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A New approach to the land capability classification: Case study of Turkey

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Abstract

Land capability classification is one of the very important issues in terms of sustainable land use. Many land capability classifications have been prepared and applied especially in the developed countries such as USA, UK and France. Most of the land capability classification systems and mapping are an adaptation of the US Department of Agriculture method. Up to now the criteria that are taken into consideration in the land capability classification are topography especially inclination of slope and soil properties, in general. In a mountainous country or regions topographic-geomorphic unites, climate and parent material are factors that must be taken into consideration in order to establish land capability classification. All these criteria are used in this study. The aim of this study is to reestablish a land classification according to the geomorphic units, climate and parent material factors in Turkey. According to these criteria, seven land capability classes were determined. Moreover, the subclass are identified according the parent material properties that mostly outcropped on the mountainous areas.

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1.Introduction

Land capability classification is a system of grouping soils primarily on the basis of their capability to produce common cultivated crops and pasture plants without deteriorating over a long period of time [1, 2, 3]. The capability

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classification is one of a number of interpretive groupings made primarily for agricultural purposes. Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations for field crops [1, 3,4]. Land Capability classes are designated by the numbers I through VIII. I-IV land classes are suitable for agricultural practices. Remaining classes are unsuitable for cultivation [1, 2, 3, 4].Land capability classes that are defined by most countries are as follows.

Class I soils have slight limitations that restrict their use. Class II soils have moderate limitations that restrict the choice of plants or that require moderate conservation practices. Class III soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both. Class IV soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.

Class V soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat. Class IV soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat. Class VII soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat. Class VII soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or aesthetic purposes [2, 3, 4].

The determining factor related to the geomorphic-topographic units, climatic limitations and the parent material effects are not adequately used and introduced in the above-mentioned classifications. The main aim of this study is clearly to show the importance of the climate, geomorphic unites and parent material properties in the land classification especially in the mountainous areas and countries.

2. Method and material

In this land capability classification the ecological properties containing topography notably slope angle of the land, the direction of orographic ranges, altitude and aspects, climatic properties, soil, parent material are taken into consideration. The limiting factors for the growth of agricultural crops are established. The importance of the physical and chemical properties of parent material that exposed on the mountainous areas is defined as subclass. This research is mainly depends on field studies conducted between 1970-2015, and previous publications mainly on Ecosystems of NE Anatolia [5], geomorphologic and land use erosion studies [6, 7, 8, 9], the ecology [10, 11, 12, 13, 14, 15, 16, 17, 18] and seed transfer zoning of main forest trees of Turkey [19, 20, 21, 22, 23, 24], climate [25], Vegetation and Biogeography of Turkey [26, 27, 28], soils [29, 30, 31, 32]. Other cited references mostly present land classification publications and applications are regarded in the determining of land classifications [1, 2, 4, 30, 31]. ASTER (The Advanced Spaceborne Thermal Emission and Reflection Radiometer) of Turkey was used to detect the land qualifications.

3. Findings

The criteria related to the land capability classification in Turkey are summarized below.

3.1. Topographic-geomorphic factors

Alpine-Himalayan orogenic belt takes place in Turkey and it has a rugged topography. Main geomorphic-topographic unites and their importance in terms of land classification are indicated below:

3.1.1. Mountains

There are two main orogenic belts in Turkey: Northern Anatolian Mountains extend in the northern part of Turkey and Taurus Mountains cover the southern section of the Anatolian peninsula. Some Mountains called horsts that are found between the grabens or lowlands occur mostly in the western part of Anatolia. Volcanic Mountains are centered in the SE and Eastern parts of Anatolia. These Mountains are responsible for the formation of altitudinal belts and high slope inclination in Turkey. Indeed, according to altitudinal belts, the area between 0-500 m covers an area of 17.5 %, 500-1000 m elevation area is about 26.6 %, and 1000-2000 m altitudinal belt accounts for 45.9 % of the total land of Turkey [33].

The slope inclination in the mountainous areas is more than 40 %. Low inclination areas are generally found in the lowland of Thrace and central part of inner Anatolia, depressions located all regions and deltaic areas of coastal

belt of Turkey [34]. The steep slopes on the mountainous areas form class VII lands, in general. The dejection fans and cones spreading the edge of Mountains and the thick colluvial deposits form class V. These areas have sandy and gravelly deposits that infiltration capacity is very high. Therefore, these areas are suitable for the growth of trees and shrubs that are resistant drought. In the Mediterranean climate, fig and vineyards are found on the dejection fans (Fig. 1-4). The fault scarps of the Mountains, as seen in figure 1 and 2, cause intense soil and parent material erosion and the formation of dejection cones and fans. The parent materials that exposed on these steep slopes determine the erosion intensity and the materials carrying by floods. The sandy materials supply abundant material for bed load of floods.

Generally, class IV, VII and VIII lands occur on the mountainous areas. The humid areas of the Northern Anatolian Mountains and Taurus Mountains support the growth of forests. The undulating areas higher than 2000 m in the Mountains encircling the coastal Mountains and higher than 2400 m in the NE Anatolia are the native meadows belonging to class IV. In addition to these, slightly undulating areas of Mountains that are found in the semiarid areas in Anatolia are suitable for the grazing (Fig. 3, 4). In the mountains, the tectonic and karstic depressions that are below 1500 m are the main cultivated cropland belonging to class IV. Whereas rocky steep slopes in the Mountains are in class VIII.

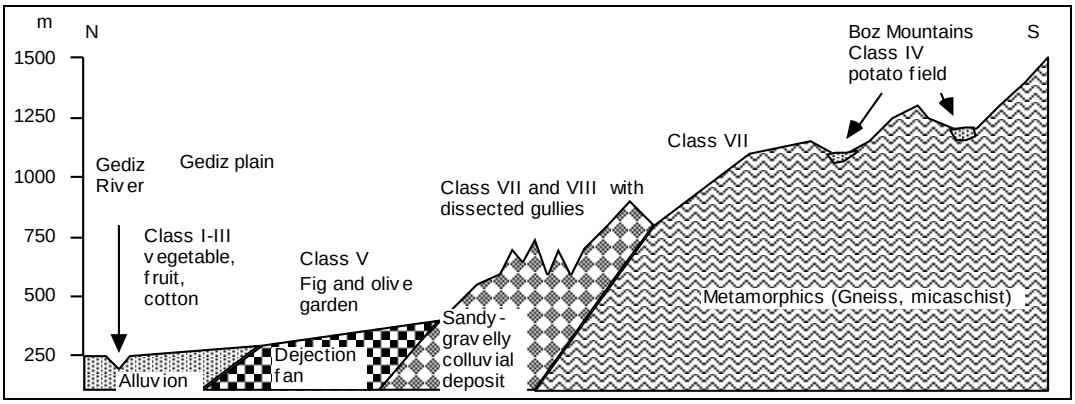

Fig. 1. Land classification based on topography and parent material in the Gediz plain and Boz Mountains, W of Turkey

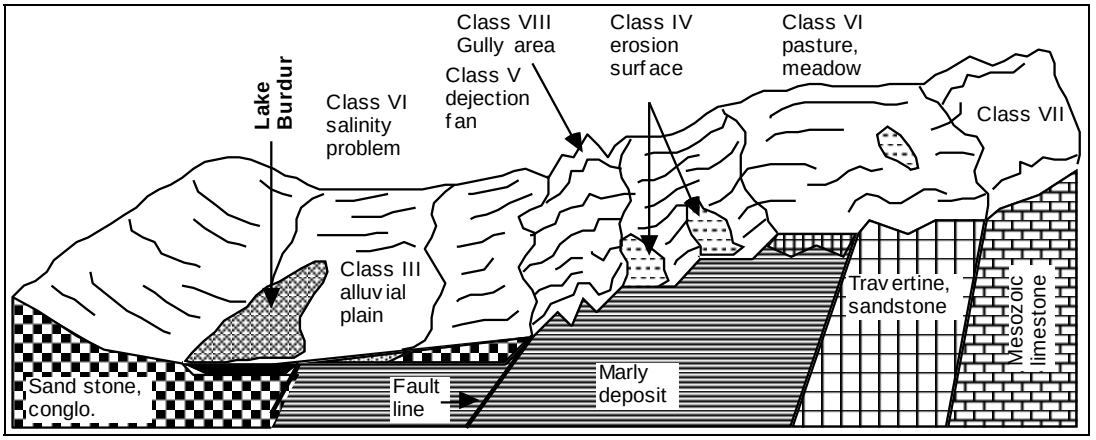

Fig. 2. Land classification based on topography and parent material in the Burdur tectonic basin, SW Anatolia

3.1.2. Plateaus

The origin, lithology and altitude of the plateaus are in different properties. For instance, the plateaus containing shallow soils on Neogene marly, sandstone, clayey limestone strata and intercalating of sedimentary and volcanic materials in the horizontal direction is suitable for dry farming in the central Anatolia. Therefore, these areas are

classified as class IV and the plateaus with stony and very shallow soils are suitable for meadow belonging to class IV (Fig. 4, 5, 9).

The basaltic plateaus higher than 2500 m elevation in the Eastern Anatolia are the main growth area of alpine grass and they are classified as class IV.

3.1.3. Plains

The plains in Turkey are divided into three groups by the formation of origins: 1. Deltaic plains, 2. Intermontane plains that were formed by the collapsing of the land along the faults, and 3. Karstic plains and 4. Karstic-tectonic plains that were formed both the dissolution of limestone and the collapsing of the area with vertical tectonic movements[8].

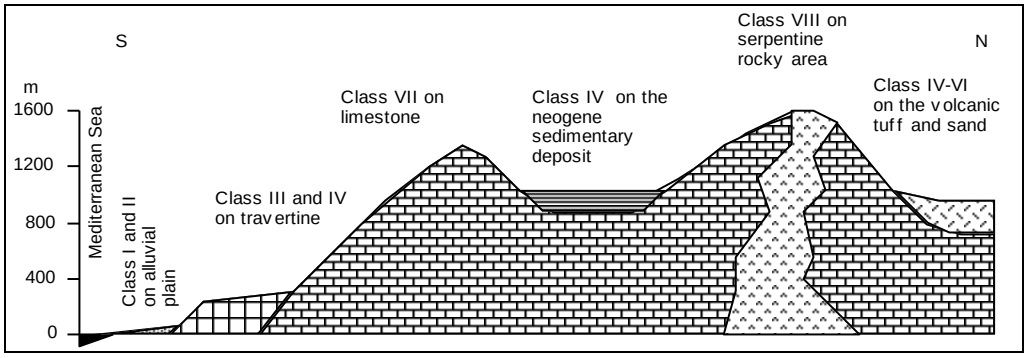

Fig. 3. The effects of topographic unites from Mediterranean Sea to inlands of Anatolia in the land classification

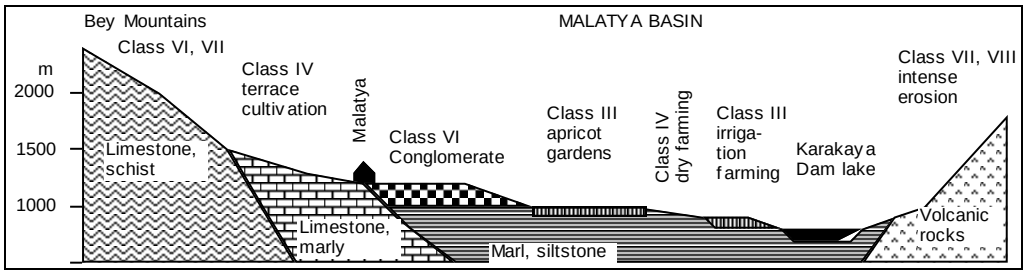

Fig. 4. Land classification depending on topographic geomorphic unites and parent material in Malatya Basin, E Anatolia.

There are general relationships among the geomorphic unites and land class in plains. The sandy levee that formed along the river channel is in class V and class VII; backswamp deposit represents class IV; the gravelly and sandy deposit of flooded area may add class V. Class. Sandy and silty deposit with good drainage in the flat land are found between class I and III under the suitable climatic conditions; wetland in the depression and sodic and salty soil affecting sea water influence form class VIII.

Some examples related to land class in the some plains: The good drainage areas that are found on plateaus and old lake deposits of Konya-Eregli plain form class IV, the wetland containing brackish water in the depression belongs to class VIII. Class V exists in the places where ground water table is high (Fig. 5).

Class IV lands are widespread on the Erzurum, Pasinler-Horasan plains, at an elevation of 1800-2000 m, due to climatic factor limits the mostly agricultural crops [35]. The plains, which are found in the grabens of Aegean Region, are in the classes between I and IV according to soil properties.

The plains on the Mediterranean coast belong to class I due to winter harvested vegetable and fruits. The terraces with conglomerate form class IV and IV, and damp and or hydromorphic soil with mostly clay texture that is found in the abandoned channels is in class IV (Fig. 6).

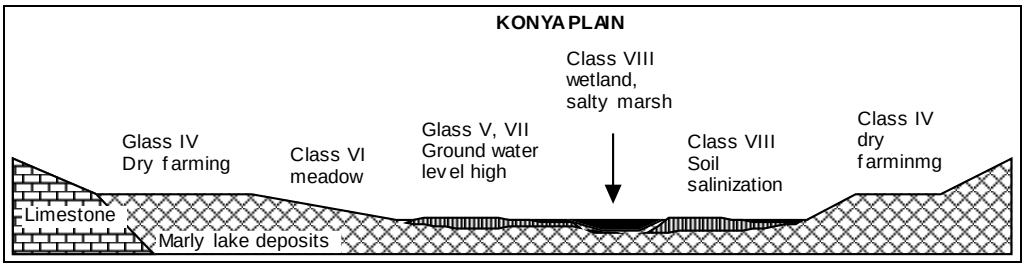

Fig. 5. Land capability distribution depending on topographic situation in the Konya Plain

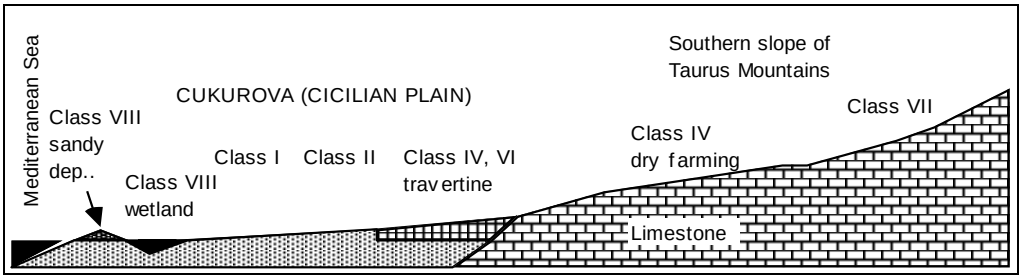

Fig. 6. Land capability classes from Mediterranean coast to southern edge of Taurus Mountains.

3.2. Climate

Mean annual temperature ranging from below 3°C to 18°C indicates to existence of different types land capability class. The mean annual temperatures less than 6°C mostly prevent to grow of agricultural crops. However, this temperature forms a suitable environment for the growth of alpine and subalpine grasses that are used for animal grazing. Coniferous forests also grow under 6°C temperature in the humid areas[18]. Whereas, productive agricultural crops harvests where the mean yearly temperature is over 12°C and January temperature is over 5°C. For instance, Çukurova (Cicilian) and other coastal plains of the Mediterranean climatic region are suitable for growing almost all vegetables and fruits.

The mean January temperature changing between 10°C and -10°C also shows the existence of the land class of I-IV, and IV-VII. The minimum temperatures determine not only to grow agricultural crops but also trees. For example, the temperature under -25°C prevents the growth of fruits like apple in the Eastern Anatolia. As to distribution of forest trees the red pine (*Pinus brutia*) subject to die under -15°C, while scots pine grows under the temperature under -40°C in the NE Anatolia and upper part of the Mountains[13,18].

It can be stated that the temperatures below the freezing point restrict the winter harvested fruit and vegetables. January temperature is generally over freezing point on the coastal areas[5,17]. Therefore, these areas are suitable for the growth of most agricultural crops. Growing areas of productive agricultural crops are found along the plains of Mediterranean region. Therefore, the grades of lands class decrease from the coastal areas toward the inner and upland parts of Anatolia.

On the other hand, the frosts in spring period cause serious damage to fruit and vegetable crops. Indeed, invasion of cold air mass during spring season especially in March leads to the frost events[16,26]. The young buds and flowers of the trees die, so the agricultural production decreases. For example on 29-31 March 2014 the Rossby wave invading of the most part of Anatolia led to serious damage for apricot, hazelnut and other fruits trees. The insufficient temperatures occurring in some years inhibit the ripe of grains.

3.2.1. Vegetation periods

As a rule, the vegetation period, based on the temperature continually occurring over 8°C, changes between 260 and 140 days in Turkey[18]. The duration of vegetation period more than 260 days occurs in the coastal belt of Mediterranean coast. Vegetation period is less than 140 days prevents the growth of fruits in the NE Anatolia, while a long vegetation period encompasses some years in the coastal belt of Mediterranean Region contributes the growth of all vegetable and fruits[16].

3.2.2. Precipitation

The distribution of mean annual precipitation ranking from 250 mm to 2300 mm considerably determines not only the crop fertility but also grades of land capability. The rainy areas totaling at least more than 1000 mm on the north facing slopes of Northern Anatolian Mountains and on the south facing slopes of Taurus Mountains are main spreading areas of good forest stands belonging to class VII. The areas of Central, East and SE Anatolia receiving less than 500 mm rainfall form dry farming areas of class IV.

Rain fed grain cultivation like corn and some vegetable only is carried on in the coastal belt of the Black Sea regions. Winter cultivation only is practiced in the winter rainy areas of Aegean and Mediterranean regions. In the semiarid region of Inner and particularly in SE Anatolia which is the hyper arid and hottest part of Turkey irrigation facilities are necessary to produce agricultural crops.

3.2.3. Relative humidity and Evapotranspiration

The amount of relative humidity especially in the summers determines in particular the selection of crops and crop rotations in the arable lands. The areas that relative humidity is low during summer and the evaporation is high form dry farming areas belong to IV. No water deficient areas that are found on the north facing slopes of Northern Anatolian Mountains are suitable for growing soft fruits and vegetables. That relative humidity is moderate high in the south facing slopes of the Taurus Mountains provides the growth of tomato and apple.

In these areas, that relative humidity is high in the summer the demand of the irrigation water is less than that of the continental region of Turkey[25]. The demand of irrigation, for example, is the highest amount in the SE Anatolian arable lands due to intense evapotranspiration. Dry farming applications in the continental part of Turkey are related to the existence of low relative humidity and high evapotranspiration.

We can reach some conclusions regarding the relationship between climatic types and land capability class in Turkey.

a. Humid mild climate of the Black Sea Coast. The climatic region is suitable for the growth of some vegetable, tea, hazelnut and fruits.

b. Cold Humid Mountain Black Sea Climate. This climate, which is not suitable for agricultural practices, supports the growth of mostly coniferous forests. For this reason class VII land is dominant in this area.

c. Subhumid/Semiarid Backward Black Sea Climate. This climate prevailing on plateaus and tectonic corridors in the backward part of the Black Sea Region supports the growth of rice along the IV valley, some of the vegetable and fruits belonging to class III and IV. The mountainous areas that mean annual temperature is less than $8^{o}C$ are found in class VII containing forest.

d. Mediterranean Climate. The irrigation lands in the Mediterranean coast present class I because almost all grains, fruits and vegetable are cultivated and agricultural production continues along the year. The other agricultural property of the region is also suitable for green houses. The other areas that mean annual temperature is less than $15^{o}C$ in the Aegean coast and south part of Marmara region is defined as II land class because slightly climatic limitations.

f. Oro-Mediterranean Climate. Cold winters and cool summers are one of the climatic limitations for the agricultural production in the mountainous areas that are higher than 1500 m elevation. The areas mostly composed of limestone are the optimum growing areas of forests in the context of class VII.

g. Continental semiarid climate of Central Anatolia and Thrace. Yearly total precipitation is around 400 mm most of which fall during the winter and spring seasons form main dry farming areas belonging to class IV.

h. Continental semiarid climate of East Anatolia. The lowlands such as Malatya, Elazig and Iğdır depressions are the main agricultural lands due to temperature are high in summer. In these areas, some of the fruits including apricot are grown. These depressions are included into class III. That snowfall and snow cover duration occurring long period in the Eastern Anatolia is the main limiting factor for the agricultural activities.

i. Semiarid hot climate of SE Anatolia. The lowlands and plateaus of this region that are hottest and aridest region of Turkey are in class IV on which dry farming is applied.

j. Marmara Transitional Climatic Region. This region covering the NW part of Turkey is under the influence of Mediterranean and Black Sea climates. For this reason, cultivated crops belonging to both Mediterranean and Black Sea regions are harvested two times during a year, notably in the plains.

k. Mediterranean Backward Transitional Climate. This climate experiencing in the lake Regions and the Inner part of Teke Peninsula in the SW of Anatolia contributes the growth of both Mediterranean and Inner Anatolian regions' agricultural crops.

3.3. Plant cover

Plant cover distribution determines and/or gives some clues for assessment of the land capability classifications.

a. Forests. The mild and humid deciduous forests of Black Sea Regions are found in the VII land capability class in the mountainous areas. The coniferous forests occurring between 1200 and 2200 m also cover class VII. In the Mediterranean climatic region the lower zone supporting the growth of Mediterranean vegetation mainly red pine and maquis mostly belong to fertile agricultural fields in class I and II in the low plains. The oro Mediterranean mountain climate that the main occurrence areas of cedar (*Cedrus libani*), Taurus fir (*Abies cilicica*) and black pine (*Pinus nigra*) forest areas belong to class VII.

b. Steppe. Steppe growing areas in the central Anatolia, southern part of SE Anatolia and depressions of East Anatolia correspond to class IV on which dry farming practiced.

c. Tall steppe and grass vegetation widespreading in the eastern part of East Anatolia form class IV.

d. Alpine and subalpine grass. The vegetation that is growing only on the natural timberline represents class IV on the flat and slightly undulating area.

3.4. Parent material

Turkey has all kind of parent materials and/or rocks belonging to all geologic periods. The effects of the parent materials according to physical and chemical properties are responsible for the subclass of mainly VII capability class.

3.4.1. Volcanic rocks

Serpentine-peridotite (spw). This rock produces fertile soils containing high cation exchange capacity rising 50 me/100 g. in deeply weathered areas. But outcropped areas it has negative effects on the plant grow. Because in the beginning phase of weathering it releases abundant clay and carbonates that have poisonous effects on the plant growth. Exposed serpentine areas are divided into subclass of VII and VIIIspw.

Volcanic tuff and sands (vt). Although nutriment capacity is very low and infiltration capacity is high, volcanic tuff and sands form a soft environment for the deeply development of plant roots, and evaporation generally is less than that of mostly other parent material due to the fact that capillarity event is low and albedo rate is high.

Negative effects of these materials are seen on the sloppy areas. Badland topography develops on the steep slopes composed of tuff and sand as is seen the Cappadocia Region that located in the SE of Central Anatolia. Dissected gully areas of volcanic tuff and sand deposits are in subclass of V, VII and VIIIvt (Fig. 8).

Basalt (b). Fertile soils with c. 70 cation exchange capacity (CEC) are common on the basalts due to alkaline mineralogical composition. However, young basalt lava is in rocky structure and creates hot environment that increases of evaporation due to high albedo. Outcropped and young basalt lavas show Negative effects on the plant growth. For that reason, these areas can be added into subclass IV, VII and VIIIb.

Granite (g). It produces sandy soil with low CEC changing 8-15 me/100 g on the deeply weathered places. Sandy soil and weathered material of granite contribute the deep root development of trees and wine. For this reason, good site index stone pine and grapevine grows very well on the weathered granite in the Mediterranean climatic conditions. But granitic parent material converts into rocky land as subclass VIIIg where weathered sandy materials are completely carried away (Fig. 8).

3.4.2. Sedimentary rocks

Limestone (k). This rock, which is one of the chemical sedimentary rocks, is commonly widespread in the orogenic belt and Cenozoic sedimentary basins of Turkey. The physical properties of the limestone determine soil formation and soil texture. In the sloppy areas, which rich in clayey soils with 40-50 CEC form along the thin cracks or fissure and bedding surfaces of the limestones. Here good site index forest is widespread because of the fact that the roots of trees deeply develops along the cracks. On the other hand, natural regeneration in these areas is very

successful due to the fact that seeds fall down within the cracks containing soil germinate and the seedlings grow very well because their roots follow the water that seeps along the cracks. At the end of a vegetation period the heights of seedlings attain 1-2 cm but the long of their roots are more than 1 meter. While clayey limestones containing low cracks produce thin soils on which poor vegetation cover is dominant.

Karstic lands are seen as subclass of VIIIk rocky land where all trees and shrubs have been completely destroyed.

Marly (m). In marly land water holding capacity is high but the available water content for plant is low, in general. For these reasons in the sloppy areas marly terrains contain poor site index forest and the success of reforestation and afforestation activities are in unreasonable level due to root development is very low. These areas can be indicated as subclass VIIm (Fig. 8).

Sandy marl and soft marly that clay content is low forms suitable arable land in the flat and slightly undulating plateaus due to easily ploughed. Some of the arable lands are found on Rendzina soil that formed on these marly deposits.

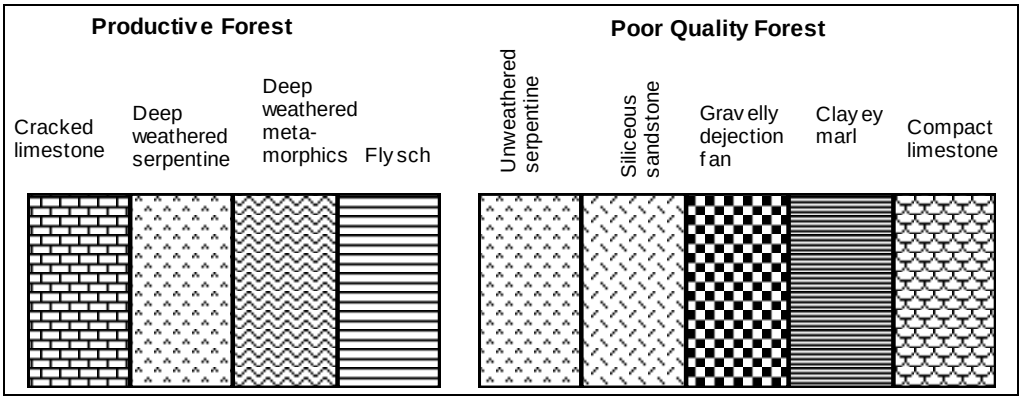

Fig. 7. The relationship between the forest productivity and parent materials

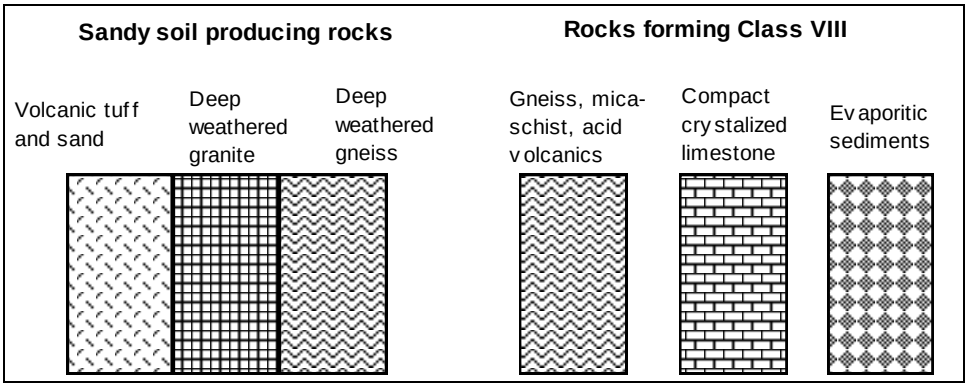

Fig. 8. The effects of some parent materials on the soil and the formation of class VIII

Flysch (f). It contains sandstone, siltstone, conglomerate layers alternately and found in the sedimentary basins. The root development of trees and shrubs are in good enough due to generally porous and soft structure. Sandy and sandy loam soils are common on the weathered flysch formation. Negative effects of flysch are very sensitive and/or vulnerable to the formation of gully erosion because fine materials are easily transported with runoff on the sloppy area. The areas that dissected with gullies are common on the steep slopes. The flysch lands in the gully erosion areas can classify as subclass IV and VIIg.

Sand and gravel (sg). No or low cemented sand and gravel deposits that are found on the edges of Mountains, old torrential and molasses basins are very sensitive to land degradation where natural equilibrium has been upset. These areas are converted into class VIII on the deeply dissected areas.

Evaporitic sediments (ev). These sediments were formed with the deposition of soluble various salt and alkaline materials accumulation under the hot climatic conditions in the closed basin. These evaporitic sediments appear along the tectonic basins around Ankara and Iğdır provinces, Narman-Oltu basin in the NE Anatolia[5,35]. The results of chemical analysis of 30 samples of evaporitic sediments in Oltu Basin, NE of Turkey, are as follows; pH 8,7-9,9; $CaCO_3$ 0,07-29,3 %; soluble Cl 0,11-3,58 me/100 g; bicarbonates 0,05-0,70 me/100 g; sulphates 0,28-32,4 me/100 g; sodium exchange 2,3-75,1 me/ 100 g; exchangeable sodium percent (EPS) 7,3-44,1; sodium absorbsion rate (SAR) 0,53-55; electrical conductivity at 25^{o}C 0,27-36,7 milliohms/cm. Especially electrical conductivity reflects the excess salty conditions[5,13]. Bare land is generally seen on the evaporitic sediments, some halophytic vegetation such as *Salicornia, Salsola* species grow sparsely. Exposed evaporitic sediment lands are the main desertification areas so that they can add subclass VIIIev.

3.4.3. Metamorphic Rocks

Gneiss (g). Gneiss which is main widespread metamorphic rocks are found in the Aegean Region, north of Thrace, Central Anatolia and the SE part of Taurus Mountains. As is granite and gneiss produce sandy soil on deeply weathered flat lands. In spite of cation exchange capacity is low forest trees particularly stone pine (*Pinus pinea*) and scots pine (*Pinus sylvestris*) grow very well. That is why, good site index forest stands are found on the deeply weathered gneiss areas[21,22,23,26]. However, gneiss and micaschist that changed into rocky land in the intense eroded areas form land capability class VIIg.

Schists that easily breaks up in the weathered areas produces sandy loam, clayey loam textured soil according the physical and chemical composition. Most of them are suitable for the forage crops production.

3.5. Land capability classes of Turkey

Class I is widespread on coastal plains of the Mediterranean and southern part of Aegean Regions. Favorable climatic conditions contribute growing almost all vegetables and fruits including winter harvested vegetable as well.

Class II is found mostly on the slightly inclination areas of Mediterranean coast, the lowland and alluvial plains of northern part of Aegean coast and southern section of Marmara Region. Especially climatic conditions support to practice of intense cultivation.

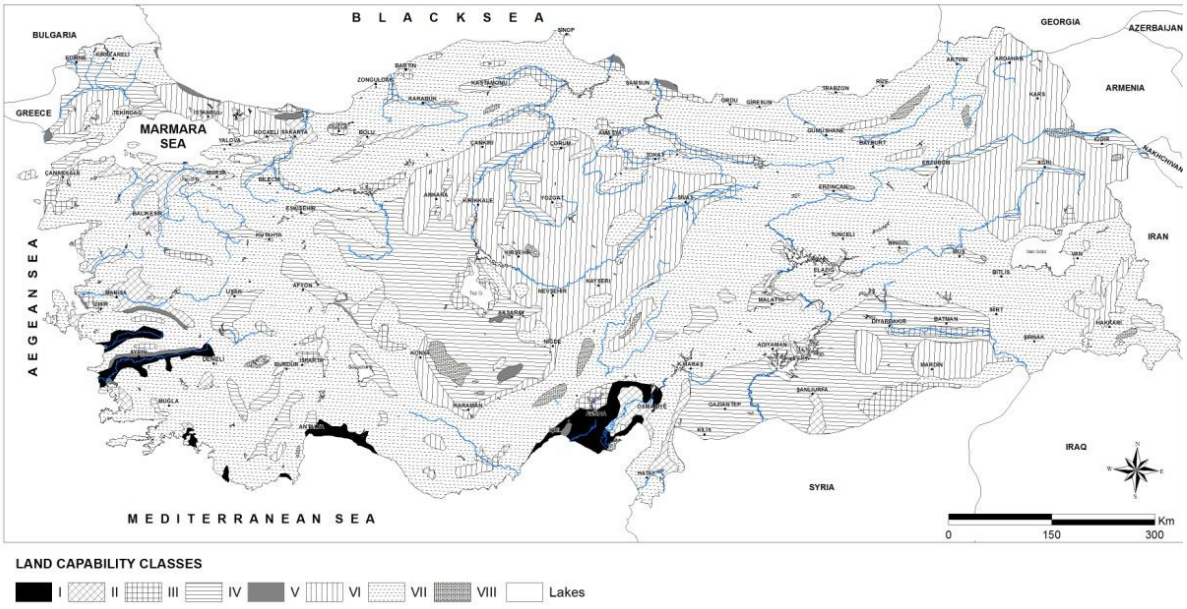

Fig. 9. Land capability classes in Turkey

Class III is common on the irrigated areas of the central part of the Anatolia and slightly undulating areas of the

coastal regions of Turkey. In these class lands are the main growing areas of sugar cane, sunflower, cheery, grains, most of the fruit and vegetables mostly for local requirements.

Class IV occurs on the plains and plateaus of semiarid regions of Turkey. Grain crops such as barley and wheat are the main harvested crops in these areas.

Class V is defined on the dejection fans and cones, and ground water level is high in the some seasons of year. Dejection cones and fans are very suitable for the growth of fig and wine in the Mediterranean climatic condition. Hydrophytic plants such *as Fraxinus, Salix, Populus* and *Alnus* species and grass vegetation grow on the ground water table is high.

Class IV occurs on the semiarid plateau surfaces with shallow stony soils that prevents cultivation in the continental areas and on the mountainous areas that above native timberline. All almost of class IV is the main spreading areas of pastures.

Class VII is found generally in the mountainous areas. Shallow soils, which reflect the physical and chemical properties of parent materials, are common. Bare lands occur on the steep slopes due to soil has been completely eroded. Parent material types determine not only the growth of vegetation but also sediment yields for flood events on the eroded areas.

In our classification, the VII land capability class divided into several subclasses according to chemical and physical properties of the parent materials as mentioned earlier. Agricultural areas account for 22 percent and remaining areas contain 78 percent of total land of Turkey (Table 1).

Table 1. Distribution of land capability class

Land capability class	Area (km²)	%
I	11639	1
II	19688	2
III	27595	3
IV	122955	16
V	4346	1
IV	145016	18
VII	450826	57
VIII	6919	1
Total	788984	100

4. Conclusions

Soil and inclination criteria and soil properties that used mostly in the land capability classification are not enough as used in Turkey. It is necessary additional factors containing detailed climatic factors that changing in the vertically and horizontally depending of topographic factors, and the geomorphic-topographic unites that arise erosional surface, dejection fans and cones etc., and the parent materials that determine plant grow on the soil eroded areas.

These additional factors were not considered by Ministry of Agriculture in Turkey; for this reason, the flat lands, which are found on the elevations higher than 1800 m, were classified as arable and/or agricultural land class I in provinces of Kars and Erzurum in the Eastern Anatolia. In our classification, class I, which is found only in the coastal areas of Mediterranean and south of Aegean regions covers 1 % of total land in Turkey, but this figure, was indicated 6.4 % in official records of Turkey.

On the other hand, there is no information related to the parent materials in the land classification for not only Turkey but also most countries. As mentioned before parent materials are very important factor in terms of plant growth, and source most of the transported materials supplies from the erosion of parent materials in the mountainous lands. For instance, the evaporitic sediments both prevent the growth of plants and the supply soluble material for the running water. The excess bed load materials of rivers such as Yesilırmak (Green River) flowing into Black Sea mainly derive from the deteriorated flysch and volcanic flysch terrains.

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