

GENERAL APPROACH TO PLANNING AND MANAGEMENT OF LAND RESOURCES (WITH PARTICULAR REFERENCE TO RUSSIA)

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Summary

Land resources are an important and indispensable part of natural resources, providing the spatial basis of life and enabling the economic activity of humans. In turn, the soil cover is the most essential part of land resources. The outstanding property of soils is their fertility—the reason why soils cannot be replaced by anything else in agriculture, forestry or other economic activities of humans. Furthermore, the soil is the environment in which the terrestrial biological diversity of life resides and operates. It therefore plays an irreplaceable role in the functioning of terrestrial ecosystems and the Earth's biosphere as a whole.

Centuries of relentless use of the Earth's vast land resources have resulted in the spread of erosion processes, technogenic pollution and soil degradation. At the start of the twenty-first century, humankind is facing a real threat of irreversible loss of a significant part of the world's soil resources.

The huge land resources of Russia occupy 1709.8 million ha, although only one-fifth of this area is suitable for agricultural production because of unfavorable soil, climatic, and orographic conditions. The state of the soil cover of both agricultural and urban land in Russia is unsatisfactory, even critical in some regions. Currently, problems of soil conservation from destruction and degradation, and of maintenance of soil biological diversity, have gained special significance.

The general approach to planning and management of land resources should rely on a natural scientific basis, as well as legislative and organization principles, to provide economically effective and ecologically balanced soil-conservative land use.

Most important of these principles are recognition and deep understanding of the irreplaceability and non-recoverability of the ecological role and significance of soils in providing sustainable development of human society and the normal functioning of the biosphere. A necessary condition for realization of scientific principles of land resources management should be establishment and effective operation of a State Service for Soil Conservation and Sustainable Use of Land Resources.

1. Earth's Land Resources

Land resources are an essential part of natural resources, providing the spatial basis for life and economic activity of the human society. To significant degree, the importance of land resources depends on the quality of soils and their fertility.

The principles and methods of survey and assessment of land resources and soil quality were developed in Russia by the outstanding scientist V.V. Dokuchaev (1846–1903), the founder of scientific soil science, and his successors, in the 1880s. Dokuchaev's school of soil science developed a complex approach to survey and inventorying of land resources. It includes not only study of soils but also surface horizons of parent rocks, local topography, climatic conditions, vegetation and fauna, economic productivity of forests, pastures and meadows, and crop yield capacity in various agricultural systems.

The main results of the soil survey in any part of the whole country are different-scale soil maps accompanied by soil quality characteristics (composition, properties and fertility level).

The first soil map compiled by V.V. Dokuchaev was demonstrated at the Paris World Exhibition in the summer of 1890. It represented a schematic map of soil zones of the Northern Hemisphere, on which just a few soil types and surface geological formations were shown.

In the meantime, work on large-scale soil mapping was started in the USA. Large-scale maps showed local soil types ("soil series") according to their texture and properties of parent rocks

In the twentieth century, soil mapping developed rapidly in most countries of the world, becoming the main tool of soil geography and land resources assessment. It came to be based not only on field surveys but also on remote sensing techniques.

In 1947, two well-known Russian soil scientists, the geographers L.I. Prasolov and N.N. Rozov, compared the world soil map compiled by them in 1937 to the world map of arable lands. This work resulted in identification of world's land resources suitable for agriculture. It was found that these resources were not as significant as had been generally thought. After this, many scientists and specialists from different countries re-examined and refined the world's land resources, paying special attention to the ecological requirements of conservation of world's nature and soils. Soil conservation became an urgent matter because of the growing understanding of the significance of soil cover for sustainable development of nature and humankind. This significance depends not only on the agricultural value of soils but also on their indispensable

ecological role as the most essential component of terrestrial ecosystems and of the Earth's biosphere. This statement directly follows from a fact that humans obtain more than 98% of their food, including 87% of protein-containing food, using soil fertility. The whole world of terrestrial plants, which make up nearly 99.5% of Earth's biomass (by dry weight) and which produces most of the atmospheric oxygen, closely relates to soil cover. From 92 to 93% of the global species diversity of plants, animals, bacteria and fungi, live and function in or on soil. The soil cover is the Earth's shell, which is characterized by the highest density of life, biological diversity and level of geochemical energy associated with living matter.

At the same time, the state of the world's soils, especially those related to agriculture, is unsatisfactory, and even critical in many countries and regions. Soil degradation became a global problem in the twentieth century.

Almost two billion hectares of soils suffer from degradation (55.6%, from water erosion; 27.9%, from wind erosion (deflation); and 12.2%, from chemical factors such as salinization, pollution and nutrient depletion). Furthermore, during the historical period, human society has already lost 1.5 to 2.0 billion ha of previously fertile lands, by transforming them into anthropogenic deserts and badlands. This exceeds the whole area of the modern world's agricultural land, equal to 1.5 billion ha, while the global area of soils suitable for agriculture is currently slightly over three billion hectares (3 278 000 000 ha). Of this amount, only 13% belongs to highly productive lands. Furthermore, nearly 8 million ha is annually converted into non-agricultural land, while 7 million ha is lost as a result of various processes of soil degradation. Hence, humans annually lose nearly 15 million ha of productive lands. Simultaneously, the process of soil degradation is speeding up—it has increased by 30 times over the last 50 years when compared to mean historical values.

In reality, there is not much land in the world that can be brought into cultivation without increasing the impact on the environment. Furthermore, these are mostly wetlands and forest lands with low productive potentials.

In addition, every year the rapidly growing world population progressively decreases the area of productive land per capita. Therefore, leading ecologists, quite rightly, consider the process of destruction and degradation of soils as a very serious threat to human prosperity and sustainability of the functioning of the biosphere.

Being deeply concerned with development of soil degradation and land desertification, the United Nations Food and Agriculture Organization (FAO) published the *World Soil Chart* in 1982. Appealing to governments and international organizations, in this Declaration FAO formulated the main principles and recommendations on preservation and sustainable use of land resources.

The Declaration states the basic role of land resources for the lives and well-being of people as well as for economic independence of whole countries. With respect to this, the necessity of solving problems of land use optimization, maintenance and increase of soil productivity, and conservation of soil resources, should be considered as being of primary importance.

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Biographical Sketch

G.Dobrovolskiy was born in 1915. He is a full member of the Russian Academy of Sciences, and an honorary member of the International Union of Soil Sciences. He has had more than 450 publications. His scientific work is mainly concentrated on study of the genesis, geography and classification of soil, ecological functions of soils, and soil conservation.