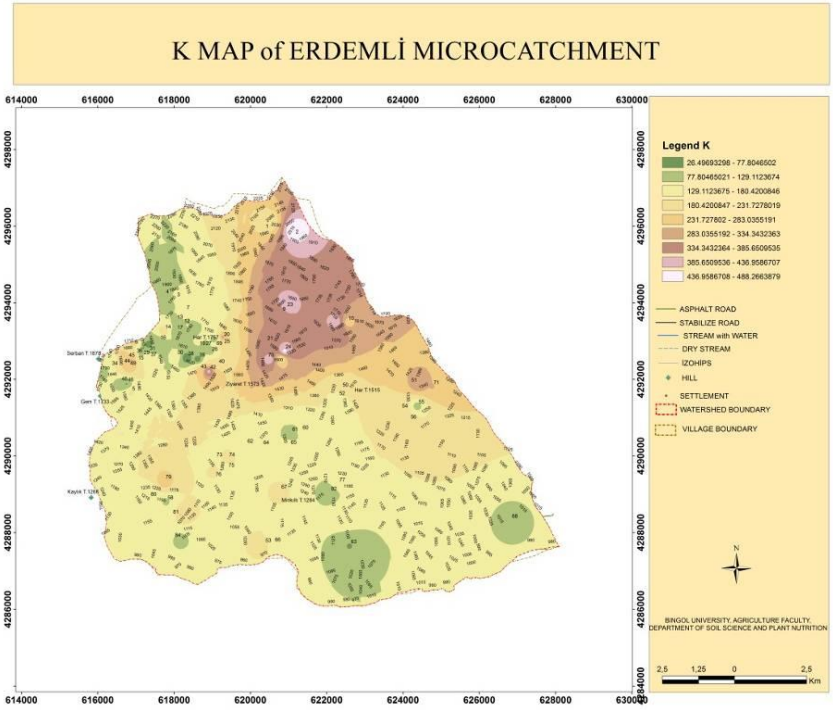

Figure 4.13. Potassium (K) Map of Erdemli Microcatchment

4.4. Determination of Problems in Erdemli Microcatchment

The Erdemli Microcatchment land usually has a rugged topographical structure. A large part of the topography is in IV- VII. Class belongs to Land Capability Classes. Therefore, in these areas, there is a significant constraint on the agricultural use of the land and it is necessary to use these lands mostly as forests, pastures or wildlife.

Severe and very severe erosion prevails in the project area. There are erosions in pasture areas of the basin of the basin resulting from animal pressures and varying sizes - from to bare soil altogether. In some parts of the basin, the botanical composition is been severely weakened. Because of the winter feeding problems, the animals that are removed early and put into the shelters late for a long period of time lead to soil compaction, the vegetation cover does not give an opportunity to renew itself and the pasture is eroding rapidly and violently. On the other hand, the infiltration of the plant cover is weak and the stuck soil is very small, and the surface flow increases and accelerates due to the inclined lands, leading to erosion. In the project area, no technical Measures are taken to intervene in this issue, and since the upper basins are not a priority in terms of farmer education and publishing, the abrasion are on the increase.

The most important natural disasters affecting natural resources and living conditions within the basin are the landslide or soil slip, flood, rock fall and ancestry. Deforestation and erosion are among the most important factors leading to landslide, seller and avalanche in Erdemli Microcatchment

Figure 4.14. Erosion situation in the Erdemli Microcatchment

Erdemli Microcatchment has the potential to be rich in water resources, and there are irrigation problems in the lower villages. Often, farmers use small opportunities and resources to evaluate small water resources and irrigate small plots of clover, vegetable and fruit trees.

Figure 4.15. Existing Irrigation Arrangement and Agricultural Land in the Basin

Figure 4.16. Water resources in the Microcatchment

In the project area, deterioration due to soil and water pollution is limited. Chemical use in plant and animal production is too small to be tested. However, the lack of sewage system in village settlements and environmental wastes, community health and surface and ground waters are serious problems on environmental health. Although Special Administration carried out the construction of sewerage networks, it is not possible to meet the demands due to the budget constraints.

Figure 4.17. Careless water sources in Microcatchment

Figure 4.18. View of Microcatchment Animal Waste

Erdemli Microcatchment sustainable planning of the natural resource values with a participatory understanding has made, and an effective model in the basin has been put together with the rural population living in the region. Preparation of an integrated natural resource microcatchment management plan, the income of the watershed villagers could been increased in order to implement the rehabilitation activities for the improvement of the people living in the microcatchment, forests, pastures and agricultural areas.

4.5. Observation of Soil Erosion in Erdemli Microcatchment

WEPP is one of the most used programs in erosion models in recent years and is an erosion model program, which is been used more frequently in the estimation of surface flow and sediment, and is generally preferred among practitioners since it is integrated with GIS in general. GeoWEPP, which is been used with the model's integration with GIS, could easily determine the values such as soil losses and sediment and superficial flow on watershed basis by automatically receiving the manually entered files in WEPP model.

The data obtained in the project process (soil, climate, vegetation, socio-cultural), adapted and developed models will be recorded using GIS based software so that easy and effective monitoring of erosion and soil losses will be possible. The data converted into visual form with effective use of GIS will be used for the acquisition and reporting of erosion maps in Microcatchment and Murat River Basins.

5. CONCLUSION AND RECOMMENDATIONS

This study was been carried out to determine some soil properties and basin characteristics of Bingöl Erdemli Microcatchment.

Erdemli Microcatchment is located to the west of the Genç district and extends to the exit of the central district. The villages located within the boundaries of the Microcatchment study area; Bahçeli, Erdemli, Dışbudak, Gökdere, Kıran, Suvaran and Yumaklı are the villagers.

Bingöl provinces mostly dry summers and hot, there is a continental climate where the winters are hard and cold. Precipitation rain in spring and autumn and in the winter months it is been seen as snow. The average annual precipitation is 831.5 mm and the annual evaporation sum is 1202.5 mm. with increasing summer temperatures, the evaporation increases and in July 262.7 mm with evaporation reaching the highest level.

Geological structure of the study area it is been made up of metamorphic hosts. Developed soils on the mainland are deeply structured, sandy-clay and sandy-clay texture. Although there is no drainage problem in this soil, a large number of non-calcareous, organic matter in the middle level, it has been determined that pH has a property around neutrality. Any restrictive factor in terms of plant breeding as a result of the analyses made.

The Agricultural land 761.44 ha, could been considered non-problematic for their use, slightly inclined, Moderate abrasion effect and stony land is 414.47 ha It has been determined that it covers the area, 228.34 ha of the study area Slight severe erosion in the area, 1466.64 ha Medium severe erosion in the area and 6700.31 ha High severe erosion is seen in the area.

The basin area generally has a sufficient drainage network. The basin length is 16.51 km and the basin width is 9.93 km. while the stream density value is 1.18, the drainage density 3.25, were measured in the measurements made.

As the result of the examination of the maps obtained by digitization, it was determined that the study area had an area of 8397.16 hectares. The circumference of the basin is 4171 m, the length is 16510 m and the width is 9930 m, and the average height is been calculated as 1550 m. The average elevation of the Erdemli microcatchment is been calculated to be higher than the average of Turkey (1130 m).

Erosion control for the protection of the soil cover and Erdemli stabilization measures such as gaming rehabilitation, Water holding capacity increasing machine and worker-made terraces, forest trees and a forestation with fruiting species, Pasture for the improvement of the existing damaged oak vegetation and pastures must be closed for grazing for a certain period of time.

There are rich water resources in the basin, but these water resources are efficient, and have not been used effectively. This is in the Erdemli microcatchment if the water resources are used in a rational manner, the existing irrigation areas Yield it with more efficiency and rural development is also expected to increase.

In the villages where Erdemli microcatchment had previously held the soil, Erosion control and a forestation work have not done. Soil structure and ecological conditions of the land and climate when considering the situation in the basin Soil conservation and a forestation are possible. Bahçeli, Erdemli, Dışbudak, Gökdere, Kıran, Suvaran and Yumaklı Soil protection in the land of the villagers, Erosion control and a forestation work should been done.

In the lower sections of the study area in the oak areas, on the one hand, the villagers in the basin, Cuts are been made to meet the needs of the People living outside the country with illegal they have been found to damage oak areas. In addition, small cattle breeding in the region is usually done as a goat and to meet the winter feed needs of these animals Branch-leaf cutting is used in oak trees. Most of the microcatchment villages have low Forests because of income level is seen as an element of intense oppression.

People living in microcatchment have their own vegetables, limited fruit needs, and that they meet inadequately. Accordingly, undercover vegetable growing and closure fruit garden Vegetables and fruits due to the lack of facilities there is no income generating activity at the desired level. Existing fruits and vegetables are cold storage and there is no marketing opportunity and does not gain economic value.

The study area could been done also shed agricultural activities in a limited manner. In addition, field farming and gardening are classic Methods have been made unconsciously, Because of the lack of the use of soil processing equipment, the loss of yield in agricultural production. Fertilizing, which is important for agricultural activities, Drip irrigation, maintenance of fruit trees and application of plant protection techniques against pruning, disease and harmfulness, serious information on basic issues such as the use of certified seeds and seedlings and lack of practice was observed. For all these reasons, the micro catchment are rural It has been observed that the poverty is felt intensely. In addition, climate features in some areas of microcatchment limit agricultural activities. Fodder crops should be common in local conditions (Clover, vetch, etc.) and cereals are not cultivated.

The fact that livestock breeding in the basin is aimed at meeting the obligatory needs, Income-generating activity, not enough nutrition, especially during the winter months and the yield was low. Feed plants are also planned and suitable for local conditions, the use of certified seeds results in lower yields.

Excessive pasture areas in the upper elevations of the study area and uncontrolled pastures, especially from early pasture Due to poor vegetation of pasture vegetation and thus the animals grazing in the Efficiency at desired level due to nutrition Has not been observed. Also in the pasture areas, salt, platter, etc. technical and the absence of auxiliary structures Activities cannot been done intensively.

In addition to poor vegetation cover in pasture, areas the flora of the existing flora and use as animal feed it has been observed that it has been extreme destruction. Especially when the places where the guests are gathered and cut are inclined, Naked and at high altitudes the land is erosion-resistant Erosion in pasture areas with the destruction of the Cause it to reign in a certain way.

Cattle and small cattle breeding in the region usually made to be a goat and to meet the winter feed needs of these animals Branch-leaf cutting is used in oak trees. Most of the microcatchment villages have low income it is been seen as an intense pressure element on the forests.

The damaged oak forest in the study area with the rehabilitation work to carry out in the fields, renewal of existing vegetation cover or complementary oak planting activities should been done with planting.

Oak rehabilitation areas, Saplings will not be harmed by animals or the paint, they will not eat must be protected by turning the wire mesh until reaching. Most of the oak trees are illegal cutting for firewood, illegal grazing, illegal leaf for animal feeding and because of branch use is inefficient and broken, these degraded forests should been transformed into productive forests through rehabilitation.

Agricultural activities within the study area Depending on the irrigation could been done in a limited way. In addition, field farming and gardening are classic methods have made unconsciously; because of the lack of use of tillage tools, there is a loss of productivity in agricultural production. Fertilizing, which is important for agricultural activities, Drip irrigation, and maintenance and trimming of fruit trees, Application of plant protection techniques against diseases and pests, serious information on basic issues such as the use of certified seeds and seedlings and lack of practice was been observed.

In the study area villagers, especially those that are technically incompatible with long winter conditions, inadequate animal shelters are small and cattle are the most important factors limiting animal production. In these insufficient animal shelters ventilation / chimney, Lighting, feeding and watering arrangements, Disinfectant with reasonable improvements such as paint-whitener and activities such as disinfection should be carried out.

In all of the villages in Erdemli Microcatchment, 3402 cadastre lands has passed in accordance with the numbered law and the forest Cadastre studies have not done until now.

Soil texturing of the working area and Erdemli Microcatchment soil it is usually sandy slime and the soil there is no problem in the process. Absolute and physiological soil depths are above 120 cm on average.

The depth of the pH value of the study area soil it is been seen that the pH values which are not changed depending on the pH change between 5.9 and 8.4, According to Ülgen and Yurtsever (1995) Neutral soil covers 47.5% of the total area. Slightly acidic soils account for 38.7% the medium-acid soils accounted for 8.7% of the area and 5% of the area in mildly alkaline soils.

Electrical conductivity (EC), value in the Erdemli Microcatchment and working area soil from minimum to maximum in the depth (0-120cm). varies between 71.9-1507.0 μS / cm (0.071 to 1.50 dS / m) the study area is that all of the soil is unsalted and the amount of salt in the soil depending on the depth the results of the analyses that have not changed have come to the end.

The lime content in the Erdemli Microcatchment soil ranged from minimum to maximum in the depth (0-120cm) varies between 0.0% and 54.1%. As the depth increases, the amount of lime in the soil becomes minimum the results of the analyses that were been made at the level were finally revealed.

The range of organic matter in the Erdemli Microcatchment from minimum to maximum in the depth (0-120cm) varies between 0.1% and 5.8%, Decrease in the amount of organic matter in the soil as the depth increases and the analysis of the best amount of organic matter in the soil at 0-30 cm was the final result.

The phosphorus content in the Erdemli Microcatchment from minimum to maximum in the depth (0-30cm) varies between 1.6 and 100.6 ppm. Decrease for phosphorus in the soil as the depth increases and that the best amount of phosphorus is been observed in the soil at 0-30 cm.

The potassium content in the Erdemli Microcatchment from minimum to maximum in the depth (0-30cm) varies between 26.2 and 488.3 ppm. As the depth increases, the amount of potassium in the soil decreases and the analysis of the best amount of potassium in the soil at 0-30 cm was the result.

Total Nitrogen content in the Erdemli Microcatchment from minimum to maximum in the depth (0-30cm) varies between 0.0% and 0.8%. As the depth increases, the amount of total nitrogen in the soil increases.

The Sodium content in the Erdemli Microcatchment from minimum to maximum in the depth (0-30cm) varies between 16.1% and 291.5% ppm. As the depth increases, the amount of Sodium in the soil decreases and the analysis of the best amount of Sodium in the soil at 0-30 cm was the result.

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CURRICULUM VITAE

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APPENDIX

A- Erdemli Microcatchment General Soil Properties

ERDEMLİ MICROCATCHMENT GENERAL SOIL PROPERTIES

Profile	Latitute	Cordinate		Depth (cm)	% CaCo3	%Org. Matter	pH	EC(µS/cm)	Texture				N (%)	K (ppm)	Na (ppm)	P (ppm)
		X	Y						%Clay	%Sand	%Silt	Classes				
P1	2076	620512	4296098	0-30	.89	2.68	7.15	261.50	22.40	50.06	27.54	Sandy Clay loam	0.078	179.8	55.23	7.08
				30-60	1.12	1.91	7.23	299.00	16.19	66.65	17.16	sandyclay				
				60-90	1.03	1.98	7.08	279.00	14.14	64.45	21.41	clay				
P2	2016	621148	4295905	0-30	1.12	2.74	6.24	216.10	45.81	28.50	25.69	sandy clay loam	0.239	488.3	148.9	9.44
				30-60	1.12	3.13	6.28	235.40	27.28	42.30	30.42	clay				
				60-90	.56	2.33	6.23	243.60	25.23	46.41	28.37	clay				
P3	1799	618042	4294165	0-30	1.82	2.59	6.86	284.40	24.43	52.26	23.31	sandy clay loam	0.08	156.7	118.5	8.16
				30-60	1.03	1.61	6.96	233.60	18.13	56.55	25.32	sandy laom				
				60-90	1.03	1.97	6.90	252.70	18.11	56.60	25.29	sandy loam				
				90-120	1.21	2.72	6.84	224.20	18.20	50.12	31.68	loam				
P4	1826	617851	4294177	0-30	1.12	5.81	7.11	322.00	25.12	54.33	20.55	sandy clay loam	0.025	77.56	91.49	6.04
				30-60	1.03	5.81	7.22	345.00	31.52	48.17	20.31	sandy loam				
				60-90	1.03	5.81	7.15	402.00	27.52	50.05	22.43	sandy loam				
				90-120	1.21	5.81	7.14	385.00	21.52	45.91	32.57	clay				
P5	1496	616862	4291645	0-30	1.31	3.29	7.23	380.00	27.63	37.25	35.11	clay loam	0.137	186.2	78.98	11.05
				30-60	5.70	2.37	6.84	145.50	29.70	37.20	33.10	clay loam				
				60-90	1.03	1.73	6.91	171.70	29.69	39.27	31.04	clay loam				
				90-120	1.12	1.26	6.86	134.20	31.75	39.24	29.01	clay loam				

P6	1713	616940	4292951	0-30	1.40	.42	7.24	297.00	45.29	41.55	13.16	sandy clay	0.074	281.2	99.9	11.51
				30-60	1.03	.90	7.25	216.60	24.61	51.86	23.53	clay				
				60-90	1.12	.66	7.45	358.00	28.68	41.65	29.67	clay				
				90-120	.84	.52	7.33	385.00	30.41	39.90	29.70	clay loam				
P7	1725	618293	4293761	0-30	5.88	.92	7.23	380.00	25.56	41.42	33.03	clay	0.019	143.8	63.16	9.99
				30-60	5.04	.64	7.25	216.60	26.14	46.35	27.51	clay				
				60-90	3.36	.45	7.45	358.00	17.75	54.78	27.47	sandy loam				
				90-120	17.09	.63	7.33	385.00	19.69	55.11	25.20	sandy loam				
P9	1660	620810	4293780	0-30	1.12	2.12	6.94	292.60	29.15	30.10	40.75	clay loam	0.102	347.4	62.67	16.66
				30-60	1.31	2.24	6.78	361.00	40.83	27.15	32.01	clay				
				60-90	1.03	1.94	6.88	297.00	43.84	28.27	27.89	clay				
				90-120	1.77	1.93	6.80	296.00	43.67	28.56	27.78	clay				
P10	1680	622568	4293483	0-30	1.31	2.67	6.99	366.00	24.84	51.09	24.07	Sandy Clay loam	0.221	253.7	25.26	11.75
				30-60	1.87	3.13	6.95	375.00	29.36	36.02	34.62	clay loam				
				60-90	1.03	3.27	6.85	349.00	36.06	29.04	34.90	clay loam				
				90-120	1.21	2.86	6.81	432.00	36.09	30.75	33.16	clay loam				
P11	1709	622241	4293495	0-30	.84	4.34	6.82	482.00	29.93	35.97	34.10	clay loam	0.322	425.2	40.03	41.99
				30-60	.75	2.98	6.98	435.00	43.36	21.79	34.84	clay				
				60-90	1.21	2.67	6.88	374.00	4.95	22.98	72.07	silty clay				
				90-120	1.03	2.33	6.84	384.00	46.18	24.93	28.88	clay				

P12	1693	618346	4293412	0-30	1.12	1.08	7.07	160.70	13.43	65.96	20.61	sandy loam	0.019	129.9	74.7	2.9
				30-60	1.31	.66	7.51	115.00	7.85	73.22	18.93	sandu loam				
				60-90	3.64	.59	7.44	158.30	9.34	75.82	14.84	sandy loam				
				90-120	.84	.70	7.47	191.10	12.20	66.30	21.50	sandy loam				
P13	1694	618042	4293515	0-30	1.40	1.49	7.79	552.00	36.66	31.58	31.76	clay loam	0.065	121.6	50.61	2.78
				30-60	2.52	.90	7.62	701.00	35.14	32.57	32.29	clay loam				
				60-90	6.35	.55	7.78	587.00	30.59	37.42	31.99	clay loam				
				90-120	4.67	.96	7.93	1036.00	28.90	40.78	30.31	clay loam				
P14	1684	617730	4293258	0-30	1.21	1.08	7.91	474.00	31.96	32.66	35.38	clay loam	0.028	225.4	53.49	3.75
				30-60	2.05	.96	7.91	475.00	34.53	33.74	31.73	clay loam				
				60-90	9.52	.72	7.98	432.00	33.94	28.66	37.41	clay loam				
				90-120	10.64	.94	7.98	448.00	33.17	34.74	32.09	clay loam				
P15	1639	617108	4292979	0-30	1.40	1.43	7.52	295.00	21.62	44.77	33.61	loam	0.065	79.09	52.1	6.07
				30-60	1.21	1.21	7.67	269.00	16.11	54.53	29.36	sandy loam				
				60-90	1.40	.73	7.78	321.00	19.63	51.14	29.23	loam				
				90-120	1.31	1.06	7.67	233.80	18.27	48.06	33.66	loam				
P16	1566	617602	4292979	0-30	4.86	.50	8.20	422.00	28.40	38.12	33.48	clay loam	0.225	88.82	47.04	1.65
				30-60	11.02	.65	8.23	467.00	29.04	36.72	34.23	clay loam				
P17	1647	618044	4293243	0-30	4.67	1.11	7.88	354.00	32.39	33.84	33.77	clay loam	0.203	105	64.53	17.21
				30-60	8.96	.91	7.87	415.00	35.37	30.00	34.64	clay loam				
				60-90	6.16	.76	7.84	403.00	33.85	35.04	31.11	clay loam				
				90-120	6.82	.63	7.68	486.00	33.93	32.83	33.23	clay loam				

P18	1748	618437	4293238	0-30	1.31	1.37	7.24	589.00	42.08	23.29	34.63	clay	0.054	88.89	89	5.97
				30-60	.93	1.19	7.47	592.00	47.70	24.38	27.92	clay				
				60-90	1.40	1.12	7.24	530.00	45.32	24.82	29.86	clay				
				90-120	.93	.89	7.47	333.00	34.79	33.24	31.97	clay loam				
P19	1693	618632	4293014	0-30	1.21	1.87	7.23	441.00	26.15	50.49	23.35	sandy clay loam	0.191	156.5	61.45	15.24
				30-60	1.03	.63	7.44	592.00	12.67	56.39	30.94	sandy loam				
				60-90	1.40	.63	7.20	511.00	8.17	74.22	17.60	sandy loam				
				90-120	1.40	.47	7.15	484.00	9.64	70.78	19.58	sandy loam				
P20	1623	619270	4293104	0-30	1.40	1.19	5.92	204.00	58.30	13.76	27.94	clay	0.06	295.8	89.42	20.88
P21	1583	620483	4292959	0-30	1.40	1.82	7.72	975.00	32.84	35.45	31.71	clay loam	0.177	376.1	64.59	15.79
				30-60	8.59	1.68	8.15	279.00	26.11	38.62	35.27	laom				
				60-90	10.83	2.65	8.11	322.00	29.78	36.67	33.55	clay loam				
				90-120	3.45	2.22	8.27	492.00	34.92	25.03	40.05	clay loam				
P22	1671	622342	4293317	0-30	.84	2.68	6.75	261.50	26.92	36.72	36.36	laom	0.318	366.1	59.71	39.84
				30-60	.84	3.16	6.77	325.00	44.29	27.53	28.18	clay				
				60-90	1.03	2.61	6.85	443.00	50.74	26.75	22.50	clay				
				90-120	.75	1.63	6.57	889.00	29.65	29.21	41.14	clay loam				
P23	1669	620930	4293899	0-30	.84	3.56	6.94	458.00	37.22	28.79	33.99	clay loam	0.287	425.9	91.63	31.37
				30-60	.75	3.03	7.01	374.00	47.43	25.05	27.52	clay				
				60-90	1.17	2.66	6.78	361.00	49.74	22.62	27.64	clay				

P24	1571	620896	4292738	0-30	1.03	2.67	6.72	231.10	30.76	37.52	31.72	clay loam	0.201	447.7	110	3.01
				30-60	1.49	4.17	6.58	227.60	34.91	35.48	29.61	clay loam				
				60-90	2.05	3.27	6.56	244.20	35.33	36.82	27.85	clay loam				
				90-120	1.21	2.86	6.71	388.00	27.14	46.88	25.99	sandy clay loam				
P25	1634	619278	4292881	0-30	7.10	1.00	7.96	506.00	41.17	22.87	35.95	clay	0.017	199.9	67.32	7.43
				30-60	21.10	.87	7.92	538.00	41.07	25.13	33.80	clay				
				60-90	20.08	.79	7.93	530.00	34.80	33.54	31.66	clay loam				
				90-120	34.36	1.11	7.93	675.00	35.03	34.79	30.18	clay loam				
P26	1636	618954	4292744	0-30	1.68	.95	7.04	357.00	24.29	38.16	37.54	loam	0.007	103.1	116	4.43
				30-60	1.49	1.17	6.89	566.00	27.87	35.59	36.54	clay loam				
				60-90	1.59	1.17	7.05	734.00	15.76	61.68	22.56	sandy loam				
				90-120	.93	.59	7.11	544.00	26.38	57.76	15.86	sandy clay loam				
P27	1664	618793	4292886	0-30	1.31	2.32	6.89	535.00	38.71	29.80	31.49	clay loam	0.102	112.6	59.44	17.14
				30-60	1.31	.72	7.25	556.00	39.20	24.93	35.87	clay loam				
				60-90	1.40	1.28	7.36	498.00	43.39	24.69	31.92	clay				
				90-120	1.31	.94	7.36	498.00	41.77	23.85	34.38	clay				
P28	1660	617260	4292688	0-30	1.40	2.01	7.94	1309.00	20.38	35.55	44.07	loam	0.174	137.9	31.42	6.95
				30-60	1.21	1.39	7.16	276.10	22.44	43.81	33.75	loam				
				60-90	1.21	1.87	7.31	240.60	24.57	37.45	37.98	loam				
				90-120	1.40	1.48	7.19	248.60	25.77	38.86	35.37	loam				

P29	1689	617185	4292818	0-30	1.68	1.57	7.77	281.00	20.58	51.21	28.21	laom	0.055	64.83	101.3	100.6
				30-60	1.40	1.28	7.88	267.20	20.36	51.73	27.91	sandy clay loam				
				60-90	1.21	.86	7.90	306.00	19.75	52.90	27.35	sandy laom				
				90-120	1.59	2.09	7.79	345.00	18.35	47.47	34.18	loam				
P30	1499	618050	4292604	0-30	4.20	1.43	7.79	616.00	24.85	36.74	38.41	laom	0.053	169.4	67	7.76
				30-60	4.48	.68	7.78	561.00	25.96	40.49	33.55	loam				
P31	1685	617321	4292906	0-30	1.40	.86	7.36	177.90	19.45	55.66	24.89	sandy loam	0.083	26.22	120.7	5.09
P32	1717	617089	4292865	0-30	1.12	1.12	6.81	305.00	31.66	33.30	35.04	clay loam	0.085	143.3	61.96	9.89
				30-60	7.19	1.21	7.69	366.00	27.64	31.11	41.25	clay loam				
				60-90	3.69	.66	7.85	342.00	31.73	29.05	39.22	clay loam				
				90-120	4.02	1.12	8.05	323.00	29.69	31.09	39.22	clay loam				
P33	1698	616739	4292857	0-30	5.70	1.77	7.20	331.00	26.96	40.88	32.16	laom	0.09	170.4	66.92	12.2
				30-60	1.03	1.37	7.49	305.00	18.64	51.22	30.14	loam				
				60-90	1.40	1.20	7.48	303.00	20.09	52.09	27.82	sandy clay loam				
				90-120	1.03	1.11	7.55	242.10	13.71	71.19	15.10	sandy loam				
P34	1725	616417	4292540	0-30	1.31	3.16	7.76	363.00	29.82	40.10	30.07	clay loam	0.135	142	99.04	8.82
				30-60	4.86	2.02	6.43	488.00	27.08	49.03	23.89	sandy clay loam				
				60-90	1.59	1.98	6.59	404.00	16.63	59.39	23.97	clay loam				
				90-120	1.31	.79	6.77	393.00	14.66	59.00	26.34	sandy loam				

P35	1649	616656	4292666	0-30	.84	2.18	7.23	380.00	32.38	40.13	27.50	clay loam	0.106	268	63.47	7.88
				30-60	1.03	1.24	6.99	342.00	30.30	42.19	27.51	clay loam				
				60-90	1.49	1.31	6.97	289.00	32.65	39.62	27.73	clay loam				
				90-120	5.70	.63	6.99	290.70	34.68	37.65	27.67	clay loam				
P36	1636	616983	4292638	0-30	5.14	1.92	7.97	990.00	24.42	37.47	38.11	laom	0.098	233.8	77,54	7.63
				30-60	14.10	1.92	8.01	374.00	27.12	37.32	35.56	clay loam				
				60-90	12.70	.92	8.08	314.00	14.79	64.04	21.17	sandy loam				
				90-120	7.38	.57	8.01	413.00	16.85	59.93	23.22	sandy loam				
P37	1590	617392	4292540	0-30	1.49	1.19	7.25	341.00	27.48	38.94	33.58	clay loam	0.088	146.9	42.31	4.91
				30-60	17.27	1.07	7.91	315.00	27.28	47.25	25.47	sandy clay loam				
				60-90	16.90	.77	8.04	256.20	25.33	47.02	27.65	sandy clay loam				
				90-120	33.62	.74	8.06	329.00	25.33	43.25	31.41	loam				
P38	1541	618327	4292560	0-30	1.21	1.24	7.59	284.90	18.98	56.00	25.02	sandy loam	0.052	32.68	98.32	7.91
				30-60	1.40	1.44	6.75	352.00	18.86	62.40	18.74	sandy loam				
				60-90	1.77	.83	7.22	253.70	19.07	55.79	25.14	sandy loam				
				90-120	.56	.92	7.16	264.10	19.13	57.71	23.15	sandy loam				
P39	1570	618624.5	4292525.1	0-30	1.49	1.90	7.81	341.00	19.06	59.95	21.00	sandy loam	0.073	48.37	93.93	8.14
				30-60	1.12	.93	7.41	310.00	19.12	59.82	21.06	sandy loam				
				60-90	1.49	1.08	7.29	247.00	19.04	59.99	20.97	sandy loam				
				90-120	1.21	.88	7.45	288.60	18.38	53.98	27.65	sandy loam				

P40	1573	619136.09	4292359.1	0-30	30.63	1.28	8.04	626.00	45.69	24.32	29.99	clay	0.034	222.2	125.8	7.25
				30-60	38.10	1.17	8.01	677.00	64.78	11.39	23.83	clay				
				60-90	46.69	.95	8.06	867.00	43.64	13.81	42.55	silty clay				
				90-120	46.31	1.36	8.08	729.00	65.12	13.04	21.85	clay				
P41	1558	620812	4292522	0-30	.47	3.48	7.37	1072.00	35.51	38.63	25.86	clay loam	0.163	192.8	59.73	11.54
				30-60	.93	1.99	7.06	448.00	35.35	38.33	26.32	clay loam				
				60-90	1.21	1.58	6.85	401.00	23.20	48.27	28.52	loam				
				90-120	.00	2.04	6.77	277.70	9.87	66.75	23.38	sandy loam				
P42	1510	618907	4292205	0-30	4.95	2.44	7.59	782.00	37.56	27.41	35.00	sandy clay	0.187	409.5	37.88	8.1
				30-60	18.49	2.36	7.91	617.00	39.56	25.41	35.03	clay loam				
				60-90	22.32	1.41	7.98	582.00	41.58	22.10	36.31	clay				
				90-120	13.35	1.78	7.89	582.00	43.46	22.49	34.05	clay				
P43	1505	618662	4292224	0-30	1.49	.98	7.97	1507.00	8.28	78.16	13.57	sandy loam	0.216	255.9	291.5	22.09
				30-60	1.49	.72	7.47	452.00	11.30	77.15	11.56	sandy loam				
				60-90	1.03	.76	7.62	480.00	10.45	75.92	13.62	sandy loam				
P44	1606	616886	4292476	0-30	1.59	1.95	7.29	412.00	27.54	48.83	23.63	sandy clay loam	0.16	300.8	118.6	13.11
				30-60	2.99	.68	7.59	542.00	28.15	44.41	27.44	clay loam				
				60-90	3.36	.48	7.83	567.00	30.92	37.17	31.91	clay loam				
				90-120	11.02	.84	8.05	470.00	18.54	53.58	27.89	sandy loam				

P45	1620	616780	4292520	0-30	1.31	3.19	6.68	382.00	30.02	42.72	27.25	clay loam	0.229	288	74.56	10.3
				30-60	1.21	1.57	6.86	382.00	34.70	31.31	34.00	clay loam				
				60-90	.93	1.13	6.99	275.80	49.05	38.06	12.89	clay				
				90-120	.84	.85	6.96	286.20	30.82	37.36	31.82	clay loam				
P46	1546	616750	4291880	0-30	12.14	.43	8.21	517.00	28.19	38.08	33.73	clay loam	0.01	74.51	48.61	7.94
				30-60	11.21	.30	8.33	320.00	25.99	40.99	33.01	loam				
				60-90	14.94	.62	8.17	420.00	34.27	36.31	29.42	clay loam				
				90-120	11.58	.47	8.45	249.90	28.49	33.44	38.06	clay loam				
P47	1725	616099	4292204	0-30	1.40	1.45	7.04	450.00	38.17	31.79	30.05	clay loam	0.049	76.98	59.33	15.51
				30-60	1.21	1.03	7.02	412.00	41.83	30.05	28.11	clay				
				60-90	1.03	1.07	6.73	318.00	35.53	38.08	26.39	clay loam				
				90-120	1.12	.73	6.50	365.00	26.51	39.81	33.68	loam				
P48	1575	616586	4291901	0-30	1.21	2.06	6.88	115.90	19.36	53.85	26.80	sandy loam	0.091	100.1	179.5	18.54
				30-60	.84	1.05	7.10	109.30	13.20	70.24	16.56	sandy loam				
				60-90	1.12	1.40	6.92	101.00	20.84	56.03	23.12	sandy clay loam				
P49	1561	616817	4292310	0-30	1.40	1.12	7.15	161.40	20.13	56.72	23.15	sandy clay loam	0.043	277.4	92.7	20.31
				30-60	1.12	.77	7.24	111.00	13.96	71.10	14.94	clay				
				60-90	4.30	.79	7.35	249.00	14.01	68.24	17.75	sandy loam				
				90-120	5.88	.63	7.21	71.90	11.95	73.10	14.96	sandy loam				

P50	1412	622385	4291744	0-30	.93	2.52	6.60	269.40	20.25	50.20	29.55	loam	0.056	211.5	75.16	17.43
				30-60	1.77	2.29	6.42	311.00	28.69	45.15	26.16	sandy clay loam				
P51		624409	4291876	0-30	1.03	4.09	6.97	450.00	26.43	35.79	37.78	sandy clay loam	0.868	333.9	56.28	18.82
				30-60	.93	2.22	6.63	534.00	46.75	31.34	21.91	clay				
P52	1353	622292	4291520	0-30	1.17	2.64	7.06	241.00	13.95	62.84	23.21	sandy loam	0.117	143.9	57.91	30.91
				30-60	.75	1.65	6.84	478.00	14.09	64.58	21.34	sandy loam				
				60-90	1.31	1.94	6.93	203.50	6.97	76.07	16.97	sandy loam				
				90-120	1.40	2.25	6.63	146.30	7.84	79.13	13.03	loamy sand				
P53	1050	620358	4287684	0-30	1.07	3.40	6.75	395.00	36.34	36.08	27.59	clay loam	0.085	209	67.58	8.28
				30-60	.84	1.99	6.60	343.00	38.67	29.36	31.97	clay loam				
				60-90	.93	1.65	6.46	332.00	21.69	45.78	32.53	loam				
				90-120	.00	2.61	6.40	385.00	37.58	32.35	30.07	clay loam				
P54	1272	623937	4291196	0-30	2.43	2.10	7.76	641.00	46.39	27.60	26.01	clay	0.063	225.4	28.16	8.77
P55	1271	624372	4291300	0-30	.93	1.71	6.98	462.00	33.01	37.89	29.10	clay loam	0.001	108.7	59.88	4.34
				30-60	.93	1.68	6.26	472.00	24.74	53.09	22.17	sandy clay loam				
P56	1202	624163	4290907	0-30	.93	2.09	7.09	471.00	31.80	44.31	23.89	clay loam	0.05	208.1	69.77	3.88
				30-60	1.68	1.97	6.60	242.30	23.74	52.91	23.36	sandy clay loam				
				60-90	1.59	1.87	6.70	232.10	22.48	51.99	25.54	sandy clay loam				
				90-120	1.49	2.21	6.51	608.00	18.14	52.37	29.49	sandy loam				

P58	1170	617791.78	4288800.8	0-30	.84	1.73	7.11	511.00	40.90	33.36	25.73	clay	0.061	119.5	111.9	2.97
				30-60	.93	2.11	6.80	435.00	23.02	50.82	26.16	sandy clay loam				
				60-90	.84	1.85	7.12	276.50	14.20	64.28	21.51	sandy loam				
				90-120	1.03	1.93	6.80	388.00	17.06	60.44	22.50	sandy loam				
P60	1298	621336	4290629	0-30	.84	2.93	7.18	146.10	40.47	28.87	30.66	clay	0.025	135.2	16.15	2.57
				30-60	1.21	1.58	7.23	693.00	10.17	74.36	15.47	sandy loam				
P61	1308	621058	4290582	0-30	.93	2.33	7.51	654.00	18.34	63.71	17.95	sandy loam	0.055	105.7	62.61	4.15
				30-60	1.12	2.39	7.32	367.00	13.77	68.52	17.71	sandy loam				
P62	1281	619885.9	4290273.1	0-30	.47	2.20	7.49	661.00	2.86	84.12	13.01	laomy sand	0.091	130.3	86.02	7.92
				30-60	.75	2.03	7.31	205.30	4.96	79.93	15.10	loamy sand				
				60-90	1.03	1.69	7.34	197.10	3.00	83.35	13.65	loamy sand				
P63	1062	622596.45	4287651.1	0-30	1.07	1.49	7.57	146.10	4.92	80.10	14.98	laomy sand	0.042	76.4	176.8	17.05
				30-60	1.21	2.10	6.77	337.00	28.56	45.40	26.04	sandy clay loam				
				60-90	.93	2.33	6.89	329.00	32.96	43.05	23.99	clay loam				
				90-120	1.03	1.98	6.90	369.00	28.39	40.71	30.90	clay loam				
P64	1358	620305	4290335	0-30	.65	2.53	7.23	462.00	31.07	41.11	27.82	clay loam	0.092	140.5	74.85	4.58
				30-60	.47	2.14	7.64	270.80	2.74	82.82	14.44	loamy sand				
				60-90	.93	1.92	7.42	110.60	1.51	89.73	8.76	sand				
				90-120	1.03	1.76	7.43	99.10	2.84	86.33	10.83	loamy sand				

P65	1257	621022	4290245	0-30	7.47	2.31	7.75	627.00	28.41	39.31	32.28	clay loam	0.071	151.3	101.4	6.75
				30-60	8.03	2.01	7.87	621.00	22.17	45.35	32.48	laom				
				60-90	8.59	1.88	7.94	623.00	20.02	49.64	30.34	loam				
				90-120	9.99	1.53	7.93	612.00	15.65	49.95	34.40	loam				
P66	1047	620604.85	4287702.7	0-30	.93	2.31	6.04	288.40	22.46	49.93	27.61	sandy clay loam	0.044	138.6	50.99	8.74
				30-60	.93	2.01	6.29	278.50	27.04	49.20	23.76	sandy clay loam				
				60-90	.93	1.88	6.51	207.40	20.89	52.75	26.36	sandy loam				
				90-120	.93	1.53	6.41	210.30	18.54	57.68	23.78	sandy loam				
P67	1171	620774.9	4289082.5	0-30	1.21	2.54	6.91	351.00	26.30	44.38	29.32	loam	0.067	195.9	108.9	15.47
				30-60	.84	1.83	6.64	303.00	24.47	48.01	27.52	sanduy clay loam				
				60-90	.93	2.82	6.69	204.10	24.42	48.12	27.46	sandy clay loam				
				90-120	1.21	1.84	6.80	377.00	30.79	43.74	25.47	clat loam				
P68	1010	626821	4288318	0-30	.93	2.68	6.48	540.00	45.44	24.89	29.67	clay	0.051	118.8	43.22	6.79
				30-60	.84	2.72	6.60	350.00	47.81	26.56	25.63	clay				
				60-90	1.12	2.46	6.93	417.00	40.98	33.71	25.31	clay				
				90-120	.56	1.88	6.95	301.00	21.42	63.73	14.85	candy clay loam				
P69	1641	619074	4293050	0-30	1.21	1.49	6.84	287.10	31.84	38.16	30.00	clay loam	0.062	103.2	59.72	9.25
				30-60	1.12	1.04	6.63	289.80	35.46	36.09	28.45	clay loam				
				60-90	1.40	.96	6.64	411.00	37.45	36.29	26.26	clay loam				
				90-120	5.42	1.39	6.86	478.00	29.05	44.71	26.24	clay loam				

P70	1560	620503.04	4292523.1	0-30	1.40	1.54	7.01	839.00	59.08	10.49	30.43	clay	0.067	415.2	94.82	16.94
				30-60	1.49	.95	7.08	829.00	61.99	11.09	26.92	clay				
				60-90	8.59	1.53	7.57	804.00	42.65	24.01	33.34	clay				
				90-120	11.67	1.11	7.57	782.00	24.88	38.76	36.36	loam				
P71	1333	624765	4291805	0-30	.56	2.68	6.98	277.80	28.16	41.96	29.88	clay loam	0.069	283.9	60.39	17.5
				30-60	.93	2.18	6.82	238.50	29.05	32.45	38.49	clay loam				
				60-90	.93	1.95	6.78	233.20	20.43	45.57	34.00	loam				
				90-120	.47	2.75	6.89	205.20	15.32	48.92	35.76	loam				
P73	1254	619075.58	4289918.5	0-30	.93	3.06	6.71	493.00	34.69	41.61	23.71	clay loam	0.082	154.2	47.47	4.7
				30-60	1.12	1.50	6.58	496.00	42.79	27.41	29.80	clay				
				60-90	1.12	1.92	6.59	517.00	36.81	26.77	36.42	clay loam				
				90-120	1.21	1.68	6.45	445.00	24.36	32.38	43.27	loam				
P74	1290	619406.29	4289919.9	0-30	1.21	2.35	7.14	613.00	30.41	45.92	23.67	sandy clay loam	0.101	214.9	60.52	8.58
				30-60	.93	2.71	7.32	692.00	34.61	22.69	42.70	clay loam				
				60-90	42.95	2.19	6.77	592.00	38.82	14.29	46.89	silty clay loam				
				90-120	54.16	1.57	7.92	649.00	39.69	15.41	44.90	silty clay loam				
P75	1290	619393.06	4289647.4	0-30	.93	2.95	6.95	445.00	23.63	42.71	33.66	loam	0.474	128.9	59.66	2.58
				30-60	.93	1.67	6.93	376.00	23.05	50.76	26.19	sandy clay loam				
				60-90	.84	2.45	6.91	428.00	11.95	69.82	18.23	sandy loam				
				90-120	1.12	2.18	6.25	554.00	27.13	41.74	31.13	clay loam				

P76	1195	619054	4289615	30-60	.93	2.20	6.86	212.90	14.17	60.16	25.68	sandy loam				
				60-90	.75	1.89	6.77	233.00	12.13	68.40	19.47	sandy loam				
				90-120	.93	1.82	6.54	286.20	3.56	87.78	8.66	sand				
P77	1188	622295	4289285.2	0-30	.84	3.30	6.72	554.00	43.26	30.85	25.88	clay	0.064	145.8	45.41	1.85
				30-60	1.12	2.09	6.54	373.00	43.36	37.09	19.55	clay				
				60-90	1.12	1.36	6.85	309.00	28.51	54.04	17.46	sandy clay loam				
				90-120	.56	1.37	6.70	263.60	17.42	63.46	19.12	sandy loam				
P78	1136	622477	4288434.7	0-30	.84	2.32	6.72	554.00	20.33	52.10	27.57	loam	0.096	175.1	61.67	1.75
				30-60	1.03	1.62	6.54	373.00	24.21	51.96	23.83	sandy clay loam				
				60-90	1.12	2.14	6.85	309.00	22.24	53.76	24.00	sandy clay loam				
				90-120	.93	2.49	6.70	263.60	20.14	55.81	24.05	sandy loam				
P79	1235	617741	4289341	0-30	1.17	2.22	6.72	554.00	24.51	43.73	31.75	loam	0.056	278.4	93.7	4.39
				30-60	1.40	1.96	6.54	373.00	22.08	54.09	23.83	sandy clay loam				
				60-90	1.40	1.96	6.85	309.00	17.95	55.90	26.15	sandy clay loam				
				90-120	1.87	1.71	6.70	263.60	15.83	60.11	24.05	sandy loam				
P80	1225	617390	4289120.5	0-30	.93	1.45	6.72	554.00	26.61	47.92	25.48	sandy clay loam	0.484	153.2	46.37	8.45
				30-60	1.40	1.96	6.54	373.00	30.61	45.56	23.83	sandy clay loam				
				60-90	1.40	1.71	6.85	309.00	24.39	51.61	24.00	sandy loam				
				90-120	.93	1.71	6.70	263.60	22.29	66.57	11.14	sandy loam				

P81	1079	617933	4288429	0-30	.70	1.19	6.72	554.00	32.88	58.37	8.75	sandy clay loam	0.074	142.8	32.16	6.85
				30-60	1.12	.94	6.54	373.00	26.34	64.75	8.91	sandy clay loam				
				60-90	1.26	.68	6.85	309.00	24.39	60.97	14.64	sandy clay loam				
				90-120	1.40	.17	6.70	263.60	22.29	68.72	8.99	sandy clay loam				
P82	1147	622076	4289033	0-30	1.87	2.73	6.72	554.00	19.29	43.73	36.98	sandy clay loam	0.09	103.5	64.32	1.95
				30-60	1.96	2.48	6.54	373.00	20.16	47.70	32.14	sandy clay loam				
				60-90	1.77	1.96	6.85	309.00	20.09	45.17	34.74	sandy loam				
				90-120	1.40	.17	6.70	263.60	11.53	53.66	34.81	sandy loam				
P83	1065	618158	4288465	0-30	1.73	2.32	6.72	554.00	24.51	45.83	29.66	loam	0.335	234.8	77.64	2.68
				30-60	1.68	1.62	6.54	373.00	22.08	47.70	30.22	sandy clay loam				
				60-90	1.63	2.14	6.85	309.00	22.24	47.32	30.44	sandy clay loam				
				90-120	1.73	2.49	6.70	263.60	20.14	55.81	24.05	sandy clay loam				
P84	1077	618177	4287822	0-30	2.38	2.32	6.72	554.00	26.61	58.38	15.02	sandy clay loam	0.095	113.8	59.48	6.89
				30-60	2.43	1.62	6.54	373.00	24.21	62.62	13.17	sandy loam				
				60-90	2.57	2.14	6.85	309.00	17.95	61.27	20.78	sandy loam				
				90-120	1.87	2.49	6.70	263.60	20.14	64.42	15.45	sandy loam				