Introduction

The diversified life forms on Earth, habitats, landscapes, and related processes, though being different objects and phenomena, form a single system, called the biosphere.

The biosphere is the layer of active life on Earth, which includes living beings and their habitats. The upper boundary of the biosphere is about 10 km high from the Earth surface, while the lower boundary is about 2 or 3 km below the Earth surface. Only microorganisms are found within the biosphere's upper and lower boundary zones. The whole hydrosphere and soil cover (the pedosphere) are a part of the biosphere. The biosphere is a rather complex system in which individual components are linked by trophic (food), energy, and other interactions. The latter are manifested by various processes of substances and energy migration and transformation. These processes are governed by specific laws and are with peculiar properties. The history of formation and evolution of the biosphere is complicated.

The biosphere is both a spatial and a functional concept. It is a single system of interrelated structural components and various processes with a mandatory participation of living organisms. These processes, taken together, ensure the stability and sustainability of the biosphere and its constituent parts (vegetation cover, fauna, landscapes, soils).

There are two different paths of sustainable development in nature. The first one is characteristic of non-living objects, such as minerals and rocks. Their sustainability is due to their inertness and

minimal interaction with natural waters, the atmosphere, and living organisms. The latter is typical of natural ecosystems, which include living objects such as soil, ecosystems, and so on, as well as individual living organisms. In this case, the system's sustainability is due to continuous processes of interaction and mass transfer. Many of these processes are a partially irreversible cycle. A living organism's metabolism is an example. When the organism's metabolism is disrupted, the organism ceases to function normally and dies. Similar phenomena occur in more complex natural systems, such as ecosystems. Their sustainability is due to the specific compliance of certain interrelated processes in space and time, and any disruption leads to the change of natural systems. Sometimes, these changes are irreversible and may even cause the complete degradation of natural systems. As a general rule, this type of stability, is relative, and can be violated naturally, by natural evolution, climatic or cosmic factors, as well as ongoing technogenic impacts.

The biosphere has many structural components, and terrestrial and aquatic ecosystems are most important of them. They, in turn, contain biota (a set of living organisms) and their habitat; interactions and changes occur constantly between them. The Earth has a wide range of ecosystems and landscapes. Soil, however, is an essential component of any soil ecosystem, as well as the biosphere.

Soil is the biggest global byproduct of the life origin and evolution, and interactions of biota with rock masses. Soil, as opposed to rocks, is a thin (a few centimeters to 1-2 meters) fertile surface layer of land. Soil is involved in all modern processes of substance transformation and migration in the biosphere. The majority of the

earth's green plants develop in soil, which is the primary source of food and bioenergy material for the rest of our planet's inhabitants. Green plants growing in the soil keep the atmosphere's oxygen levels normal. The annual energy production of terrestrial green plants is approximately ten times greater than the annual energy production of the world's fossil fuel-based industry. A large amount of biomass is transformed in the soil, ensuring the natural composition of the atmosphere as well as the relative stability of fertility and the natural soil evolution in particular.

Soil is the food base for the inhabitants of both, the land and the ocean. Biophilic elements of mineral nutrition (essential elements of mineral nutrition of plants and animals: carbon dioxide, nitrogen, phosphorus, potassium, calcium, iron, etc.), as components of marine microorganisms, plants and animals, enter the ocean first, with the surface (soil) waters and then, with river flows. Many of these elements repeatedly participated in the soil nutrition of terrestrial plants before. This is one of the migration flows that, through the soil, connects various structures of the biosphere and ensures its normal functioning. In general, the connections between the biosphere and different structural units of soil is realized implemented through biogeochemical cycles. They are a cyclic coordinated system of transformation and migration currents of substances in space and time, with necessary involvement of biota and soil.

One of the characteristic features of soil as of a natural body that distinguishes it from rocks is its involvement in the biogeochemical cycle. Biogeochemical cycles are a necessary condition for the existence of the biosphere, soil, and life in general.

Substance rotation is a condition of an individual's existence, whereas biogeochemical cycles are a condition of life as of a global event.

It is known that life on our planet originated in the ocean. Soils evolved as various forms of life developed on Earth, primarily as the vegetation cover propagated. As the biosphere evolved, soil became not only the result of, but also an important and necessary condition for the existence and development of life on Earth.

Land plowing, the use of large amounts of mineral fertilizers and pesticides (chemicals to protect plants from weeds, pests, and diseases), industrial emissions and discharges into the atmosphere, rivers, and oceans are all contemporary topical problems. Toxic substances account for a significant portion of them: heavy metals, carcinogens, artificially created radioactive nuclides, and so on. The development of marshy soils for agricultural purposes, the use of various reclamation methods, the construction of irrigation systems and reservoirs, and other human activities can seriously violate the biosphere's balance and have negative consequences if carried out with ecological ignorance.

During the contemporary technogenesis, toxic compounds participate in biogeochemical cycles, and get into plants, food, animals and the human body through the soil, hydrosphere and atmosphere.

One of the primary causes of environmental problems is lack of environmental awareness. People are not familiar enough with the laws of ecology.

Ecology has become an essential part of public life and almost all scientific disciplines, including soil science. Monograph "Soil

ecology" by Academician V.Volobuyev was first published in Baku in 1963. No comparable work has been created since then despite the well-developed soil science in the former Soviet Union. In 1993, the supplementary textbook "Ecological Soil Science" by Professor L. Karpachevsky of the Lomonosov Moscow State University was published. There are few works on soil ecology in Georgian.

The introduction of the subject "Soil ecology" in universities is very important. A future specialist must be well aware of the characteristics of mankind's supplier - the land in its various natural states depending on environmental factors. Awareness of soil properties and composition, as well as environmental factors, are a prerequisite for the further development of public agriculture, including farming.

The textbook "Soil ecology" has been printed in Georgian for the first time. It gives fundamental information on soil ecology. The book contains possible maximum information from the research conducted in Georgia. In Georgia, the subject "Soil ecology" was first taught at the Faculty of Geography of Batumi Shota Rustaveli State University and at the Faculty of Agronomy of the Agricultural University of Georgia. The course "Soil ecology" is divided into two parts: the first covers the fundamentals of soil ecology, and the second addresses the ecological crisis of soils caused by the impact of negative factors on soil.