BIODIVERSITY CONSERVATION IN RUSSIA

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Contents

Summary

Since at least the early 1960s in Russia, processes of biodiversity extinction have accelerated, and at all levels, i.e. genetic, species, and ecosystem. Reduction of biological diversity has resulted in decrease of sustainability of terrestrial and aquatic ecosystems, and caused negative changes in environment and life conditions of human populations. While in some regions of Russia, these changes have an irreversible character, in others biological diversity can be saved and restored. Signature and ratification of the Biodiversity Convention obliged Russia to implement the following objectives: generation of the legislative base on biodiversity; development of the monitoring system for biodiversity; establishment of an inventory of biodiversity in individual regions; and finally, creation of a national strategy in Russia for conservation, restoration, and rational use of biodiversity components. This strategy must be one of the components of the general Concept of Transition of the Russian Federation to the Model of Sustainable Development. Thus, the problem of conservation of biodiversity can be solved within a strategic framework of global sustainability. A number of general principles of sustainable development were identified in documents issued at the Conference on Environment and Development in Rio de Janeiro in 1992. In particular, the ecological aspects of sustainable development require a complex of measures directed at conservation of environment and rational use of natural resources; protection of the atmosphere; rational use of land resources; conservation and rational use of aquatic resources; conservation of forests; conservation of biological diversity; ecologically safe use of biotechnologies, and solution of waste problems.

1. Introduction

Biological diversity, or biodiversity, is one of the central biological concepts. It is defined as the whole complex of living forms on the Earth and all the biotic communities formed in different habitats (land, soil, sea, fresh waters). Biodiversity

both maintains and is maintained by a balance of natural processes, and the functioning of the Earth's biosphere. Diversity determines operation of mechanisms of stability of life at all levels—from molecule to ecosystem. Biological diversity is the main output of the evolutionary process.

All living organisms are natural biological resources that in turn help to create conditions for life on the Earth, including human beings. Maintenance of biodiversity is of vital importance for both present and future generations. Decrease of biodiversity would result in severe ecological problems and raise moral/esthetic consequences for human populations. It can be considered as a global problem, as important as destruction of the ozone layer or increase of carbon dioxide (CO_2) concentration in the atmosphere.

For the last 65 years extinction of plants and animal species has been proceeding at an elevated level. Degradation of many valuable communities has also been observed, mostly associated with the increasing impact of human activity on the biosphere.

For the last few decades, the rate of species extinction has been, on average, five times the background rate. Taking into account that the average period of existence for each species on the planet is about 4 million years, the theoretical average rate of extinction must comprise four species per year, for a total number of species of about 10 million. However, in the very near future, according even to the most modest estimates, about 50 000 species will die out each year. It is even possible that we could lose about half the current species diversity of terrestrial organisms in the next fifty years.

Three main reasons are usually emphasized when giving arguments about the extreme importance of halting the processes of biodiversity reduction.

The first reason (or more exactly a group of reasons) is associated with the possibility of destruction of ecosystems and biospheric functions. These functions provide for optimal gas content of the atmosphere, biological purification of fresh waters, maintenance of the ability of ecosystems to transform solar energy into the chemical energy needed by living organisms, absorption of polluting substances and consequent purification of different habitats, preservation of soil cover and soil fertility, regulation of microclimate, etc. Ecologists have always connected stability of ecological systems with diversity. Even today it is well known that biological diversity influences ecosystem functioning, i.e. reduction of biodiversity destroys structural and functional relations in ecosystems, leads to changes in, and in extreme situations, destruction of communities.

The second reason to conserve biodiversity is associated with the commercial value of living organisms. Humans use plants and animals for production of food, medicine, clothes, construction materials, etc. Furthermore, the products of photosynthesis provide people with their main source of energy. Humans rely on only about thirty species of plants, in a variety of genetic forms. This number could potentially be multiplied a thousand fold by utilizing wild species of plants for food production, until their extinction.

The possibilities of medicine production from the 250 000 species of wild plants are

almost unlimited. Humans currently only use 10 000 species of plants in medicine.

The third reason for biodiversity conservation is moral and esthetic. In only fifty years, the human population has doubled and has now reached 6 billion. *Homo sapiens* is clearly the dominant species on the Earth. As a result of human activity one third of the forests has been destroyed, about one fourth of the soil cover has been exhausted, the ozone layer has been depleted, concentration of carbon dioxide keeps on increasing in the atmosphere, and hundreds of thousands species of living organisms have died out. As humans are only one component of the planet they carry a moral responsibility for the state of the biosphere, especially as long as it is the only place where people can exist.

All the above indicate why the problem of biodiversity conservation has become the focus of attention of the world community and international organizations. In 1992 at the UN Conference on Environment and Development in Rio de Janeiro the world came together to debate environmental protection. The Convention on Biological Diversity was accepted and signed by 160 nation states, including Russia. In the first half of 1995, both chambers of the Russian Parliament ratified this Convention.

All the human commercial activity that negatively affects biodiversity or the state of biological resources, and indeed the biosphere, can be examined by taking Russia as an example. Over the last half century in Russia, the processes of biodiversity extinction have intensified at all levels (genetic, species, and ecosystem). Reduction of biological diversity has resulted in decrease of stability of terrestrial and aquatic ecosystems, and has caused negative changes to the environment and quality of human life.

While in a number of regions of Russia, these changes are irreversible, in others biological diversity can still be saved and restored.

2. Current Status and Problems of Biodiversity Conservation in Russia

The vertebrate fauna of Russia includes over 1300 species, falling into six classes. This constitutes about 2.7% of global diversity.

Mammals are the best-known group of vertebrate animals in Russia. The number of species accounts for about 7% of the world mammalian diversity. The highest species richness occurs in the Northern Caucuses, southern Siberia, and southern Far East.

The bird fauna of Russia (732 species) comprises 7.6% of their global diversity; the reptile fauna (75 species) constitutes 1.2%, and amphibians (27 species) 0.6%. Cyclostomes (lampreys) are represented in Russia by eight species, which corresponds to 40% of their global diversity. The total fish and cyclostome fauna comprises 351 freshwater, semi-migratory and migratory species, and over 400 species are found in coastal waters.

No official and reliable information on invertebrate fauna in Russia is available at present. Hence, only a rough estimate can be made of the number of invertebrate species, i.e. 130 000 to 150 000.

In Russia about 11 400 species of native and alien vascular plants belonging to 1488 genera and 197 families have been presently registered. Of these abut 20% of the species are endemic to Russia. The total number of bryophyte species in Russia is 1370.

Over 9000 species of marine, freshwater, and soil algae (macro- and microphytes) are found in Russia. This is about one forth of the world algae.

The Russian lichen flora contains about 3000 species, and the total number of fungi species (mixomycetes, oomycetes, macromycetes, and ustilaginaceae) is about 1200 species.

All existing domestic animal and plant breeds are registered in special catalogues: the State Catalogue for Protected Advances in Breeding and the State Catalogue for Advances in Breeding Approved for Practical Implementation. The number of domestic animal breeds and plant sorts recorded in the State Catalogue of Breeding Advances of the Russian Federation for November 1997 comprises 454 species and groups of domestic animals including 129 under protection, and 30 119 varieties of cultivated plants of which 375 are protected.

Biodiversity conservation through protecting areas: Protected areas in Russia occupy about 2% of its total territory. They are represented by 95 reserves (310 265.5 km^2) and 33 National Parks (66 451.4 km^2). There are also about 1600 state game reserves (up to 600 000 km^2) and over 8000 natural monuments. Floral abundance of individual protected areas and National Parks varies from 300 to 1500 species of vascular plants. That constitutes 30–80% of the total composition of a region. At present there are only 40–50% of vascular plants conserved in reserves out of the list recorded in the Red Data Book, that of mosses is 36%, and of lichens 86%. Russian reserves protect 87% of the terrestrial mammal fauna including 37 species from the Red Data Book, 92% of amphibians (3 from the Red Data Book), 73% of reptiles (6 from the Red Data Book) and 83% of birds including 60% of species from the Red Data Book. Protected areas are considered to include 60–70% of landscape diversity. Out of 58 Russian biogeographic regions, ten still have no reserves or National Parks. Not all phytogeographic regions are provided with protected areas.

Conservation of rare and endangered species: The department of biodiversity conservation of the State Committee of Environmental Protection of Russia, together with the Russian Academy of Sciences, has prepared a list of rare and endangered animals for a new edition of the Red Data Book. It includes 65 mammal species, 123 species of birds, 20 species of reptiles, 8 species of amphibians, 44 fish species, 13 worm species, 44 mollusks species, and 94 insects. Conservation and restoration of rare and endangered species are performed *in-situ* (in reserves, National Parks, game reserves) and *ex-situ* (in zoos, botanic gardens, breeding farms, and arboreta). Yet, many species have dropped out of various forms of protection and this is why it is still important to keep on expanding a network of protected areas and setting up special breeding centers for rare species, geared to re-introduction to the wild.

Biodiversity conservation in forestry: The forest fund of Russia comprises 11.81 million km^2. Protection of forests is performed in accordance with the Forest Code of

the Russian Federation of 1997. In Russia the number of forest-dependent plant and animal species includes 847 species of trees and shrubs; 1438 species of grasses and herbs; 212 species of fungi; 127 species of mammals; 158 birds (the data may be defined more precisely later). Forest habitats are typical of 80 and 257 representatives of fauna and of flora, respectively, from the Red Data Book. Most Russian reserves are located in the forest zone; hence biodiversity conservation here is more satisfactory than in other biomes. For the Russian Federation National Report on Criteria and Indicators for the Conservation and Sustainable Management of Temperate and Boreal Forests (Montreal Process, July, 1997), the Russian Party prepared statistical and analytical materials, which incorporate data on the criterion "Biological Diversity Conservation". It indicates that landscape and biological diversity has been studied insufficiently and requires a full inventory. That can be fulfilled through regular forest area arrangement (once in 10–15 years) and state registration of forest fund, i.e. a national inventory of forests (once every 5 years).

Hunting management and game animal protection: Hunting lands in Russia occupy an area of 1.5 billion hectares. About 60 species of mammals and 70 species of birds, being regular prey of commercial and amateur hunting, inhabit the territory of the Russian Federation. Since 1994 the Russian Federal Government has entrusted hunting resources and management to the Department of Hunting Resources Protection and Rational Use under the RF Ministry of Agriculture. The State Service for Hunting Resource Registration of the above Department performs an annual census of the main species of game animals, both in individual regions and throughout Russia.

Data of the Russian Federation State Service for Hunting Resource Registration reveal a decline in abundance of some valuable species of game animals since the early 1990s. This was especially pronounced in the center and south of European Russia. On the whole in Russia, the abundance of game animals has reduced, but not so dramatically. It varied within natural limits of abundance fluctuations, and the observed reductions were probably caused by the unfavorable weather conditions that prevailed in most parts of Eurasia during 1992 to 1995.

Conservation of biodiversity of marine and inland waters: The level of investigation of Russian marine biodiversity is still quite low. The Black, Azov, Baltic, White and Barents Seas, and individual parts of the Sea of Japan have been studied better than others. There is still no single organization responsible for conservation and management of marine biological resources. In addition to high fishing pressure, in recent years marine ecosystems have been experiencing a significant impact from companies that carry out oil and gas prospecting and extraction. There is a danger of losing unique marine ecosystems as a result of construction of oil pipelines and tanker transportation in both southern and northern seas. Introduction of invertebrates and fishes has also been happening without any attempt at control. This situation demands the development of a network of marine reserves and expansion of existing protected areas, and also completion of an inventory of marine biodiversity. Fresh waters in Russia are experiencing drastic anthropogenic impacts, such as pollution, transformation, flow reduction, etc. Their ecosystems, flora and fauna are dramatically altering, and the status of a number of species is considered very grave (especially for fishes such as sturgeon, salmon, etc.).

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Biographical Sketches

Dmitrii Sergeevich Pavlov was born in Moscow in July, 1938. He graduated from Moscow State University in 1960. He has the following scientific degrees: Candidate of Biological Sciences, Moscow State University (1966), Doctor of Biological Sciences, Moscow State University (1977). He worked as Senior Research Assistant (1960); Junior Scientific Researcher (1963); Senior Scientific Researcher (1969); Deputy Director of Science of the Institute of Evolutionary Morphology and Animal Ecology, Soviet Academy of Sciences (1976); Professor of Ichthyology of Moscow State University (1984); Head of Laboratory of Behavior of Lower Vertebrates in A.N. Severtzov Institute of Ecology and Evolution (1986), and Corresponding Member of the Russian Academy of Sciences (1987). His present positions include: full member of the Russian Academy of Sciences (since 1992); Deputy Academician-Secretary of the Department of General Biology, RAS (since 1997); Director (since 1998) of A.N. Severtzov Institute of Ecology and Evolution, Russian Academy of Sciences. 33 Leninsky Prospect, Moscow; Head of the Department of Ichthyology (since 1986) of the biological faculty, Moscow State University. He also took part in different spheres of social activities: Chair of the Council on Problems of Hydrobiology and Ichthyology of RAS (1982); Member of the European Ichthyological Union (1987); Chairman of the Russian Federal Program on Biodiversity (1994); Vice-President of the American Society of Wild Salmon (1995); Deputy Chair, Russian MAB Committee (1998); Deputy Editor-in-Chief, *Journal of Ichthyology* (Russia) (1983); Editor-in-Chief, *Russian Journal of Aquatic Ecology* (1992); Editor-in-Chief, *Biology of Inland Waters* (1997). His total number of publications is about 300, including several books: (1) *Biological Foundation of Fish Behavior Management in Water Flow*. Nauka Publishers. Moscow, 1979 (in Russian); (2) *Downstream Migration of Young Fishes in the Volga and Ili Rivers*. Nauka Publishers. Moscow, 1981 (in Russian); (3) *Rare and Endangered Animals (Fishes)*. Vysshaya Shkola Publishers. Moscow, 1994 (in Russian); (4) *The Diversity of Fishes from Taimyr Peninsula*. Nauka Publishers. Moscow, 1999 (in Russian); and special issues: (5) *Structures Assisting Fish Migrations*, FAO, Rome, Italy. Fisheries Technical Paper 308, 1989 (in English). The scope of his scientific interests includes: ichthyology, ecology, behavior, migration, biodiversity, and protection of fishes on dams and water intakes.

Mikhail Il'ich Shatunovsky was born in Kharkov, in June 1938. He graduated from Moscow State University in 1960. He has the following scientific degrees: Candidate of Biological Sciences, Moscow State University (1963); Doctor of Biological sciences, A.N. Severtsov Institute of Evolutionary Animal Morphology and Ecology (1979); Professor of Ichthyology (1982). He worked as a post-graduate of the Department of Ichthyology of Moscow State University (1960–1963); Junior Scientific Researcher (1963); Senior Scientific Researcher, All-Union Institute of Fishery and Oceanography, Moscow (1967–1969), Head of the Laboratory of Fish Physiology, All-Union Institute of Fishery and Oceanography, Moscow (1970–1977). His present positions are Head of the Laboratory of Ecology of Lower Vertebrates (since 1997) in A.N. Severtsov Institute of Ecology and Evolution, Russian Academy of Sciences. He also took part in different spheres of social activities: Member of the Program Committee of the 9th International Ecological Congress (1986); member of the Praesidium of Russian Ichthyological Commission (1986); member of the Bureau of the Council on problems of Hydrobiology and Ichthyology (Russian Academy of Sciences) (1982); Supervisor of project *Overall Strategy of Ichthyofauna in Extreme Conditions of Moscow Megalopolis*, Deputy Editor-in-Chief *Journal of Ichthyology* (Russia) (1983); member, Editorial Committee *Polskie Archiwum Hydrobiologii (Poland)* (1991); member, Editorial Committee on Topics in Species of Fauna of Russia and Adjacent Countries, Moscow, Nauka Press; member, Editorial Committee of Journal of Ecology (Ekaterinburg) (1990), Editor-in-chief *Russian Journal of Aquatic Ecology* (1992). He is the author of the following publications: Four books in Russian: *Ecological Aspects of Metabolism of Marine Fishes* (1980); *Ecology and Physiology of Young Sturgeons* (with A.D. Gershanovich and V.A. Pegasov) (1987); *Fishes of Moscow District* (with E.N. Ognev. L.I. Sokolov and E.N. Tsepkin) (1988), *Dictionary of Animal Names in Five Languages. Fishes*, (with Y.S. Reshetnikov, A.N. Kotlyar, and T.S. Rass) (1989), and more than 190 articles and chapters in books on fish ecology and physiology. The scope of his scientific interests is physiology of fishes; riverine fish communities; aquaculture; aquatic biological resources, and biodiversity.