

Problems of degradation of Soils of dry Subtropics of Southern Caucasus

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Abstract

A map of degradation of soils of dry subtropics of Southern Caucasus using an example of Miles-Karabakh steppe has been made. On the basis of the map various actions directed to restoration of the broken lands are offered. In particular ways of conducting supported agriculture are offered. Based on the form and degree of degradation of the soils are options are offered for carrying out of concrete actions, intended to restore degraded lands.

Key Words

Reclamation of disturbed soils

Introduction

In last 60-70 years soil resources under anthropogenic influence have been changed. For protection and reconstruction of the natural resources of soils it is necessary to examine them in the evolutionary order, to analyze their contemporary situation, to prognosticate changes and management option.

The problem of soil degradation and soil exhaustion of Southern Caucasus dry subtropics zone has reached an alarming scale (Aliyev 1983). These problems are closely connected with the process of active social development. The main types of soil degradation are the loss of the organic matter, weakening of biological activity, physical degradation, irrigated erosion, salinization, lack of nutrients, lack of moisture, anthropogenic and chemical pollution, acidity increase, etc. (Babayev 1984, 2006; Gerayzade 1989; Mamedov 1980, 2007; Mamedov 1989). The intensive use of soil for monoculture can be considered the beginning of soil degradation (Salayev 1991). In this case the violation of technical measures also led to the loss of soil organic matter in an area of more than 1.5 million hectare, and reduced biological activity by 1.5-2.0 times.

Methods and Results

The influence of the human on a physical condition of soil has been verified. Agricultural affects density and porosity of soils. The physical degradation of soil as the result of the influence of heavy agricultural technique, leads to structural violation, concentrating the soil layer under tillage, decreasing its porosity, in some occasions to the loss of upper layers, and occupies an area 0.5 million ha. The mountainous territories of the arid zone are characterized by appreciable amplitudes of height and strong relief. Consequently about 41.8 % of soils (3.61 million ha) are exposed to the erosion of different degree. The most widespread types of erosion area: windy, water and irrigation. Here the influence of the natural factors is more aggravated by violations of the zonal agrotechnics. The salted soils are mainly in Kura-Araks lowland and Apsheron peninsula. Their area is 1.5 million ha. The nature of salts is soda, chloride, sulfate, sulfate-chlorite, chloride-sulfate. 500 thousand ha of these salted soils are irrigated. In these regions the irrigation-drainage network is out of order everywhere. This fact and violation of the irrigation regime lead to repeated soil salinity, forming an saline-alkali stain. The incomplete restitution of elevated crops of nutrients, the insufficient use of organic fertilizers, the erroneous use of crop rotations or their complete absence has led to loss of nutrients from an area of 1.5-2.0 million ha.

The chemical polluted soils mainly contain the following substances -the remnants of pesticides, herbicides, radioactive elements, heavy metals, etc. Losses of the fertile soils which have been taken away under building of megacities and their communications has also occurred.

The complex maps indicating different kinds of degradation (erosion, salting and others) have been composed. The composition of the soil degradation maps is based on exact soil maps. In this work revealing the natural and anthropogenous factors influencing soil cover have an important meaning. As an example we can present the map of the soil cover degradation of the Mil-Karabakh plain. Mil-Karabakh plain which is 772 thousand hectares of the dry subtropics zone and is widely used for agricultural production (40% of the general area).

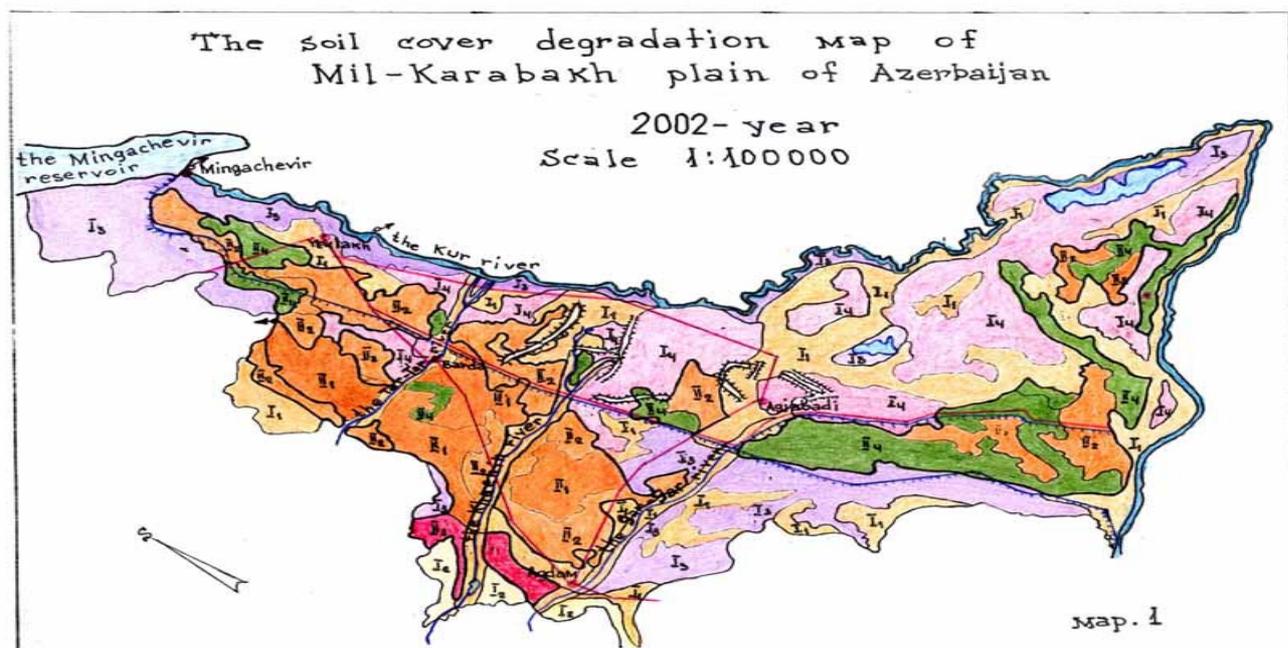


Figure 1. Fragment of the map showing degradation degree of the dry subtropics soils of Southern Caucasus

Legend to Figure 1.

- I₁- Normal soils: Virgin, greyish-brown (chestnut), meadow. An even surface, ground water level 3-5 m, humus layer 30-50 cm, it is provided with N, P, K optimally. Regulating pasturage, grass sowing, afforestation, planing surface, irrigation-drainage system, agriculture direction-forage preparation, crop rotation, mineral organic and local fertilizer. Cattle breeding, cultivated grasses, watering, technical and cereals, gardening and sericulture.
- I₂- Soil erosion: Brown Soil exposed to erosion. Strongly destroyed surface (sharply changing) concentrating, carbonate, little thickness, stony. Unfit for irrigation, afforestation, grass sowing, cattle breeding, gardening, viticulture.
- I₃- Salinity, concentrating. Salting, greyish-brown serozem, meadow and meadow-swampy virgin soils. Weak destroyed surface, surface good for irrigation, carbonate, develops on loess forming salinity. Thick layer of fine soil, provides elements of nutrition. Complex of ameliorative measures: right irrigation, improvement of collector – drainage system, planing of surface, deep ploughing, sowing of bean fodder crops. Cereals and technical cultures, viticulture, grass of high crop capacity, stock-breeding.
- I₄- Salinity-solonetz garden and repeated salting soils. Garden-saline meadow - marl soils. An even surface, exists weak slope, under ground water level 1,0-2,5 m, strong salinity, solonetz, clayey. Planing of surface, drainage, use of ameliorant on clayey soils. Cotton, cereals, vegetables, melon, grain-bean, cultural pasturage.

The soil-climatological conditions of Mil-Karabakh plain are favorable for cultivating valuable agricultural plants (cereals, bean, grape, pomegranate, cotton, etc.). On the basis of the having soil map of Mil-Karabakh plain (scale 1:200000) the map of the soil degradation of this zone had been composed (map 1). On the map have found the reflection the kinds of the soil cover degradation of Mil-Karabakh plain, and found their geographical reflection

In this connection the condition of the soils of on dry-steppe zone of Southern Caucasus has been studied, changes of physical characteristics of soils are established, the various maps and the schemes characterizing various types and level of degradation of soils have been made. In Figure 1 part of a map of degradation of soils of dry-steppe zone of Southern Caucasus, covering Miles-Karabakh plain is presented. In a legend to the map of the degraded soils actions are presented which are necessary for soils according to their degree of degradation.

In the legend of the map of soil cover degradation every kind of degradation of types and subtypes of soils are shown, they show area, agro-industrial character, limiting factors and agromeliorative measures.

The maps of the soil cover degradation identify separate regions. In accordance with the appreciation of the expertise a choice of measures directed to the prophylactic and the removal of negative processes is suggested. The given stage of work including methodical recommendations on conducting complex appreciation of soil degradation in the Southern Caucasus is prepared and on the basis a computer expert system of soil degradation expertise is composed.

So, we use these technologies to solve the problems of soil degradation and desertification, we do not try to fight with the nature, on the dry steppe we aspire to restore the natural ecological balance.

Conclusion

For the fight with the processes of degradation we use technologies promoting optimization of the natural environment situation, stable management of degraded soils enabling restoration. For the creation of these technologies it is necessary to consider traditional methods that are acceptable for the conditions of the regions. The technologies include agro and phytomelioration measures, restoration of soil biological activity and vegetation of the degraded pastures and Tugay ecosystems.

Considering the zonal soil-climatic conditions we have used the complex of ameliorative and agrotechnical methods of soil protection from erosion (soil-protective crop rotation, anti-deflation forestry zones, link sowing, soil-protective technology of soil cultivation including non-moldboard friability with root remnants, minimalization method). The irrigated system must include progressive methods of surface watering (discrete watering on furrow, automatization of watering and etc.) also technology of dropping irrigation, providing economic use of irrigated water. For preventing excessive evaporation of the deficient moisture and microelement improvement it is offered mulching. With the use of the vegetative remnants, silt of river water, zeolite, turf, waste of fish and wine-making industries, silk science, etc. The ameliorative measures must be directed to using in crop rotation with salt-stable plants which are stable under extreme environments.

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