Russian Academy of Sciences

Ministry of Natural Resources of the
Russian Federation

National Strategy of Biodiversity Conservation in Russia

Moscow – 2001

The National Strategy of Biodiversity Conservation in Russia was approved at the National Forum on the conservation of living nature (Moscow, June 2001).

The text of the Strategy was jointly discussed by representatives of academic and applied research institutes, institutions of higher education, ministries and departments, public organizations, business sector, deputies of the State Duma of the Federal Assembly of the Russian Federation.

Contents

Introduction

A threat of the global ecological crisis at the break of the 20th century dictates the necessity to elaborate a strategy for optimal coexistence of man and nature. The adoption of many important decisions in the field of ecology by the UN Conference on the Environment and Development (Rio de Janeiro, 1992) and signing of the Convention on Biological Diversity by many countries including Russia proved to be key events in the history of mankind.

By biological diversity in the context of the Convention is meant "the variability of living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems, and ecological complexes which include them as parts; this definition includes also the diversity within species, between species, and diversity of ecosystems."

Impaired biodiversity is a most important environmental problem facing mankind. Many natural ecosystems have been destroyed which resulted in the extinction of living organisms associated with them. One-fifth of the Earth's land surface has suffered a complete change of natural ecosystems. Thousands of plant and animal species are now threatened: over 9 thousand species of animals and almost 7 thousand species of plants are included in the IUCN Red List (2000). The extinction of 484 animal and 654 plant species has been documented since 1600. In fact, several times this number have disappeared or undergo a threat of extinction.

A further decline in biodiversity may lead to destabilization of the biota, the loss of integrity of the biosphere and its ability to maintain the principal characteristics of the environment. As a result of irreversible transformation of the biosphere, it may become unsuitable for human life. The maintenance of biological diversity on Earth is an indispensible prerequisite for the survival of man and sustainable development of civilization.

Russia plays a key role in the conservation of global biodiversity and maintenance of major functions of the biosphere because its vast territory still supports the largest natural ecosystems and a considerable part of the world's biodiversity.

The National Strategy and the Action Plan for biodiversity conservation in Russia have been elaborated to promote fulfillment of the country's commitments as a member of the Convention on Biological Diversity.

Mission

● National Strategy is a document of long-term planning.

● National Strategy determines principles, priorities, and policies of the country concerning biodiversity conservation.

● The Action Plan, a system of concrete measures and actions aimed at biodiversity conservation, is worked out on the basis of National Strategy.

● National Strategy determines main lines of elaboration of legislative and normative legal acts, a system of organizational, administrative, financial, and economic mechanisms to ensure conservation and sustainable use of biodiversity, conservation strategies for particular species and ecosystems, action plans and strategies of governmental, public and commercial bodies to the same effect.

● The Strategy expresses common aspirations of the Russian society to safeguard biodiversity thus opening the possibility for active participation of all interested parties.

Subjects

Being a document of national scope, the Strategy is designed to envolve a wide range of subjects:

● Citizens of Russia.

● Legislative, executive, and judicial bodies at federal and regional levels.

● Local self-government bodies.

● Companies and enterprises engaged in industrial production, construction, extraction and trteatment of natural resources, agriculture, forestry, fishery and hunting, transportation and communication, trade, and communal services.

● Banks and other financial structures.

● Mass media.

● Educational, cultural, scientific, and public health facilities.

● Political parties and movements.

● Religious confessions.

● Russian and international public organizations.

● Foreign juridical and physical persons acting on the territory of the Russian Federation.
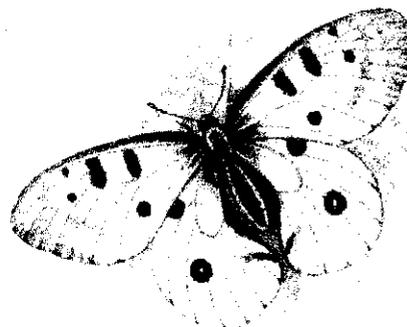
1. Specific Features of Biodiversity in Russia and Socio-Economic Conditions Influencing It
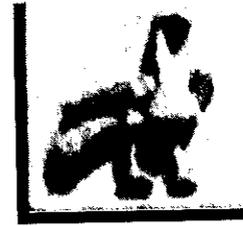
A vast territory occupied by Russia (17 million sq. km), its highly diverse natural and socio-economic conditions, and enormous length of land and sea frontiers taken together account for a unique scope of problems facing the nation in the field of biodiversity conservation.

1.1. General Characteristic of Biodiversity in Russia

● The diversity of non-tropical natural ecosystems of Eurasia (polar deserts, tundras, forest tundras, taiga, mixed and broad-leaved forests, forest steppes, steppes, semi-deserts, and subtropics) is fully represented at the territory of Russia. There is an equally high soil diversity ranging from Arctic soils in the north to brown semi-desert soils and subtropical yellow soils in the south.

The territory of Russia is unique in that it features major planetary latitudinal and zonal trends of biodiversity (well-apparent zonal succession of natural ecosystems).

Russia hosts more than a quarter of the primeval forests still remaining on Earth. Russian forests account for about 22% of the world's forest resources and 40% of the most valuable coniferous stands. The total forest cover in Russia exceeds 6 million sq. km, with swamp forests occupying 1.5 million sq. km.

Russia has the largest wetland systems in the world with its almost 120 thousand rivers totalling 2.3 million km in length and about 2 million lakes having a total area of 370 thousand sq. km (the Caspian Sea excluding). The area of man-made water reservoirs is 65 thousand sq. km. Peatlands and marshes occupy 1.8 million sq. km. They and the lakes collectively cover ca. 15% of the Russian territory (up to 85% in some regions). Thus, wetlands are of primary importance for the formation of the natural physiognomy of the country.

Russia plays the leading part in the protection of Arctic ecosystems and their biodiversity. About a third of the entire Arctic zone is situated within the Russian sector where the most typical territories of this region support characteristic Arctic ecosystems and their complexes. About 80% of the Arctic species diversity is represented in Russia, and almost 90% of the true Arctic forms live in the Russian Arctic.

About a quarter of the Russian territory is occupied by mountains: they occur in 43 of the 89 administrative regions of the Russian Federation. Mountainous areas of Russia feature a great variety of natural conditioins.

Russia is bordered by 13 marginal seas of three oceans (Atlantic, Arctic, and Pacific). The country's coastline stretches some 60 thousand km, and is thus the world's longest one.

● A major part of species diversity of Northern Eurasia, the largest land mass on Earth, is concentrated in Russia.

The flora of Russia includes more than 12,500 species of wild-growing vascular plants, over 2,200 species of mosses and liverworts, and ca. 3,000 species of lichens. Soils and waters of Russia including seas give home to 7,000-9,000 species of lower plants (algae); the number of fungi amounts to 20 -25 thousands.

The vertebrate fauna comprises 1,513 species, viz. 320 mammals, 732 birds, 80 reptiles, 29 amphibians, 343 freshwater fishes, and 9 cyclostomates; in addition, there are 1,500 marine fish species in Russian seas. The fauna of invertebrates comprises about 100 thousand species. Many of them are endemic to Russia.

● Unique natural complexes designated as UNESCO's natural and cultural heritage sites as well as centres of endemism are situated at the terrotory of Russia, such as Kurskaya Kosa (Courland Spit), coastal waters of the Barents Sea, the Caucasus, virgin forests in the north of the European part of Russia and in Siberia, the Volga Delta, Caspian Sea, Putorana Plateau, Altai, Lake Baikal, Transbaikalia, southern quarters of the Russian Far East (Primorye), Kamchatka and Chukchi Peninsulas, Wrangel Island, and other territories requiring special attention in the context of biodiversity conservation in Russia.

● According to the UNEP criteria, 65% of the territory of Russia remains virtually unchanged by economic and other human activities and supports undisturbed ecosystems.

Around 20% of the territory has suffered considerable human impact, but its ecosystems are still viable (even if partly destroyed) and retain the potential for compensation at the current rate of anthropogenic changes.

About 15% of the territory of Russia occupied by two thirds of its population is considered to be ecologically unsafe as undergoing progressive destruction of natural ecosystems and soil degradation (urban agglomerations, industrial, mining, and agricultural regions in the European part of Russia, the Urals, Siberia, and the Far East). In Russia, 124 million hectares of agricultural land (56%) are vulnerable to or actually undergo water and wind erosion.

● Unlike many other countries, Russia experiences relatively low anthropogenic transformation of natural ecosystems on a large part of its territory (northern and Asian regions). This accounts for the fact that many of them remain virtually unchanged and may serve as standard natural features. Thus far, many types of ecosystems appear to face no serious risk. In the first place, these are tundra, northern and southern taiga biomes, and most Arctic seas only slightly affected by human impact (with the exception of certain areas subject to intense economic developments).

Generally speaking, species diversity in Russia is also safe. Main faunistic and floristic complexes of all landscape zones of the country as well as freshwater and marine ecosystems still survive.

● Despite the apparent safety of biodiversity in Russia, some types of ecosystems and animal species are in a catastrophic state, that is on the verge of extinction. In particular, the biomes of European steppes and broad-leaved forests have almost disappeared, being represented today by

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*Here and hereinafter in the text of the Strategy, whenever a mention is made of a sea, mountain system or other large natural complex which occupies the territories of several countries, its part under the jurisdiction of the Russian government is regarded as an object of the Strategy.

small fragments at specially protected natural territories and military testing sites closed to the public. A large number of species are rare or endangered and require special attention. The Red Data Book of Russian Federation lists 114 species and subspecies of animals (Red Data Book. Animals, 2011); 516 plant species and 17 fungi are listed in the Red Data Book of RSFSR, 1988.

● Natural ecosystems of Russia are of exclusive value for the biosphere as they perform the most important regulatory functions. The largest peatlands and swamp forests occur in Russia. They play a key role as sinks of carbon facilitating its fixation and maintenance of carbon dioxide balance in the biosphere. Also, forests and peatlands of Russia are the most important terrestrial regenerators of oxygen.

● Northern ecosystems (tundra and taiga) dominate the territory of Russia, especially its Asiatic part, due not only to geographic location of the country but also to its continental climate and an extensive permafrost area in Siberia. These ecosystems are extremely vulnerable, slow in recovering from disturbance, and highly subject to erosion where they are underlain by permafrost if their vegetation cover is destroyed. Ecosystems of northern seas and freshwaters are equally vulnerable.

● A large part of the Russian territory is characterized by highly variable climatic conditions accounting for instability of its ecosystems. Marked annual and secular variations of environmental conditions lead to wide fluctuations in the number and distribution of many species.

● Natural and climatic conditions of Russia account for a relatively low species diversity of natural ecosystems coupled to high intraspecific and intrapopulation diversity. This should be taken into consideration in the elaboration of a system of criteria for the choice of priority objects of biodiversity, organization of monitoring, and planning biodiversity conservation.

● Over 500 local breeds, populations, and stocks of agricultural animals of 36 species are raised in Russia. Five hundred and fifty-six of them are placed on the state register of selected breeds recommended for use in the year 2000. More than 11,000 native varieties of plants are cultivated. A shift to a system of agriculture using industrial techniques, chemical fertilizers and pesticides in the last decades has had a marked levelling effect on agro-ecosystems and resulted in a decrease of their breed and species diversity.

● High diversity of cultural landscapes embodying harmony of man and nature is characteristic of Russia (gardens, parks, traditional agricultural landscapes, areas of sustainable use of natural resources by indigenous peoples, canal systems of historical value, man-made forests, etc.).
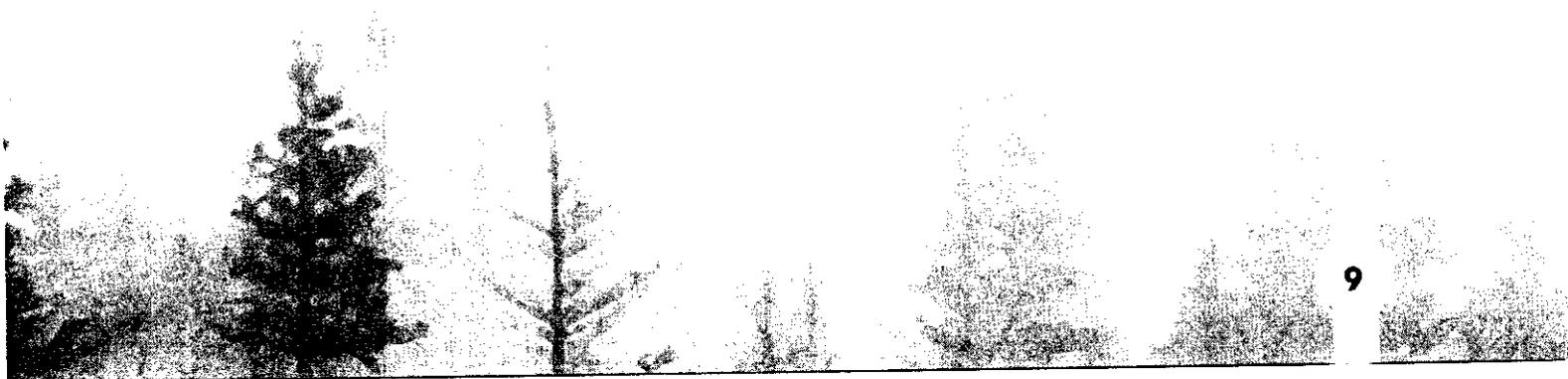
1.2. Social and Economic Conditions Influencing Biodiversity

The following social and economic factors should be considered when addressing biodiversity conservation issues:

● Highly heterogeneous social and economic conditions across the vast territory of the country:
- uneven distribution of the population;
- differential orientation of regional economies making them either essentially industrial, agricultural, mining or poorly developed;
- multinational population incorporating over 50 indigenous minorities that adhere to traditional husbandary and practice different strategies of exploitation of biological resources and biodiversity.

● Resource-oriented economy:
- key industries relying primarily on the extensive exploitation of natural resources and power-consuming technologies;
- raw materials as a main export;
- low efficiency of economic and financial mechanisms for biodiversity conservation, lack of measures and incentives by which to make attractive the rational use of natural resources and power-saving technologies;
- rapid and high returns from over-exploitation of natural resources;
- failure to assess and recognize the value of biodiversity as a considerable portion of the national wealth.

● Economic importance of biological resources. Exploitation of forests, fish-stock, game animals, and other bioresources plays an important role in the national economy at large and the leading one in some regional economies. Bioresources are vital for minor ethnic groups deriving subsistence from their traditional use.

● Widespread practice of indiscrete utilization of natural bioresources to fulfill immediate personal needs (hunting, fishing, gathering mushrooms, berries, food plants, etc.).
Poor state of knowledge and understanding of the importance of biodiversity conservation.
Strongly utilitarian attitude towards living nature among Russians promoted by the recent economic crisis. Risk of further "deecologization" of public consciousness.

● Conversion to free market economy; transition from the centralized command planning system to a private-enterprise economy regulated by market mechanisms with a degree of state involvement.

● Predominance of short and medium-term priorities over long-term strategies in government plans and plans of private companies.

● Absence of an integrated approach to the exploitation of natural resources, low levels of elaboration and implementation of programs and projects for comprehensive regional development.

● Incomplete and contradictory legislation concerning nature use and protection, rights and duties of land owners and users. Limited applicability of many legal documents and regulations.

A poorly defined law on separation of property in natural objects under joint ownership of federal and regional bodies. Absence of legal mechanisms for coordinated activities and treatment of debatable issues concerning the use and protection of migrating and other separable bioresources.

● Ineffective application of the existing laws on biodiversity conservation.

● Low efficiency of state control and supervision over nature conservation and use of natural resources; frequent reorganization of governing bodies; decreased status of nature conservation institutions; chronic shortage of budgetary funds allocated to nature conservation.

● Poor development of the state system for monitoring and statistics of the use of natural resources and environmental protection. Inadequate inventory control during the last years, impaired efficiency of ecological and hygienic monitoring via a network of plague-control stations, polar stations, forestry service, etc. Insufficient or faulty information on the extraction of natural resouces and their abusive exploitation.

● Consequences of economic crisis of the 1990s:
− increased environmental repercussions per unit of production (despite a decreasing trend since 1966); higher resource and power consumption for the country's gross output as a result of the predominance of environmentally unfriendly technologies in the production sector (resource-consuming industries most harmful for the environment were the last to suffer the decline); deterioration of basic stocks; poor technological discipline;
− considerable cuts in investments in environmental protection;
− increased frequency of technogenic catastrophes affecting biodiversity;
− somewhat decreased human pressure on agroecosystems owing to the decline in industry; reduction in the area of land under cultivation; abandonment of remote pastures and hayfields; reestablishment of woody vegetation on agricultural lands especially meadows;
− increased pollution by domestic waste and municipal effluents attributable to the wear and tear of sewage treatment equipment;
− markedly increased poaching and its transformation in many cases to an officially tolerated commercial activity undermining bioresources.

● The following facts are positive:
− well-developed network of nature reserves and national parks occupying around 2% of the total area of the country;
− deep-rooted traditions of environmental research.
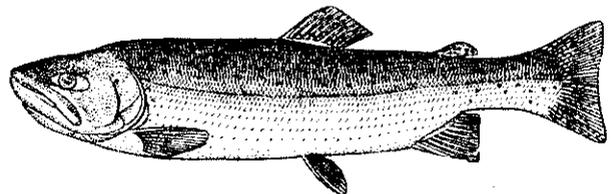
1.3. Principal Trends of Human Impact on Biodiversity

Anthropogenic factors and their negative effects on biodiversity are many and variegated. They may be arbitrarily categorized into two main groups, as follows:

● Direct effects

Decimation of animal and plant populations resulting from overexploitation, abusive and illegal exploitation; commercial harvesting of living organisms; unwise and non-selective pest control; animal mortality caused by collision with man-made constructions; destroying animals and plants considered dangerous, harmful or unpleasant to people.

Destruction of natural biotopes resulting from their transformation to agricultural lands (e.g. steppes put to cultivation); changes in the make-up of forests and in forestry itself; building; mining; draining of wetlands; water and wind erosion of soils promoted by human activities; construction of hydro-electric power plants and water reservoirs; disappearance of small rivers.

● Indirect effects are changes in the natural environment of living organisms. They are largely exerted along the following three lines.

Physical effects, i.e. changes in physical characteristics of the environment, include alteration of soil and ground physical properties; regulation of river channels; overexploitation of water bodies as sources of water supply; seismic surveys and explosion works; effects of electro-magnetic fields, noise and thermal pollution.

Chemical effects, i.e. pollution of water, air and soils with waste matter generated by industry, power plants including nu-clear power stations, mining, agriculture (herbicides, pesticides, chemical fertilizers), forestry (chemical weed and pest-killers), traffic, military facilities and operations, domestic and municipal sources, technogenic accidents (oil spills), launching missiles, and also carried by aerial transport (e.g. acid rains).

Biological effects manifest as man-induced changes in the structure of natural biocenoses and ecologically stable natural-cultural complexes include deliberate or accidental introduction of alien species and their self-dispersal; dissemination of infectious diseases of plants and animals; population explosions of certain animal species; potential penetration of natural ecosystems by genetically ngineered organisms, eutrophication of water bodies, depletion of food resources of animals.

As a rule, various human activities (agriculture, building, mining, transportation, industry, recreation, harvesting, etc.) have both direct and indirect effects on natural ecosystems. The latter may act on several targets at a time. Therefore, anthropogenic impacts are often cumulative or synergetic.

It is important to dstinguish between man-induced changes of biodiversity and natural processes of its formation. Natural effects should be considered when it comes to the elaboration of biodiversity conservation programs, but there is no much sense in attempts to block them even if possible. Those anthropogenic factors should be controlled in the first place which are crucial for biodiversity or apt to most seriously affect it.

2. General Approach to Biodiversity Conservation. Objects and Goal of the Strategy

2.1. Concept of Sustainable Development and Biodiversity Conservation Strategy

● The Strategy of biodiversity conservation should be considered as an element of the general trend of the country towards sustainable development. The Concept of transition of the Russian Federation to sustainable development was approved by the Presidential Decree No 440 of April 1, 1996. The following theses of this Decree are important for the elaboration of the National Strategy of biodiversity conservation:

- integration of society, economy and nature;

- importance of stable and maximally predictable development of the country excluding destruction and degradation of the environment.

Conservation of biodiversity can be achieved at a higher than ecosystemic level, namely at the socio-ecosystemic level which comprises socio-economic and environmental constutuents. The socio-ecosystem remains stable provided the normal development and harmonic interaction of all its components is ensured. Violation of this condition leads to the general crisis and degradation of the society and nature.

The present-day ecological crisis arises from a neglect of natural laws governing the development of ecosystems and the socio-ecosystem itself by man pursuing what he considers to be his vital interests without regard for the damage he inflicts on the environment. It should be recalled that nature often responds to human impact with a delay. Over-exploitation of natural resources may have important repercussions on the quality of human life after many years, when degradation of the environment becomes irreversible.

Social and economic developments at the expense of suppression and decimation of natural systems have led to the current economic crisis. The only way to overcome it is to recognize that the normal development of natural systems is a necessary prerequisite for the sustainable existence of the socio-ecosystem, hence of man himself.
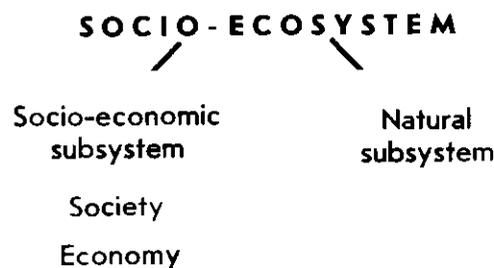
SOCIO-ECOSYSTEM

Socio-economic subsystem

Society

Economy

Natural subsystem

● Biosystems perform functions vital for mankind of which the following are most important:

Environment-forming function consists of the maintenance of biospheric processes and creation of favourable living conditions for man, such as clean air and water, suitable climate, and fertile soils. This function is crucial for human existence. Life on Earth is a result of long evolution and uninterrupted work of nature during billions of years. The biosphere acts as a regulator and maintains characteristics of the environment within a narrow range which happens to be beneficial for man.

Productive function consists of biological production. Man obtains foods and raw materials for various sectors of economy both from nature (practicing forestry, fishing, hunting, etc.) and from artificial biosystems using a variety of biotechnologies including agriculture. Many mineral deposits, such as oil, gas, and coal, are actually remnants of past life forms that thrived at eralier geologic periods.

Informational function consists of the storage of information on the structure and function of biological and ecological systems (including genetic information) accumulated in the course of a long evolution of biosphere. Today, man uses only a small fraction of this information in research and education and for the development of biotechnologies. In the future, this function will acquire an increasingly greater importance.

Spiritual and aesthetic function consists of the enormous influence of living nature on the cultural development of mankind, formation of aesthetic and ethical views, and creation of comfortable environment.

● Sustainable existence of biosystems and efficient performance of the above functions is feasible due to biodiversity. Decreased biodiversity and the loss of key components of natural ecosystems lead to their dysfunction, instability, and eventual degradation.

● The objectives of the Strategy and basic principles of biodiversity conservation should be established with due regard for specific features of biological systems, their structure, function, and evolution. The socio-economic system determines possible mechanisms for the realization of the Strategy.

2.2. Objects of the Strategy

The object of the strategy is initially designated as "biodiversity". This notion needs to be expounded.

● Living nature has a hierarchical structure, and its conservation calls for a specific approach at each level of organization. The current state of science and society allows hierarchical levels from organism to biosphere to be considered for the practical purpose of biodiversity conservation. Two interrelated and overlapping but independent hierarchies should be distinguished:

— population/species hierarchy includes systems consisting of individuals of the same species: organisms, subpopulations, populations, intraspecific forms, subspecies, species and species complexes; genetic links between individual elements of the system represent a system-forming character of this hierarchy;

— hierarchy of ecological systems includes communities of organisms, biocenoses, and ecosystems of different spatial and temporal scale; ecological relations between the elements of the systems make up a system-forming trait of this hierarchy.

Solution of practical problems of biodiversity conservation should be based on the following conceptual approaches:

— *population-species approach* based on the belief that each species is a minimal genetically closed system possessed of a unique gene pool; this approach analyses genetically related systems of the population-species hierarchy;

— *ecosystem approach* based on the concept that all biological systems are inseparably connected with their environment and with one another, and that naturally free-living organisms exist only as members of ecological communities and ecosystems; this approach analyses ecological systems at different levels.

● With these approaches, the following objects of the Strategy whose diversity needs protection are distinguished: organism, population, species, community of organisms, ecosystem, territorial complex of ecosystems, biosphere.

Objects of the Strategy and their internal diversity

Approaches	Objects	Internal diversity of objects
	Organism	Diversity of genes, cells, tissues and organs*
Population--species	Population	Intrapopulation diversity of organisms including genetic diversity Population structural diversity
	Species	Diversity of populations, intraspecific forms and subspecies
	Community of organisms	Diversity of species
	Ecosystem	Diversity of species, communities and biotopes**
Ecosystem	Territorial complex of ecosystems	Ecosystem diversity
	Biosphere	Global species diversity Global ecosystem diversity

*Internal diversity of the organism is not considered in this Strategy within the framework of practical problems of biodiversity conservation.
**Conservation of abiotic environment is a necessary condition for the sustainable development of biodiversity.

- Most important in the context of the Strategy on biodiversity conservation is the diversity of systems at each hierarchical level conducive to the complexity and stability of systems at the next higher level. Conservation of internal biodiversity of biological systems is a necessary precondition for the conservation of these systems.

- Objects of the Strategy are both natural biodiversity (species, biocenoses, and eco-systems) and the diversity of domesticated and cultivated species of animals and plants, genetically engineered organisms, and man-made ecosystems (agroecosystems, ecosystems of urban areas, artificial water reservoirs and forest stands, parks, gardens, etc.)
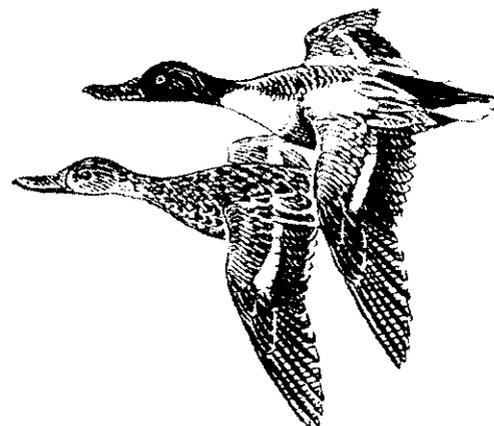
2.3. Goal of the Strategy

Based on the Conception of sustainable development, the overall goal of the Strategy is formulated as follows:

Conservation of diversity of natural biosystems at the level ensuring their sustainable existence and sustainable use, as well as conservation of the diversity of domesticated and cultivated forms of living organisms and man-made ecologically balanced natural-cultural complexes at the level ensuring the development of efficient economy and formation of optimal environment for human life.

Conservation of biodiversity is understood as a complex of active measures and actions to meet the goal of the Strategy including direct measures for conservation, recovery and sustainable use of biodiversity and application of socio-economic mechanisms through which it is influenced by selected groups of the population and economic sectors.

The goal of the Strategy determines major lines of work for the foreseeable future. The desired characteristics of biodiversity to be maintained within a given period are detailed in the Action Plan. They need to be adjusted in light of events affecting biodiversity, changes of socio-economic situation, and progress in the realization of the Strategy.

3. Biological Principles of Biodiversity Conservation

Biological systems of different hierarchical levels differ in terms of structure, function, and development. Therefore, principles of conservation flowing from a set of initial scientific premises, its major objectives and methods need to be identified for each hierarchical level.

3.1. Organismic Principle

Object: organism.

Initial scientific premise: organisms are minimal self-contained life units capable of existing in the environment and carriers of hereditary information determining basic traits and properties of the species.

Main objectives
– Conservation of organisms and conditions for their reproduction.
– Conservation of genotypes.

Methods of ex situ conservation
● *Keeping and breeding of organisms in nurseries, zoos, botanical gardens, and gene stock farms* need methods to ensure their natural and assisted reproduction.

● *Storage of genetic material:* gametes, zygotes, somatic cells, and embryos, in cryogenic gene, cell, and tissue banks, as well as in seed banks.

● *Cultivation of species.* Cultivation of species declining from overuse may alleviate or remove the pressure from their natural populations.

The organismic principle allows to preserve only a part of genetic diversity of natural populations. As a rule, only selected organisms (their genetic material) or small groups of organisms are conserved in gene banks, various nurseries, and botanical gardens. Genetic diversity of even thriving populations originating from the organisms preserved in captivity or cryobanks arises exclusively from progenitor genes (excepting new mutations). A long-term breeding of small groups of organisms in captivity tends to interfere with gene exchange inherent in their natural populations and compromise genetic diversity. Cultivation is equally inefficient as a tool to conserve the gene pool of species and their natural populations because it is fraught with significant changes of their properties and genetic structure.

The organismic principle may be considered as the leading one only when all other opportunities for safeguarding natural populations of a species have been exhausted.

3.2. Populational Principle

Object: population.

Initial scientific premise: populations are a form of species existence, elementary units of evolution possessed of a unique gene stock.

Population number is of crucial importance for sustainable existence. A population decline enhances the probability of stochastic extinction and compromises intra-population genetic diversity.

Genetic diversity, spatial, socio-ethological, age and sex structures of the population determine its stability, adaptability, and ability to survive in the changing environmental. Conservation of genetic diversity of domesticated species, cultivated breeds and varieties is an important prerequisite for their effective economic exploitation and availability for further selection.

However, neither the number and nor the genetic diversity of a population is of itself sufficient to evaluate its condition because certain human impacts on natural systems lead to a significant deterioration of the health of organisms, even if population numbers and genetic diversity remain unchanged for a time or even increase. Health status of organisms is an important indicator of the population well-being determining the possibility of their long-term sustainable conservation.

Conservation of natural environment typical for a population is another indispensable prerequisite for its effective long-term conservation.

Main objectives

- Conservation or restoration of population number and range at a level sufficient for sustainable existence and exploitation.
- Assurance of population well-being.
- Conservation of intra-population genetic diversity and genetic uniqueness of the population.
- Maintenance of population structural diversity (spatial, ethological, social, sex, and age diversity).

Methods of ex situ conservation

● *Conservation of populations of wild and domestic plants and animals in nurseries, zoos, botanical gardens, and gene stock farms*; implementation of optimal schemes for an exchange of organisms between nurseries as a tool to maintain genetic diversity in particular groups of organisms and a population as a whole.

Methods of in situ conservation

● *Conservation of populations of rare and endangered species listed in the Red Data Book of Russian Federation; monitoring and management* * *of populations of other unexploited species*. Attention should be given not only to the maintenance of population numbers, but also to the conservation of population structure.

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* Here and hereinafter, monitoring and management are understood as a wide range of measures and techniques for population, species, and ecosystem control including prevention of their illegal exploitation, rating of their legal use for various purposes (recreational, scientific, cultural, etc.), ecological expertise of economic projects likely to affect biodiversity.

• *Population control of commercial species*. When planning exploitation, the necessity of maintianing population stability, genetic and structural integrity should be taken into account. This objective is reached not only through the catch-size control but also by the evaluation of structural characteristics of a harvested fraction of the population (sex, age, size, and other variables). Conservation of population structure and genetic diversity must be a major concern in any sustainable use scenario.

• *Conservation and restoration of the environment, habitat reconstruction*. This approach is imperative in regions with intense economic activities. Decreased diversity and habitat area are a major cause of extinction of natural populations. It is often necessary and sufficient to reconstitute the environment and restore the lost habitats naturally occupied by a population at risk to ensure its maintenance and conservation.

• *Conservation on specially protected natural territories* is one of the most efficient methods for the conservation of rare or endangered populations including populations of species listed in the Red Data Book of Russian Federation. In may cases, a specially protected natural territory needs to be established for the conservation of a given population.

• *Assisted or artificial reproduction* is an effective tool for the maintenance of natural populations whose natural rehabilitative mechanisms have been undermined by overexploitation or disturbance (certain commercial, rare, and endangered species). However, partial and especially total dependence on artificial breeding is fraught with a disturbance of the population genetic structure and impoverishment of its gene pool. No effort should be spared to recover the population's potentai for natural reproduction.

• *Measures for the prevention of damages to the population spacial structure* caused by engineering works (pipelines, highways and other roads, power lines, canals, dams, etc.); establishment of corridors for animals; the use of devices excluding animal mortality on man-made constructions.

• *Technological and organizational measures for the prevention of animal mortality* during agricultural, felling, ameliorative, and other works; assistance to animals in emergency situations (technogenic and natural disasters, weather anomalies, etc.)

• *Elimination of factors threatening the health of organisms,* such as chemical and radioactive pollution of the environment, injurious harvesting techniques, depletion of food resources, deterioration of hydrological conditions, and other environmental changes. The cause of the worsening health of the organisms should be identified and eliminated to ensure the long-term conservation of the population.

• *In situ conservation of populations of domestic animals and cultivated plants* implies their keeping in initial conditions under which a given race, breed, or variety originated and developed. Maintenance of typical agroecosystems, habitats, and breeding conditions is a necessary prerequisite for the in situ conservation of the diversity of forms and races. Territories where a traditional economy is practiced may be used as an instrument of in situ conservation if they are protected from import and introduction of alien breeds and varieties. In situ conservation techniques allow to combine protection and sustainable use of local genetic resources of plants and animals, maintenance of traditional economies and nature management, and sometimes conservation of natural ecosystems (e.g. grazing aboriginal livestock in steppe reservations).

• *Prevention of hybridization between protected wild organisms and genetically engineered ones* is crucial for the conservation of natural populations, domestic animals, and cultivated plants.

3.3 Species Principle

Object: species.

Initial scientific premise: species is a minimal genetically closed system carrying a unique gene pool; as a rule, species exists as a system of interrelated local populations, intraspecific forms and subspecies.

Conservation of the population structure of a species is a necessary precondition for its stable existence and sustainable exploitation. Local populations, intraspecific forms, and subspecies are carriers of unique adaptations to specific environmental conditions. In order to maintain the spatial and genetic structure of a species, it is necessary to ensure an extent of isolation of its populations and forms that takes place in nature. Both an exceedingly strict isolation and a break of the isolating barrier as well as artificial mixing are detrimental for populations and forms.

Main objectives

– Conservation of species numbers and range.
– Maintenance of spatial and genetic population structure.
– Conservation of the diversity of populations and intraspecific forms (seasonal races, ecological forms, subspecies, etc.)

Methods of in situ conservation

● *Conservation of rare and threatened species listed in the Red Data Book of the Russian Federation*, monitoring and management of other non-exploited species. Attention should be given not only to the maintenance of numbers and range, but also to the conservation of population structure.

● *Population control of commercial species*. When planning exploitation, not only the maintenance of species number at a constant level should be considered but also that of genetic and structural integrity of its populations. Inter-regional and international co-ordination of harvesting strategies over the entire range of the species is mandatory.

● *Conservation and restoration of the environment, habitat reconstruction*. This approach is imperative in regions with intense economic activities. Habitat rehabilitation may be necessary if certain important biotopes of the species, e.g. breeding or wintering sites, have been lost or when an extinct pop-ulation of the species needs to be reconstructed.

● *Conservation on specially protected natural territories* is one of the most efficient methods for the conservation of rare or endangered species occupying small areas. This equally refers to a number of species listed in the Red Data Book of Russian Federation.

● *Reacclimatization (reintroduction) of species, restoration of the lost populations.* Reacclimatization should be done taking into account requirements of the species for a specific environment (areas formerly inhabited by the species, reconstructed or specially selected new biotopes may be used for the purpose). Also, the species genetic structure and potential repercussions of its reacclimatization on natural ecosystems should be considered. Reacclimatization is especially valuable as a tool for safeguarding species listed in the Red Data Book whose numbers and range significantly decreased in the past but tend to recover at present.

3.4 Biocenotic Principle

Object: community of organisms.
Initial scientific premise: in nature, species live in close functional relation to other species; collectively, they give rise to a community of organisms.

Species diversity accounts for the complex structure of communities and their cenotic relationships. The disappearance of some species and a decrease in species diversity result in community degradation. Introduction of alien species either by man or through spontaneous dispersal may also lead to a change in the structure of natural communities. Their effective and long-lasting conservation is feasible only if their intrinsic species diversity is preserved with due regard for natural community dynamics.

Main objectives
— Conservation and restoration of communities.
— Conservation of species and functional diversity of communities.
— Maintenance of natural processes underlying formation of community structure and composition.

Methods of conservation

● *Control and regulation of anthropogenic pressure on communities.* This objective is achieved in a variety of ways including management of individual species, regulation of recreational pressure, etc. A reduction of human impact on biocenoses to the level at which communities still retain their ability for self-recovery may be sufficient for their lasting conservation.

● *Monitoring and management of community composition and structure.* Stability of natural communities is ensured by maintaining their intrinsic species composition including relative abundance of the constituent species and the structure of cenotic relationships, with due regard for their dynamics.

● *Monitoring and management of the species composition of organisms derived from natural ecosystems.* These objectives are achieved by maintaining species composition and biodiversity typical of natural ecosystems under different conditions of exploitation.

● *Reintroduction of species extinct from a biocenosis.* This method is efficient when the structure of a biocenosis has not under-gone irreversible changes since the time of species extinction. Reintroduction enhances overall stability of the biocenosis. Conversely, reintroduction of a species into a grossly altered biocenosis may be detrimental for its stability.

● *Monitoring and management of spontaneous dispersal and acclimatization of alien species.* The main task is to prevent the introduction of invasive species which can significantly change the structure of natural communities. Removal of such species from a biocenosis and restoration of its original structure may be difficult or unfeasible. It is necessary to distinguish between the natural introduction and dispersal of non-invasive species and those induced by man. The former should be promoted.

● *Prevention of penetration of genetically engineered organisms into natural ecosystems,* control of their use in agrosystems and in forestry.

● *Restoration (reconstruction) of communities and biocenoses.* This method is used when damages to a biocenosis are so serious that its self-recovery is either impossible or time-consuming.

3.5. Ecosystem Principle

Object: ecosystem.

Initial scientific premise: a totality of functionally related organisms (biocenosis) and abiotic components of the environment where they coexist (biotope, ecotope) make up an integral system (ecosystem).

Effective lasting conservation of species and communities of organisms is possible only in their capacity as members of a natural ecosystem, together with their specific environment. The quality of abiotic components (water, air, ground) is considered today as most important indicator of environmental health.

The normal existence and development of ecosystems implies a regular succession of stages. Its dynamic character should be taken into consideration in the elaboration of the strategy of biodiversity management at the ecosystemic level. Ecosystem conservation can be ensured only through the conservation of the diversity of communities representing various stages of succession and the total stock of their species.

Main objectives

— Conservation and restoration of natural ecosystems, maintenance of their environment-forming functions.
— Maintenance of natural processes underlying the development of natural ecosystems.
— Conservation and restoration of ecologically balanced natural-cultural complexes.
— Conservation and restoration of the environment (abiotoc components of ecosystems).

Methods of conservation:

● *Monitoring and management of the use of land and water areas*. At this level, the attention should be paid first of all to the conservation and restoration of abiotic environment.

● *Establishment of specially protected natural territories with different protective regimes*. The protection of such territories may include special measures for the conservation of the environment, e.g. a ban on a specified physical or chemical impact, protection of unique abiotic features of the environment (waterfalls, springs, cliffs, etc.).

● *Reconstruction (restoration) of natural ecosysyetms* is required if an ecosystem and the related habitat have been destroyed. This method includes habitat reconstruction as an essential stage of the conserevation process.

● *Support of traditional economic activities* is necessary for the maintenance of ecological equilibrium in natural-cultural complexes.

● *Construction of ecosystems* is in order when restoration of natural ecosystems is unfeasible, e.g. in agricultural, urban, and industrial areas, man-made water bodies, etc. Artificial ecosystems with a structure similar to that of natural ones are most stable and have the highest environmental-forming potential.

3.6. Territorial Principle

Object: complex of conjugate ecosystems occupying a single land or water area.
Initial scientific premise: territorial complex arises at a territory having a unique history and harbouring interrelated ecosystems.

Biodiversity conservation within territorial complexes of ecosystems requires to take into account the following data:
– distribution of biodiversity objects through the territory;
– total area of nature ecosystems;
– spatial structure of populations, species, ecosystems;
– minimal areas for sustainable existence of natural biocenoses and ecosystems;
– minimal areas for existence of particular individuals, families and populations of protected species, including the requirement of the conservation of various seasonal habitats.

Main objectives
– Conservation of territorial complexes of ecosystems.
– Conservation of the diversity of natural ecosystems and their spatial structure within the territorial complex.
– Conservation of the diversity of ecologically balanced natural-cultural complexes.

Methods of conservation:
● *Territorial planning with a view to objectives of biodiversity conservation.* Planning of socio-economic developments at administrative territories (e.g. the siting of engineering works such as construction of roadways and other linear structures, allotment of land, etc.) should take into consideration the needs of biodiversity conservation including protection of species and ecosystem diversity, integrity of territoral complexes of ecosystems, etc.

● *Planning of measures for the conservation and sustainable use of biodiversity in ecological regions or basins.* Any anticipated impact on biological systems should take into consideration their size and integrity; in other words, it should be planned by the basin or ecoregional principle and supplement administrative-territorial planning.

● *Measures for conservation and recovery of spatial structure of populations, species and ecosystems:*
– prevention of fragmentation of natural ecosystems by organization of ecological corridors (including the establishment of special regime of land use on the rights of way around engineer constructions and

troads, as well as other non-reclamated lands;
– conservation of natural barriers between populations, species and ecosystems; their recovery if they are disturbed by men.

● *Creation and development of the network of specially protected natural and historico-cultural territories with different protective regime.* Compexes of ecosystems may be conserved within the bounds of large specially protected territories. Smaller territories having this status are designed to protect individual ecosystems or their constituent elements (e.g. nature sanctuaries and natural monuments). Natural ecosystems, ecologically balanced natural-cultural complexes, and their elements at specialy protected territories should be connected by ecological corridors established on specially alloted and managed lands such as right-of-ways and others used by a public utility or man-made construction. The network of specially protected natural territories must ensure protection of the diversity and integrity of territorial complexes of conjugate ecosystems.

3.7. Biospheric Principle

Object: the biosphere.

Initial scientific premise: species and ecosystem diversity supports biospheric processes and ensures functioning of biosphere as an integral system.

A global decline in species and ecosystem diversity affects spatial integrity of the biosphere and thus undermines the ability of the Earth's biosystems to perform their functions.

Main objectives
- Conservation of the global ecosystem (biosphere).
- Conservation of global species diversity.
- Conservation of global ecosystem diversity.

Methods of conservation

• *Elaboration and implementation of global, regional and national strategies for biodiversity conservation.* Convention on Biological Diversity gave impetus to the development of a global biodiversity conservation system. The Convention provides a framework for international co-ordination of principles and approaches to biodiversity conservation.

• *International agreements on biodiversity conservation and control of their implementation.* The basic objective of relevant international agreements is to ensure conservation of the systems most important for the normal functioning of the biosphere or to improve control over human activities most harmful for living nature.

• *Elaboration and implementation of international research and development programs on conservation of selected species and natural systems.* Such programs must be primarily targeted at the objects most important for the conservation of global biodiversity and may be implemeneted at a global or regional levels.

• *Participation in keeping the JUCN Red List* and other international lists of rare and threatened plants and animals aimed at identification of live organisms most vulerable globally or regionally.

• *Development of global network of specially protected territories* including biosphere reserves and other systems of specially protected natural and historico-cultural territories of international importance.
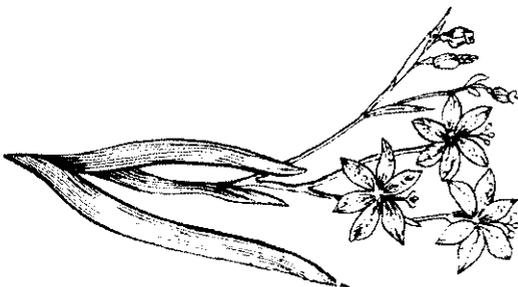
4. Socio-economic Mechanisms for Realization of the Strategy

4.1. Principles of Application of Socio-Economic Mechanisms to Biodiversity Conservation

Conservation of biodiversity should be considered as a government and society priority. It must be included in the system of socio-economic relations as a most valuable component of the national wealth and a necessary condition of national and international security.

The Strategy of Biodiversity Conservation should be co-ordinated with the strategy of the transition of Russia to sustainable development and with the strategies of development of other spheres of the country's life: economy, law, social insurance, culture, education, ecological policy, etc. The aims of biodiversity conservation should be considered in programs, plans, and forecasts for all spheres of life and at all levels of state government.

Biodiversity conservation implies integration of norms and principles of nature protection into organization of economy and the system of rules of conduct accepted by all social groups as an element of national culture. Successful conservation of biodiversity is only possible based on developing a clear consensus of all government and public institutions and private companies that may be considered to express interests of different groups of the population. Such concensus is reached via a series of politcical, economic, organizational, legal, educational, and propagandistic activities.

The general approach to biodiversity conservation and the ultimate goal of the Strategy provide a basis for identifying principles of the application of socio-economic mechanisms available for the purpose. The may be described as follows.

- *The principle of broad action*. Socio-economic mechanisms of realisation of the Strategy should regulate the activity of all governmental, commercial and public structures as far as it directly or indirectly influences the condition of biodiversity.

- *The principle of pertnership*. Success of Strategy implementation depends on efficient partnership. A broad circle of partners well aware of their role in conservation of biodiversity and actively participating in attaining its goals are recruited from non-traditional actors, such as mass media, small business sector, armed forces, frontier guards, resource-extracting and processing companies, non-governmental organizations, religious confessions, etc

- *The principle of openness and free access to information* on the condition of biodiversity and relevant risk factors is crucial for the success of conservation and sustainable use of biodiversity. Promoting public awareness of biodiversity and problems of its conservation greatly enhances the operational efficacy of all socio-economic mechanisms available for the purpose.

- *The principle of broad participation of of a lay public and non-governmental organizations* in ecological decision-making and in the development of an efficient system of coordinated public and government management of natural resources.

- *The principle of optimisation of relationships between natural and socio-economic subsystems*, based on the understanding that a sustainable existence of one is impossible if the other is unsafe. Concrete decisions must take into account both the interests of people and the requirements of biodiversity conservation.
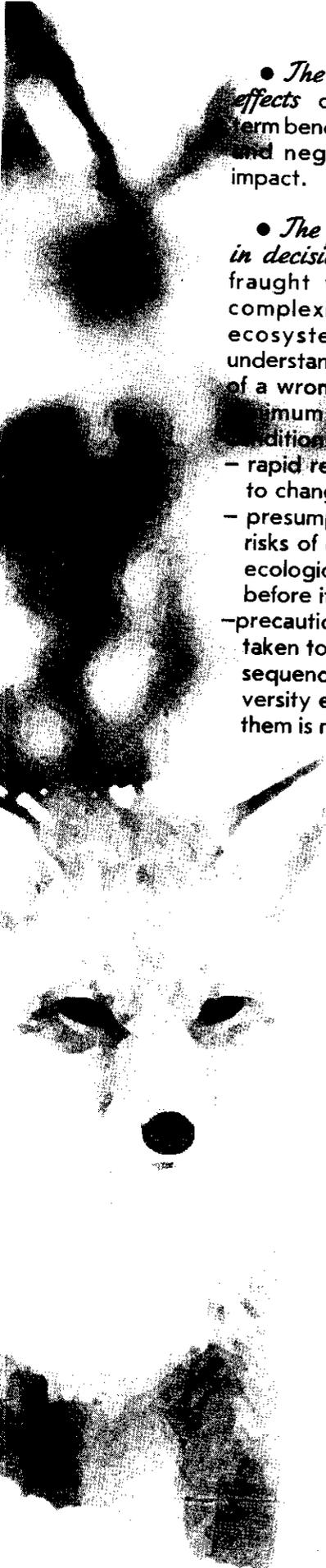
● *The principle of account of delayed effects* of decisions, including both long-term benefits from biodiversity conservation and negative consequences of human impact.

● *The principle of minimization of risk in decision-making*. Making decisions is fraught with high risks owing to the complexity and instability of socio-ecosystems and the absence of clear understanding of their functioning. The risk of a wrong decision can be reduced to a minimum by observing the following conditions:

— rapid response of the managing system to changes in biodiversity;
— presumption of potential environmental risks of economic activities implying that ecological safety of a project be tested before its implementation is initiated;
—precautions or special measures should be taken to prevent potential negative consequences of economic activity for biodiversity even if a causal relation between them is not immediately apparent.

● *The principle of broadening of the scope of application of the known and approved socio-economic mechanisms*, improving their efficiency to facilitate implementation of the strategy and attaining its ultimate goal. Totally new mechanisms may be used only if a desired aim cannot be achieved by the existing methods or en they prove inefficient.

● *The principle of account of normalized characteristics of the environment and rates enforced for particular impacts* exerted by economic and other activities. This principle is employed to formulate administrative mechanisms to realize a system of prohibitory rules and limitations, economic mechanisms to regulate economic interests of various sectors (taxation) and mixed mechanisms (licensing, certification).
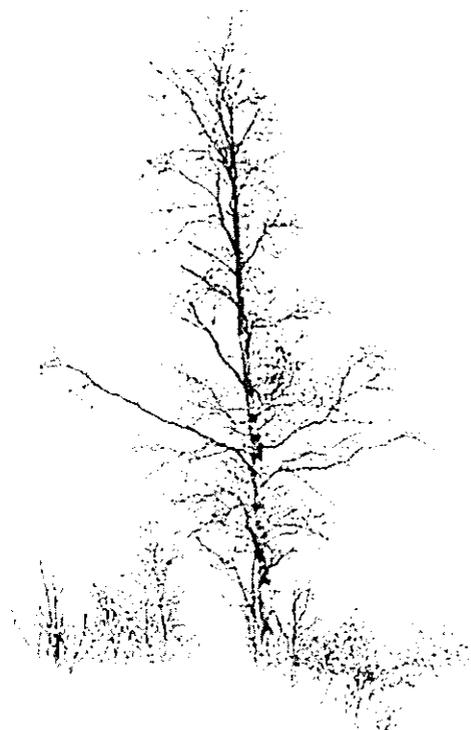
4.2. Legal Mechanisms

Improvement of legal mechanisms should be in the first place aimed at introducing biological principles of biodiversity conservation into the law sphere with regard for socio-economic conditions of their realization.

Legal mechanisms pertinent to biodiversity conservation include three elements: legislation, its practical application, and law-enforcement. Generally speaking, the current situation in Russia is characterized by fairly well-developed legislation and poor implementation of the existing laws.

Legislation

A basis for modern Russian legislation is provided by the Constitution of the Russian Federation. There is a well-developed system of legislative institutions, rules, and prescriptions concerened with biodiversity conservation. The law On the Conservation of the Environment is of crucial importance. Also pertaining to biodiversity conservation are the laws On the animal world, On Specially Protected Natural Territories, On Ecological Expertise, On Mineral Resources, Water and Forest Codes. There are a number of presidential and government degrees and by-laws on conservation and use of natural resources and the environment. Russia is a member of many international conventions on conservation and sustainable use of biodiversity and its components, protection of marine and air basins.

On the whole, Russia has rather a large body of laws regulating biodiversity use and conservation. However, many of them are frame documents laying emphasis on natural resources and have to be realized through the introduction of additional legislative acts. Hence, controversies and conflicting situations dictating the necessity of

changes, amendments, and further target-oriented work of making new laws in the areas covered by the Convention on Biological Diversity.

Systemic consideration of basic requirements for biodiversity conservation as one of the most important strategic resources of the country is very important in the period of reforms and development of the Russian legislation.

Development and improvement of legislation

● Systematization and improvement of the enacted laws on the use of nature resources and environmental protection. Extension of the existing legislation on the protection and sustainable use of biodiversity along the following lines:

– Adoption of the new edition of the basic law On the Conservation of the Environment to meet present-day socio-economic conditions and needs of biodiversity conservation.

– Adoption of the completed Land Code ensuring biodiversity conservation in the land sale-and-purchase process and subsequent land use; it is necessary to maximally broaden and clearly specify ecologically-slanted charges and public land servitude (right by which a piece of land owned by one is subject to a specified use by another), co-ordinate articles of the Land Code concerning protected lands with those of the law On Specially Protected Natural Territories.

– Modification of the Water and Forest Codes with a view to creating an up-to-date system of state control over the exploitation of land and water areas by owners and users designed to improve nature conservation in general and biodiversity in particular.

● Modification of tax legislation in order to increase collection of rental payments for the use of natural resources and offer tax incentives to encourage their sustainable use.

● Inclusion of biodiversity issues in protocols of ecological expertise.

● Development of methods for the estimation of the loss of specific resources in connection with damages inflicted on natural complexes and ecosystems in general.

● Further legally enforced separation of property in natural resources between the federal government, regional and municipal authorities, differentiation of their ensuing rights and commitments with a view to facilitating the resolution of disputable issues concerning separable (migrating) natural objects.

● Adjustment of legislation concerning administrative infringements of the law including the levy of heavier fines for the damage to biodiversity, optimization of mechanisms for bringing juridical persons to administrative account, creation of strict legal grounds for the on-site confiscation of tools and products of illegal nature use.

● Further development of traditional legislating actions. Adoption of laws on the protection and use of plants, game animals, fish, and soil; on trade and commerce in rare and endangered animal and plant species; on the prevention of penetration of alien species into the country; on the status of old forest stands and wetlands of international importance.

● Development of legislation bearing in mind the ecosystem approach and biological principles of biodiversity conservation.

● Development of legislation to regulate access to genetic resources and sharing benefits from their use with that in mind that Russia may be both an exporter and importer of genetic resources. A use of genetically engineered organisms should be guided by the Russian law (1995) on genetic-engineering techniques and the Cartagena Protocol on biosafety (2000) that regulates international transport of such organisms.

● Improvement of legal framework for the protection of public ecological rights including the development of various forms of public participation in making ecologically important decision, legally bounding practice of public hearings on environmental projects; rules concerning the liability for the concealment of vital ecological information.

● Development of legislation ensuring conservation of natural systems and traditional methods of nature use by indigenous peoples.

Practical Application of Legislation

This function rests on federal and regional bodies of executive and legislative power and organs of local self-government.

The existing legislation needs to be analysed with respect to laws concerning biodiversity conservation; relevant reviews and comments on their practical application should be conveyed to specialists through publication with special reference to the danger of law infringement and misdeeds in this sphere for state economy and population.

Specially authorised state agencies for conservation, monitoring, and management of natural resources, ecological expertise, environmental protection and other government bodies (customs, procuracy, internal affairs and security agencies) as well as organizations directly responsible for biodiversity conservation act inefficiently and actually in an uncoordinated manner. Coordination of their activities is needed to prevent and suppress illegal or abusive use of biodiversity.

Law application can be promoted by training and education of the personnel in law and biodiversity conservation; allocation and efficient use of funds to drastically raise the level of their technical equipment; adoption and publication of

relevant by-laws and their enforcement; increasing personal responsibility as stipilated by the labour legislation of the Russian Federation.

Law-enforcement

To-day, the low level of law-enforcement is a burning legal problem. Nature protection suffers more seriously than other spheres from the inadequate law-enforcement because it is far from being a major priority of law-enforcement bodies.

They are now confronted with a task of building up a system of organizational, technical, economic, and ideological measures which must ensure inevitable responsibility for any violation of ecological legislation or damage inflicted on living nature. To enhance the efficiency of law-enforcement, it is very important to raise the level of ecological and legal education of the population and especially that of officials and specialists making environmentally important decisions.

Law-enforcement with special emphasis on biodiversity conservation must follow two main lines.

● Control and supervision of nature protection by specialized agencies, law-enforcement organs (militia, procuracy), and other government bodies. More efficient crime control as regards abusive exploitation of biodiversity is urgently needed. Priority must be given to monitoring activities of enterprises directly exploiting biological resources (forests, fish stock and other aquatic bioresources, game animals) or engaged in activities that pose a risk for the environment (agriculture, building, mineral extraction, etc). The following measures are needed to ensure effective control of these activities:

– equipment of controlling and supervising organs with necessary technical tools and methods for the detection and collecting evidence of an illegal action injurious to biodiversity;

– rapid retrieval of information from monitoring facilities suggesting potential direct or indirect threat to biodiversity;

– general improvement of state control and

supervision, correction and adjustment of relevant technical documentation (methods, standards, regulations, norms, etc.).

● Bringing to account of the perpetrator or perpetrators and imposing punishment by administrative commissions, inspections or courts. Improvement of court practices as regards cases, suits, and complaints of citizens and non-governmental organizations, elaboration of legislative strategies pertinent to the infringement of law on conservation and use of biodiversity, more efficient putting into effect court orders concerning environment-related cases to ensure inevitable legal responsibility for ecologically significant violations or abuses of the law. The following forms of responsibility are distinguished:

– administrative – the system of fines needs improvement;

– disciplinary – to be imposed not only by nature conservation agencies, fishing and hunting inspectorates but also by all other relevant bodies including organs of state environmental control and supervision;

– civil – improvement of procedures for bringing actions for a damage to the environment in a court by individual persons and public organizations;

– penal – when the lawsuit requires estimation of real danger to the environment;

– ecologo-legal – when the loss of right of nature use and cessation of environmentally unfriendly actions are in order; this form is applicable to all subjects exploiting bioresources or engaged in other economic activities.
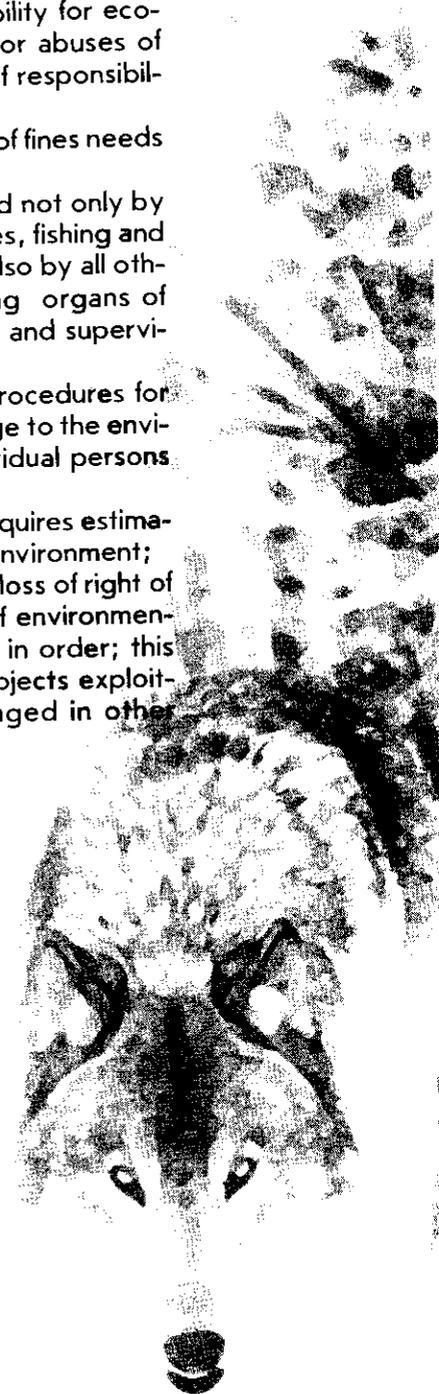
4.3. Economic Mechanisms

Transition from the current economic paradigm considering economy and environmental conservation as separate activities to the integrated eco-economic approach viewing nature and economy as two interacting components of a socio-ecosystem is crucial for the progression of the country to the ecologically friendly sustainable stage of its development.

This integrated eco-economic approach dictates the necessity to consider economic mechanisms of nature conservation at two levels:

- macroeconomic level at which national economy is regarded as an entity (with due regard for international economic links) and characterized by aggregated economic and eco-economic indices;
- level of special eco-economic mechanisms designed to ensure conservation of living nature.

Macroeconomic level

The following key strategies are crucial for biodiversity conservation.

● "Ecologization" of structural transformation of economy and reorientation of export-import policy:
- decrease in the proportion of resource-oriented activities in the national economy; increase in high-technology processing and manufacturing industries oriented to yield a finished product;
- decrease in the proportion of resource and energy-consuming industries; increase in high-technology science-consuming industries; development of energy and resource-saving technologies; decrease in the consumption of natural resources per unit of production;
- replacement of technologies and industries affecting biodiversity by ecologically friendly ones;
- altered export structure, decrease in the export of virtually unprocessed raw materials and increase in the export of high-technology products.

Restructuring of national economy in favour of highly-technological resource-saving production is a strategic goal for the

further development of the Russian society. It is the only way to modernize the country's economy and ensure its transition to the modern post-industrial society, to make Russian goods quality-competitive on the world market, and guarantee well-being of the population.

A build-up of a new economic system is underway in Russia. Right now, it is very important to establish a basis for future highly-technological resource saving economy. Were the current trends reversed, it would be very difficult to curb a new rise of resource-oriented "dirty"economy and neutralize its catastrophic effect on the environment.

Investment policy oriented towards the priority development of highly- technological resource-saving economy and the attraction of investors is indispensable for the successful restructuring of Russian economy. Consistent ecological policy and implicit fulfillment of the commitments under international agreements, including the Convention on Biological Diversity, by the Russian government is considered by the international community as a guarantte of foreign funds invested in the country and a move towards civilized legal business as opposed to ecologically unfriendly activities.

● Formation of ecologically-oriented national accounts, incorporation of biodiversity in macroeconomic parameters of the country (including, and gross national product) and the system of international mutual accounts. Ecologically-orientated accounts are intended to ensure
- estimation of the biodiversity increment to loss ratio which reflects dynamic trends in the nature constituent of the national wealth; estimation of quality changes of natural objects experiencing effect of anthropogenic pressure and effectiveness of nature conservation measures;
- estimation of ecological variables indicative of the trends in the country's development and its stability in macroeconomic parameters;
- comparison of alternative ways of the country's development in terms of effec-

tiveness taking into consideration their potential environmental impacts;
- orientation of the economy towards a rise in the finished product output required by consumers rather than to an enlargement of the volume of resources used and raw materials extracted which should be minimized;
- estimation of the loss of natural resources and damage to the environment (leading to resource depletion and environmental degradation) in compliance with the recommendations of the UN Statistical Commission;
- estimation of net domestic product (computed from gross domestic product after allowance is made for the consumption of capital used in the process of production) and its dynamics which most adequately reflects the country's development including its socio-economic and natural components

● Reform of the taxation system to ensure transition from the current essentially indirect taxation (based on product output estimates without regard for the use of natural resources used in the process of production) to direct taxation of such use (taking into account the amount of natural resources involved in production). A significant rise in the collection rate of taxes on exploitation of natural resources without a change of the total income:
- raising taxes on the use of nature resources and decreasing them in high-technology sectors oriented towards finished product output;
- raising tax and amortization rates for ecologically harmful works and technologies; granting tax privileges and "soft" amortization schemes for resource-saving and ecologically safe technologies; estimation of the influence of various technologies on biodiversity;
- differential taxation of ecologically harmful works with regard for their potential effects on biodiversity;
- raising payments for the use of natural resources including biodiversity, permissible and heavier pollution, disposal of waste matter and other materials having injurious impact on the natural environment and biodiversity;
- tax benefits to enterprises and organizations which re-invest profit in the implementation of measures for conservation

and recovery of biodiversity, produce equipment and develop technologies for nature protection, provide ecological services, and practice advertising with an ecological slant;
- assurance of target-oriented distribution and use of revenue brought in by taxation of the exploitation of natural resources for the purpose of nature-conservation.

Transition to direct nature-resource taxation has many advantages. It promotes salvation of resources, conservation of natural environment, and tax collection because makes it impossible to hide the object of taxation. Also, it helps to accumulate real funds for conservation and restoration of natural resources and reconcile commercial and environmental interests by stimulating all owners to rationally use resources.

This reform should be performed gradually in order to give tax-payers an opportunity to adapt themselves to new conditions of taxation. At the initial stages of the taxation reform, the total revenue must remain at the previous level.

● Creation of a nation-wide system of economic evaluation of biodiversity as a part of the national wealth. Adequate assessment of all functions of natural systems, from the most important environment-forming one to productive, informational, cultural, aesthetic, and others. It must be paralleled by the improvement of legislative and methodical basis, broad estimation of the total economic importance (value) of natural systems and their environment-forming function, costs of alternative methods of nature use and rehabilitation, prevented damage, rent, and other variables.

Elaboration of a system of economic evaluation of genetic resources

Economic evaluation of biodiversity adequate to its importance for the sustainable development will allow to improve the system of tax rating and collection with due regard for the real value of boiresources, such as land, forests, water, commercially hunted animals, etc.

● Eaboration and coordination of mechanisms of international cooperation in environmental protection. Incorporation of the value of living nature in the estimates of national wealth and macro-economic parameters would reflect its key role in biospheric processes and conservation of global biodiversity. These estimates should be regard-

ed as a real contribution of Russia to the conservation and restoration of the global environment when it comes to settling balances among countries in international transactions.

● Elaboration of economic mechanisms of access to genetic resources and calculation of their cost. Expenses of such an access should be differentiated dependening on the further use of the genetic material, either non-commercial (in research, education, health care) or commercial (selling to biotechnological companies for manufacture of commercial products).

Special eco-economic mechanisms

Eco-economic regulation is effected by mechanisms of stimulation (tax incentives to users of natural resources participating in their conservation and/or employing resource-saving technologies, inclusion of relevant expenses in tax payment, etc.) and compulsion (administrative constraints, fines and penalties). The efficiency and expedience of application of economic stimuli depend on the state of the natural environment, extent of human pressure, regional conditions and economic characteristics. The present-day difficult economic situation of Russia makes it necessary to give preference to limiting, prohibitory, and fiscal measures for biodiversity conservation which do not however exclude the elaboration and application of purely economic measures whenever they may give maximum effect.

Main areas of application of special eco-economic mechanisms include:

● Modification of the system of payments and penalties for an excessive or illegal impact on the environment; fines paid not only for a direct damage to the environment but also for its aftereffects. Elaboration of a system of target-oriented distribution of revenue brought in by penalties and its use to recover those objects of biodiversity which suffered from the harm.

● Introduction of standards for ecologically-grounded management of enterprises taking into consideration the needs of biodiversity conservation.

● Organization of goal-oriented innovation funds for the development of resource-saving and environmentally friendly industrial and agricultural technologies. Establishment of ecologically-oriented innovation programs and funds includes substantiation of their functions and financial sources as well as elaboration of economic incentives to ensure their realization. Such ecological programs and projects should be implemented with due regard for expenditures on resource-saving and environmentally friendly technolgies involved. Such an approach facilitates the choice of the most attractive investment schemes

● Promotion of the market for ecologically pure products, technologies, and equipment; extension of ecological safety requirements to the industry as a main instrument of market competition. This puprpose is reached with the aid of economic, administrative, legislative, and propagandistic measures, as follows:
– improvement of the national accounting system as recommended by the UN Statistical Commission to ensure accurate estimation of environmental losses and depletion of natural resources;
– prohibition of export and import of ecologically dangerous commodities and technologies;
– advertising ecologically pure products and ecologically safe technologies; beneficial tariffs for advertising production of ecologically friendly enterprises and distribution of advertisments with an ecological slant;
– shaping the ecologically attractive face of Russian business taking advantage of its involvement in conservation of biodiversity;
– development of mechanisms for selling quotas on permissible environmental impacts to stimulate the development of ecologically friendly technologies and thus prevent excessive pressure on the environment at the level of sale-and-purchase transactions.

● Incorporation of requirements for biodiversity conservation in privatization programs. This implies the establishment of an ecological privatization fund accumulated in the form of investments paid back to support ecologically relevant projects, amorti-

zation payments, and profit reinvested by industrial enterprises and companies for further use in nature conservation programs.

● Development of the system of ecological insurance with regard for the risks to biodiversity. This system should

– ensure maximum compensation for the harm to living nature resulting from catastrophes and other unpredictable consequences of economic activity;

– perform controlling functions including permanent ecological audit;

– ensure establishment of special funds by insurance companies for funding nature conservation actvities and development of ecologically safe technologies.

● Promotion of ecological certification and licensing taking into account parameters of biodiversity.

● Incorporation of requirements for biodiversity conservation into the system of basic principles of economic organization and activity in sectors exploiting natural resources, such as forestry, commercial hunting, fishery, and creation of conditions ensuring their sustainable use.

● Support (state protectionism) of Russian producers practicing traditional economic activities adapted to specific natural and socio-economic conditions of a given region. This measure pursues two goals:

– to adjust industrial and related activities to local natural and socio-economic conditions;

– to support traditional subsistence economies facilitating protection of biodiversity.

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4.4. Improvement of the Management System for Exploitation and Conservation of Biodiversity

Main lines of work

● Orientation of the state management system towards biodiversity as a strategically most important component of the national wealth and security. The temporal scale and structure of the system of state regulation in all spheres of the country's life must ensure consideration of long-term returns of the conservation and sustainable use of biodiversity which exceed an immediate profit from its over-exploitation or realization of economic projects that destroy nature. Also important is the establishment of a system the for strategic ecological assessment of the most general decisions on the further development of the country.

● Structural correction of the management system for the conservation and sustainable use of biodiversity. The following aims are distinguished:
– Establishment of specialized state nature protection bodies at all levels of government management.
– Creation of ecological departments in large companies regardless of the form of ownership.
– Improvement of the federal environmental protection service with a view to more efficient conservation of biodiversity.
– Establishment of Ecological Council to be constituted by members of the President's administration, representatives of ministries and agencies, large nature resource companies, Russian Academy of Sciences, universities, and non-governmental organizations involved in preparing political decisions and recommendations on environmental protection and sustainable use of natural resources.

● Encouragement of the joint management of biodiversity by government agencies and general public. Participation of the public and non-governmental organizations in decision-making on biodiversity conservation. Promotion of public control over activities of state institutions and com-

mercial companies influencing biodiversity. Support by the local population is an indispensable precondition for the successful implementation of any nature conservation project. Public participation in making ecologically significant decisions is very important because it has serious repercussions on the development of ecological culture. Equally important for the success of biodiversity conservation is the involvement of indigenous minorities with their experience in traditional methods of nature use and management. This aspect of the development of management system is in line with the strategy of democratization and promotion of human rights.

● Clear differentiation of tasks, competence, and functions between executive and legislative powers, commercial companies, social and political organizations for the purpose of efficient conservation of biodiversity. Co-ordination of their activities.

● Correction of aims and procedures of decision-making:
– use maximum available information about biodiversity state and threats for it;
– estimation of correspondence of decisions to the aim of the Strategy;
– account of the specificity of natural biosystems;
– operative reaction of the system of decision-making in case of rapid changes in the condition of biodiversity and social-economic processes influencing it;
– control of implementation of decisions.
This task should be accomplished at federal, inter-regional, regional, and local levels.

● The management process must involve:
– a system for monitoring biodiversity and socio-economic activities influencing it; the system must be able to actively participate in decision-making;
– a system ensuring an immediate decision

on the use and/or protection of biodiversity in emergency situations; to be efficeint, such a system must use a set of criteria for the identification of priority actions and ecological expertise;

– mechanisms obliging all interested actors to base their work on the principles of conservation and sustainable use of biodiversity, employ resource-saving technologies, rapidly respond to a changing situation, and obey orders of decision-makers.

– independent control organs supervising activities of biodiversity users.

● Territorial management must be organized with regard for the location of natural comminities. Boundaries of large natural systems (river and lake basins, mountain massifs, etc.) do not always coincide with the boundaries of administrative units. This discrepancy and the resulting discoordination of activities should be compensated by concerted actions of management systems at different levels, inter-regional co-ordination, and establishment of coordinating territoral centres.

● Elaboration and realization of regional and ecoregional Action Plans for the conservation and sustainable use of biodiversity co-ordinated with the programs of socio-economic development of these territories.

● Incorporation of requirements for biodiversity conservation in territorial planning schemes, elucidation of the spatial population and ecosystem structure.

● More extensive partnership is needed in the framework of management systems for the conservation and use of biodiversity to ensure involvement of non-governmental organizations, private companies, and non-traditional actors representing government bodies. Integration of a wide circle of partners into target-oriented activities pertinent to biodiversity conservation.
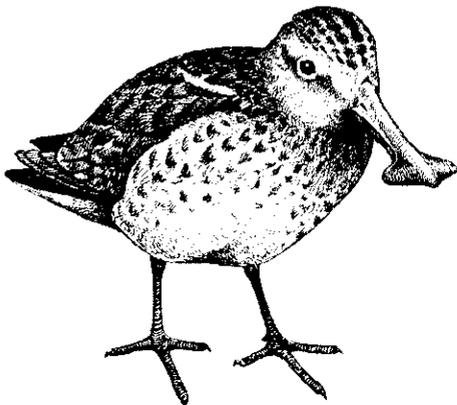
4.5. Formation of Public Consciousness. Education and Propaganda

Main objectives

● Formation of public ecological culture and elaboration of an ecological imperative for all groups of the society, introduction of norms and principles of biodiversity conservation into decision-making practices at all levels of management, organization of production processes, and everyday public life.

● Formation of responsible and active attitude of all citizens towards biodiversity conservation, attraction of a broader public to ecologically significant decision-making, monitoring biodiversity, and realization of environmental projects. Raising prestige of professions and occupations involved in nature conservation.

● Formation of humanistic attitudes towards living nature, development of ecological ethics.

● Promotion of public education and awareness, formation of systemic views on the role of living nature in the maintenance of biospheric equilibrium. Raising awareness of polcy-makers. Public education and popularization of methods for rational nature use and biodiversity-friendly technologies.

Main lines of work

● Propaganda of biodiversity conservation in mass media, at public forums and campaigns, through advertising with an ecological slant.

● Ecological and biological public education; distribution of environmental and biological knowledge; popularization of environmentally friendly methods of nature use.

● Promoting public awareness of the current state of biodiversity and potential risks.

● Support of public initiatives on biodiversity conservation, rising and promoting ecological movements.

● Encouragement of arts and literature depicting the beauty of living nature and its diversity, love and care of nature; popularization of folk culture and traditions having implications for nature conservation.

● Religious education with emphasis on nature conservation.

Specificity of the work with different groups of people

For organization of effective work on the formation of public consciousness, it is necessary to consider characteristics of various groups of people.

– Children. The future of ecological culture depends on how today's children are brought up. Children lack an established system of notions and stereotype behaviour, but they are highly susceptible to a variety of influences. The most important vehicles for infusing children with appropriate ideas are games, books, and films.

– Young people constitute another group very important for the formation of future ecological culture; they are readily open to new ideas. The principal form of work with this group is biological education with special reference to the role of biodiversity in the maintenance of biospheric processes. Members of this group are strongly influenced by the behaviour and attitudes of star performers in show business and leading figures of youth culture, by video, audio, and print advertisements. Main methods of work are biological education and raising awareness of the importance of biodiversity in biospheric processes.

– The main part of the population – middle-aged and elder subjects involved in different professions. Their attitudes towards nature and its protection predominate in public opinion. Many of them are disposed to social conformism and do not readily absorb new ideas. They choose to believe what they are told by experts, officials, and mass media about the importance of biodiversity for the health and well-being.

– The most active and prosperous fraction of the population (politicians, businessmen, high officials, intellectuals, popular performers and athlets) play a key role in the formation of public opinion. These people make decisions of paramount importance for the fate of biodiversity. The group is distinguished by widely varying opinions. They need to be convinced of the advantages (poitical or economic) offered by biodiversity conservation.

– The clergy and their flock may be carriers of moral and ethical views consistent with the cause of nature conservation; members of this group do not readily change their opinion which is largely formed by spiritual guides and preachers.

– Indigenous peoples and other minorities. Morals and ethics of indigenous peoples and other minorities are firmly anchored to their subsistence actvities. The main task is to support and encourage their traditional views and practices beneficial for the environment and biodiversity.

Formation of public consciousness with respect to natue conservation should be based on the universal concept of integration of Nature, Society and Economy, sustainable development, and the impossibility of human survival without regard for the environmental health. Evidently, different aspects of this concept are likely to find understanding in different social, psychological and age groups.

Pragmatic aspect: living nature constitutes a basis of healthy environment, a source of material welfare and vital resources; the safety and well-being of each family depend on the the quality of the environment. This aspect applies to the overwhelming majority of medium-aged and elder people of various social status.

Patriotic aspect: Russia is a great power whose world role is determined, apart from other considerations, by conservation of the largest massif of natural ecosystems which support normal functioning of the biosphere; biodiversity is a most valuable constituent of the national wealth (at the regional level, it is a component of the unique local environment, traditional life style and culture of aboriginal minorities). This aspect is of importance for subjects expressing fervent patriotic sentiments.

Economic aspect: nature conservation is a source of additional income, better quali-

ty and increased competitive ability of consumer goods, attractive ecological image of a company. This aspect is important for businessmen of different status.

Aspect of prestige: conservation of nature is a matter of good form, a token of prestigious and respectable way of life. This aspect is important for the most active and prosperous fraction of the population.

Aspect of fashion: nature conservation is fashionable because popular actors, athlets, and leading figures of youth culture patronize and encourage it. Many youngsters would follow their example.

Moral and ethical aspect: living creatures share the right to live with man; animals and plants suffer from humans. This aspect finds understanding in children, emotional and religious persons.

Rational/systemic aspect: living nature is a subsystem of biosphere; the biosphere exists as long as nature does; the greater impact on the living nature the lower the status of the whole system. This aspect is important for subjects of rationalists disposition, students, teachers, and intellectuals.

Aesthetic aspect: nature is beautiful, it gives pleasure and enjoyment.

Religious aspect: nature must be protected as a God's sacred creation. Most religious doctrines admit the value of nature as an evidence of God's wisdom. This aspect applies to religious people.

Such a work requires close partnership of all actors involved in the formation of public consciousness, such as mass media, political parties, non-governmental organizations, advertising agencies, show-business, scientific, cultural, educational, and religious institutions.

Implementation of the Strategy at the federal and regional levels should be supported by special promotion programms.

Nature conservation is one of the few ideas that consolidate rather than split the society; it provides a basis for the unification of different social and corporative groups.

4.6. Scientific Research

● **Inventory of biodiversity**

– Development of taxonomic studies: elaboration of new methods of systematics; creation of catalogues, keys, federal and regional floristic and faunistic compendiums, cadastres of plant and animal world; continuation of serial monographic publications on the Russian fauna and flora; support and development of scientific biological collections.

– Development of approaches and methods for estimation of sub-population genetic diversity and its geographic distribution.

– Development of methods and approaches for the inventory of ecosystem diversity in Russia at regional and federal levels.

– Informational support of taxonomic and inventory studies, creation of computerized databases.

– Development of methods for the classification, typing, and mapping of components of biodiversity.

● **Biodiversity evolution studies**

– Studies on general mechanisms of biodiversity evolution.

– Studies of the evolution of biodiversity at the territory of Russia.

– Study and prognostication of anthropogenic evolution of populations and communities of organisms.

● **Studies on current dynamics of biodiversity**

– Basic studies of current trends in biodiversity and identification of factors promoting a decrease in biodiversity at the genetic, species and ecosystem levels.

– Elucidation of mechanisms of action of natural and anthropogenic factors on biodiversity dynamics in various environments, climatic zones, and natural landscape complexes; priority studies of ecosystems exposed to the heaviest hropogenic pressure.

– Analysis of influence of alien species on biodiversity and role of invasions in biodiversity dynamics.

– Elaboration of short-term and long-term forecasts of biodiversity dynamics.

– Studies on cyclic processes especially successions. Estimation of the ability of ecosystems for self-recovery.

● **Studies of general structural and functional patterns of biodiversity**

– Studies on the relationship between the diversity and stability of biosystems; elucidation of ecosystem stability mechanisms and elaboration of criteria for the estimation of stability; determination of stability limits at different levels of biosystem organization.

– Studies on the relationship between the diversity and productivity of biosystems and their environment-forming function.

– Ecological studies pertaining to the identification and protection of key species for the maintenance of functional potential of different types of communities and ecosystems.

● **Development of the scientific and methodological basis for biodiversity monitoring**

– Elaboration of the national system of criteria for the identification of priority objects of biodiversity conservation and estimation of their condition.

– Elaboration of the conceptual basis for biodiversity monitoring at genetic, taxonomic, and ecosystem levels.

– Development of methods and schemes for the organization of biodiversity monitoring in various environments (seas, oceans, fresh waterbodies, soil, terrestrial ecosystems, parasitic and symbiotic systems).

– Development of remote sensing techniques for biodiversity monitoring.

– Development of methods for express indication.

– Development of methods for the estimation of well-being of organisms in natural populations.

● **Development of the scientific and methodological basis for protection of rare and threatened species and unique communities**

– Identification of rare and endangered species and threatened communities; extensive studies of their biological and ecological features.

– Estimation of risks to threatened populations, species and communities.

– Elaboration of the scientific basis for conservation of rare species, scientific sup-

port of programmes for conservation and use of rare species, scientific support of the Red Data Book.

– Elaboration of the scientific basis and technologies for reproduction and ex situ maintenance of selected species of wild plants and animals, threatened breeds of domestic animals and plant varieties.

– Elaboration of the scientific basis for conservation of the most vulnerable biomes and ecosystems

● *Elaboration of the scientific basis for sustainable use of biodiversity*

– Elaboration of the scientific basis for rating, quota setting, and regulation (in terms of amount, time, regions, and objects) of the use of selected components of biodiversity especially migratory ones.

– Elaboration of the scientific basis for the replacement of the extensive use of biological resource by their intensive use to ensure sustainable development of biodiversity.

– Development of a complex approach to the sustainable use of natural ecosystems (forests, water bodies, wetland, soils, etc.).

– Elaboration of schemes for the sustainable use of selected species and ecosystems.

– Elaboration of the scientific basis for territorial planning of biodiversity conservation including the development of a network of specially protected natural territories and conservation of biodiversity outside these territories.

– Elaboration of the scientific basis for conservation of agrocenoses and urban areas.

● *Elaboration of the scientific basis for restoration of biodiversity*

– Elaboration of the scientific basis for rehabilitation of disturbed natural ecosystems.

– Development of technologies for restoration of selected populations and multi-species communities in land and water areas undergoing degradation.

– Development of technologies for the re-cultivation of natural ecosystems and creation of their analogs on technogenically disturbed lands.

● *Elaboration of scientifically-based legislative mechanisms of biodiversity conservation*

– Elaboration of the scientific basis for the incorporation of ecosystem approach

and principles of biodiversity conservation in legislation.

– Elaboration of the scientific basis for legislation on standards, licensing, certification, rating, and audit.

– Elaboration of the scientific basis for legislation on the access to genetic resources.

● *Elaboration of scientifically-based economic mechanisms of biodiversity conservation*

– Development of methods for economic estimation of biodiversity with regard for its environment-forming function, improvement of methods for the economic evaluation of damage to living nature taking into account its delayed effects.

– Development of inter-related macroeconomic and special economic instruments (taxation of the use of natural resources, creation of ecologically-oriented national accounts, promotion of the market of ecologically pure products, environmentally friendly technologies, and equipment, etc..

– Identification of areas and conditions for the efficient application of ancillary economic methods (optimization of the complex of economic and administrative methods).

● *Elaboration of the scientific basis for the formation of public consciousness and education*

– Development of methods for monitoring ecological aspects of public consciousness.

– Sociological analysis of relationships between ecological consciousness (with reference to biodiversity conservation) and characteristics of different social groups, activities of political parties, associations, religious confessions, and non-governmental organizations.

– Elaboration of principles of work with various social and age groups as regards ecological education and propaganda of biodiversity conservation.

– Correction of methods of ecological and biological education at various levels with special reference to biodiversity conservation.

– Publication of an inter-disciplinary encyclopaedic dictionary of terms and conceps related to conservation of biodiversity.

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4.7. Monitoring Biodiversity

In Russia, information on biological resources used in agriculture, forestry, fishery, and commercial hunting, on the activities of sanitary and epidemiologic service, land and water use services, and the network of specially protected natural territories is collected on a multi-sectoral basis. However, such a systems does not ensure a comprehensive characteristic of biodiversity because different sectors are focused on its different parameters, employ different methods, and on the whole act in an uncoordinated manner. The efficiency of the system has greatly reduced in the last years.

Monitoring must provide governing bodies, research institutes, non-governmental organizations, commercial companies, and general public with the information on the current stand and trends of biodiversity. Concrete tasks and organizational forms of the monitoring system as well as the use of its results depend on the object of monitoring and the way it functions. Timely biodiversity information allows for rapid and adequate correction of biosystem conditions and socio-economic processes influencing them. The most general information on biodiversity should be incorporated into a national report on the environmental situation.

Main objectives

● Inventory of biodiversity at population, species and ecosystem levels; soil inventory. Identification and estimation of the most valuable, rare and threatened objects of biodiversity and soils. Biodiversity inventory is in the first place needed in high-risk regions to ensure rapid elaboration and implementation of conservation programs.

● Establishment of a biodiversity monitoring system, organization of continuous monitoring and collection of information necessary for decision-making.

In Russia, high diversity and complexity of objects of monitoring coupled to significant differences in regional conditions do not allow to construct a state monitoring system based on a single scheme. The efficient government system of biodiversity monitoring (a sub-system of the General System of State Ecological Monitoring) can be organized based of the common informational space and an extensive network of relatively independent regional, departmental, and other information centres.

The biodiversity monitoring system must include the following complementary subsystems.
– Federal information and analytical biodiversity centre coordinating collection, storage, and analysis of data necessary for the decision-making at the federal level and the fulfillment of international commitments of the Russian government concerning biodiversity conservation.
– Regional systems of biodiversity monitoring with the involvement of local nature reserves and biological stations. These systems must ensure informational support for the management actions at the regional level, collection and preparation of information for the federal information centre.
– Sectoral monitoring systems in agriculture, forestry, fishery, hunting, sanitary epidemiologic service, water economy, and a network of specially protected natural territories.
– Information system on genetic resources.
– Data analysis system on land use and soils.
– Data analysis system on abiotic components of the environment with emphasis on biodiversity conservation.
– System of remote sensing data analysis.
– Systems of data analysis for general statistics (estimation of human impact on living nature) and monitoring public opinion (elucidation of attitudes of different groups towards biodiversity).

Main lines of work

- Organization of federal and regional information and analytical biodiversity centres.

- Elaboration of a system of biodiversity indicators based on characteristics of populations, species, communities and ecosystems, health parameters of organisms in natural populations; elaboration of a scheme for the siting of observation points over the territory, development of applications of modern techniques for the collection of information including remote sensing systems.

- Elaboration of common standards for the collection, storage, and presentation of biodiversity information taking into account the traditional milti-sectoral approach.

- Modification of the multi-sectoral system of data collecton in compliance with the aims of biodiversity monitoring including that at specially protected natural territories.

- Organization of an information system on genetic resources.

- Establishing links with the systems of monitoring abiotic components of the environment.

- Establishing links with the state monitoring system for land resources; setting up a state system for monitoring protected soils.

- Collection of information about unexploited biodiversity outside specially protected territories. A substantial body of relevant data can be obtained from research institutes, lay observers, and students.

- Development of methods for the collection of information about economic activities and estimation of their influence on biodiversity.

- Rational use of remote sensing data.

- Co-ordination and integration of biodiversity data obtained from regional and departmental information centres.

- Preparation of biodiversity monitoring data for decision-makers at all levels of goverment management and in all sectors of economy;

- Training of technical servants and the senior staff of information biodiversity centres.
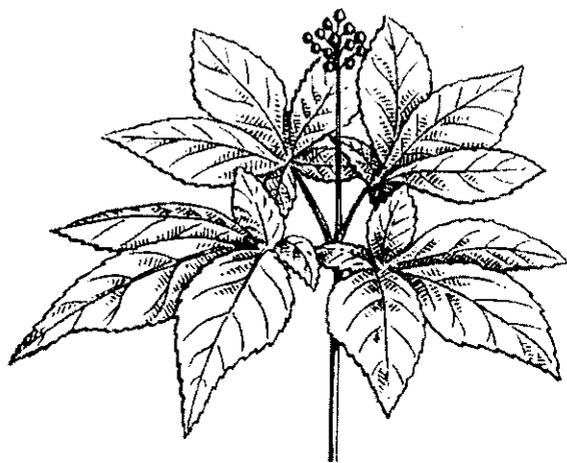
5. Priority Actions at the Federal Level

5.1. Basic Principles of Criteria for the Identification of Priority Actions

● A system of criteria for the identification of priority actions for biodiversity conservation must be in correspondence with the goal and principles of the Strategy.

● At the federal and regional levels, such a system must include the following groups of qualitative and quantitative criteria:
– criteria for the choice of priority objects of biodiversity (ecosystems, communities, species, and populations);
– criteria for the choice of priority territories (regions at the federal level and sites the regional level);
– criteria for the choice of necessary actions and measures;
– criteria for the estimation of biodiversity conservation projects.

● Objects of biodiversity and territories should be estimated by three groups of criteria:
– estimates of the current state and trends of objects or territories (abundance and area, total size of ecosystems of a given type, extent of anthropogenic transformation, etc.).
– importance of an object or territory for the sustainable conservation of biodiversity, e.g. the likelihood of a decrease in total genetic diversity after the loss of a given species; role of a species in the ecosystem, importance of a habitat for species conservation, etc.);
– socio-economic and technological criteria (economic and cultural value of a species or ecosystem, threatening socio-economic processes, current measures and available technologies for nature conservation, necessary expenses, economic efficiency, etc.)

●Actions, measures and projects for biodiversity conservation should be estimated by three groups of criteria:
– agreement with the aims and principles of the Strategy;
– practicability (probability of successful realization of an action or project during the period of the Strategy);
– efficiency (cost to benefit ratio).

●Priority choice order:
– choice of priority objects of biodiversity and territories, choice of measures necessary for their conservation;
– choice of priority actions in the socio-economic sphere, choice of the ways for their realization;
– estimation and choice of projects for the Action Plan, formulation (search) of the order for aditional projects.

● When the choice of a single priority object or action is unfeasible (ineffective), simultaneous realization of a group of priority actions must be considered to ensure stability of the system in general (at the federal or regional level depending on the level of decision-making). The available funds should be distributed taking into account mutual influences between these actions and objects (e.g. non-realization of one project may considerably decrease the effectiveness of others; vice versa, successful realization of one of the projects is likely to facilitate implementation of the remaining ones; it is equally true of the objects of biodiversity conservation, i.e. a failure to protect one leads to the impairment of stability of others).

5.2. Current State of Biodiversity and Measures for Its Conservation

5.2.1. Species Conservation

Conservation of species diversity in animals and plants is to be accomplished in the framework of the population-species approach.

Species diversity in Russia may be described as relatively safe. Russia remains to be one of the most important regions maintaining the global species diversity.

At the same time, economic developments in the second half of the 20th century have caused marked disturbance of floristic and faunistic complexes in some regions; as a result, many species fell in the category of critically endangered ones and had to be enlisted in the Red Data Book of Russian Federation.

Animals – 414 species and subspecies (Red Data Book of Russian Federation. Animals. 2001):
– Vertebrata – 259 (Cyclostomata – 3 , Pisces – 47, Amphibia – 8, Reptilia – 21, Aves – 126, Mammalia – 74;
– Invertebrata –156 (Annelida –13, Bryozoa –1, Pelicipoda – 1, Mollusca – 43, Arthropoda – 99.

Plants – 516 (Red Data Book of RSFSR. Plants. 1988):
– Angiospermae – 440;
– Gymnospermae – 11;
– Pteridophyta – 10;
– Lycopodiophyta – 4;
– Bryophyta – 22;
– Lichens – 29.
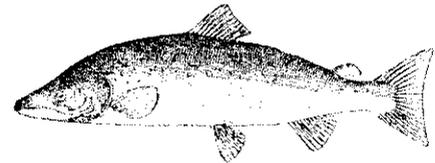
Fungi – 17 species (Red Data Book of RSFSR. Plants. 1988).

Major Threats to Species Diversity in Russia

● Destruction and disturbance of habitats.
● Extensive application of chemicals and industrial technologies in agriculture.
● Environmental pollution.
● Over-exploitation of natural populations of animals and plants.
● Acclimatisation and introduction of alien species, self-dispersal of invasive species, plant and animal diseases.
● Extensive use of transgenic (as a rule, more productive) forms of plants and animals which may lead to the replacement and eventual extinction of traditional varieties, cultivars, and breeds.
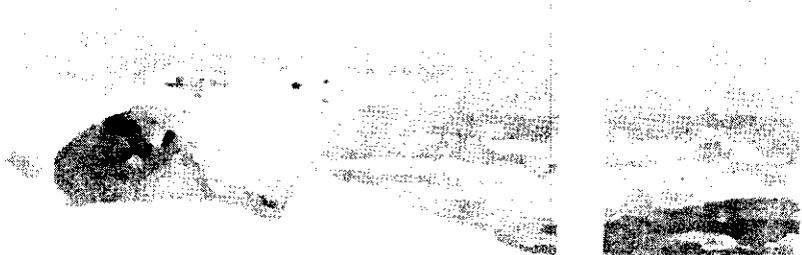
The Most Apparent Consequences of Negative Human Impact on Biological Characteristics of Species

● Population decline.
● Deterioration of physiological condition of organisms.
● Disturbance of reproduction.
● Increased mortality at the early developmental stages and in adults.
● Disturbances of life cycles including migrations.
● Disturbance of sex and age population structure.
● Disturbed genetic structure of populations, loss of genetic diversity.
● Disturbance of species population structure.
● Non-adaptive changes in animal behaviour.

These consequences may differ depending on the combination of factors influencing a given species and specific features of its environment. Collectively, however, they lead to a decline of individual populations and finally to the extinction of the species.

Priority Measures for Species Conservation

In species conservation programs, priority must be given to in situ protection because the long-term survival of a species and its continuous natural evolution are possible only under natural conditions. Those methods should be preferred which minimize disturbances to an object of biodiversity and facilitate its conservation in typical habitats.

Ex situ conservation should by no means be considered as an independent problem. This approach must always be integrated into programs of species rehabilitation and reintroduction. Its application is in order in the following cases:

– if it is impossible at present to eliminate effect of main limiting factors;

– when population numbers are at a critically low level accounting for a high probability of accidental extinction of the species or one of its populations;

– when the genetic structure of populations is disturbed to the extent of decreased genetic diversity thus leading to inbreeding, reduced viability of individuals, and development of characters alien to the species;

– when serious disturbances of self-recovery mechanisms of a population necessitate its artificial reproduction.

In parallel with the ex situ conservation of a species, reconstruction of its natural habitats must be undertaken concurrently with the elimination of major risk factors associated with the adverse human impact.

The ex situ conservation may be a self-contained task only in a special case of protection of species that have been extinct from nature and whose reintroduction appears impossible in near future. Such species need to be conserved for scientific and educational purposes and also as carriers of genetic information which may be potentially useful in the future.

Analysis of socio-economic conditions for the conservation of a species prompts the choice of methods for the purpose, their applications, economic and legislative mechanisms for the prevention of adverse anthropogenic effects, measures necessary for the formation of public consciousness and education.
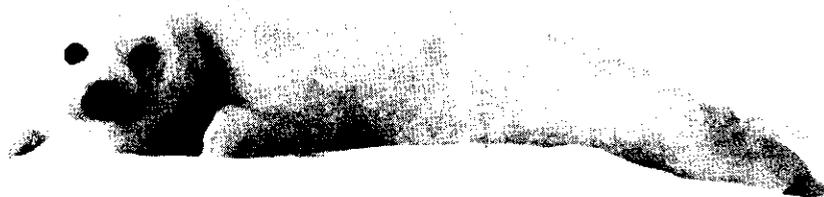
5.2.2. Ecosystem Conservation

5.2.2.1. Ecosystems of Polar Deserts, Tundras and Forest-Tundras
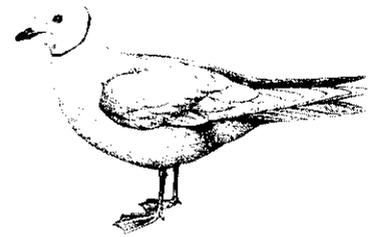
The Arctic is a key region in terms of national interests of Russia and sustainable development of the whole circumpolar basin. Russia bears responsibility for biodiversity conservation in the Arctic and the well-being of indigenous peoples inhabiting northern Eurasia.

To-day, biodiversity of the Russian Arctic can be described as relatively safe owing to large tundra and water areas supporting autochthonous ecological communities and still avoiding considerable direct impact of economic activities.

In the past decades, however, industry has tended to spread from isolated centres over a larger territory thus threatening the integrity of Arctic ecosystems. Negative anthropogenic effects on these ecosystems are especially pronounced and dangerous resulting largely from the pollution brought in by the Gulf Stream, large rivers flowing to the north, and aerial transport from different parts of the globe and accumulated within a relatively small area. The situation is aggravated by the high vulnerability of Arctic nature and its weak ability to recover after damage because of low activity of biocenotic processes.

To-day, populations of many Arctic plants and animals as well as a large number of unique natural communities, ecosystems, and their territorial complexes are in critical if not catastrophic condition and require urgent protective measures at the federal level.

Major threats to biodiversity of Arctic ecosystems

● Environmental pollution from the following sources:
− smelters in Norilsk, Pechenganikel, Severonikel, etc.;
− oil and gas extraction and transport, exploratory drilling for oil and gas in coastal areas and on the Arctic shelf;
− global pollution (Gulf Stream, Siberian rivers, aerial transport);
− early nuclear weapon tests in the air and under the sea on Novaya Zemlya;
− nuclear submarines and naval bases;
− solid and liquid waste discharged by military holdings and industries.
● Industrial developments in the Arctic, uncontrolled use of off-road vehicles in summertime.

● Extremely poor government control over the use of biodiversity in the Arctic, ineffective protection of Arctic nature reserves.
● Indiscriminate exploitation of natural animal and plant populations in the form of fishing, hunting, and collecting biological materials for public and private museums (the latter activity has been increasingly popular in recent years and is especially detrimental for the well-being of rare and threatened species).
● Dying out and disappearance of ecologically-balanced systems of traditional nature use by indigenous peoples of the North ousted by mining companies.

Consequences of human impact on natural ecosystems

- Destruction, alteration, and fragmentation of natural ecosystems.
- Cryogenic erosion resulting from the disturbance of the natural vegetation cover and pollution.
- Invasion by alien species, replacement of aboriginal Arctic species by invaders from the south, cosmopolitan and synanthropic forms having advantage over local ones in anthropogenically transformed landscapes.
- Disturbance of biocenotic structure and impoverishment of food resources for animals caused by pollution and overgrazing.
- Deterioration of wintering grounds and migration routes of some species.

Priority measures for conservation of Arctic ecosystems

- Recognition of the necessity of a special nature management regime in the Arctic. Elaboration of the Arctic doctrine and basically new legislation on nature protection in the Arctic.
- Raising efficiency of environmental conservation in the protected land and water areas of the Arctic. More attention to small forms of territorial protection (natural monuments, "microreserves", nature sanctuaries) for the conservation of specific sites and habitats of narrow-ranged and endemic species, subspecies and populations. Involvement of aboriginal people of the North in these activities.
- Rehabilitation of the network of polar stations and reorganization of their work such as to include elementary biomonitoring. Restoration and enlargement of the fleet of research and patrol ships for the purpose of monitoring and exploration of Arctic biodiversity.

Regions and objects of biodiversity requiring special attention

- Arctic regions experiencing the largest human impact and threat to their ecosystems include the Kola Peninsula, the lower Pechora River, Bolshezemelskaya Tundra, Yamal Peninsula, the Gulf of Ob, south-west part of the Taimyr Peninsula, mining regions in the north of Yakutia and Chukchi Peninsula.
- Most important ecosystems and communities:
- meadow or forbs-low shrub communities on southern slopes;
- marches and maritime solonchak meadows;
- zoogenic (first of all, ornithophilous) biocenotic complexes of bird colonies and other sites of permanent or prolonged residence of animals;
- isolated forest massifs and brush groves penetrating to the north along river valleys and other elements of landscape, borderline forest communities at the polar tree limit on Bolshezemelskaya Tundra, Yamal and Chukchi Peninsulas;
- tundra-steppe communities (Pleistocene relicts in north-east Asia).

5.2.2.2. Forest Ecosystems

Forests are most important for the maintenance of biospheric processes including prevention of unfavourable climatic changes; also, they are a potent renewable source of raw materials. In Russia, forests have always been one of the main components of the national wealth. Russia has been and remains the most forested country in the world.

Despite intensive exploitation, forest ecosystems of Russia have been preserved better than those in other countries. During the last decade, forested areas have enlarged due to a sharp decrease in logging and agriculture. However, intensive felling in the past especially in the European part of Russia has led to a significant deterioration of the quality of forest stands, change in their age and species composition, altered vegetation structure, and reduced biodiversity.

Main threats to biodiversity of forest ecosystems

- Forest fires and related undesirable pyrogenic successions, especially in Siberia and the Far East.
- Biologically unsound felling systems and poor utilization of logging residues.
- Reafforestation without regard for biodiversity conservation.
- Allocation of forest lands for purposes unrelated to forestry (for industrial and urban construction, mining, building of roads, cableways, and other linear structures).
- Technogenic degradation of forest stands under the influence of discharges from smelters, chemical plants, power stations, and traffic.
- Illegal tree-cutting and other forms of illegal forest use ousting populations of rare and threatened species from forest communities.
- Negative anthropogenic impacts on protective forest stands in the forest-steppe zone and its natural communities (long-lasting intense forest exploitation and agricultural use, hydrotechnical works, grazing livestock, the use of pesticides, etc.).
- Uncontrolled recreational activity.

### Consequences of human impact on forest ecosystems

- Decrease in the total wooded area and disappearance of characteristic landscapes.
- Decreased area of undisturbed forests.
- Fragmentation of forest massifs.
- Changes in age and species composition of forests, increased proportion of young deciduous stands and brushwood communities replacing one another in succession.
- Disappearance of primary forest communities, impoverishment of tree and bush vegetation, decline in consort species diversity, disturbed biocenotic structure.
- Impaired or lost ability for self-recovery.
- Decreased carbon sequestration.
- Decreased resistance of forests to unfavourable environmental factors, wide distribution of fungal diseases and heavy infestation by pest insects, increased frequency and severity of forest fires.
- Bogging and sodding of large forest clearings, upset biological equilibrium of swamp and meadow forest complexes, soil degradation, disturbed hydrological regime.
- Disappearance and degradation of town parks, suburban foresrs, and green belts as a result of inadequate planning of urban development and uncontrolled recreational activity.

Priority measures for conservation of forest ecosystems

● Development of a long-term national forest policy conceivable and beneficial for the population. Sustainable forest management equally advantageous from the ecological, social, and economic standpoints.

● Elaboration of a forest management strategy oriented towards conservation of biodiversity as a necessary condition for the existence of forests; development and implementation of forestry techniques ensuring conservation and reproduction of biodiversity and adapted to specific regional conditions.

● Development of a network of specially protected territories sufficient for the conservation of landscape, ecosystem, and species diversity.

● Development of forestry strategies and economic mechanisms of forest management (co-ordinated with international ones) giving impetus to the improvement of ecological characteristics of forest ecosystems and their biodiversity conservation.

● Completion of the inventory of old stands and promulgation of a law granting them special nature conservation status.

Regions and objects of biodiversity requiring special attention:

— broad-leaved forests in the central part of European Russia;

— climax forests of the taiga zone including large massifs of virtually undisturbed coniferous forests in north-west Russia and the Urals;

— coniferous/broad-leaved forests of the South Urals;

— mountainous dark-coniferous forests of western and eastern Siberia (Yenisey Ridge, Salair, Altai, Sayan, Khamar-Daban);

— coniferous/broad-leaved forests of Khabarovsk and Primorye regions;

— cedar pine forests (Altai, Tuva, Khakassia, Tomsk region);

— urban forests and green belts.

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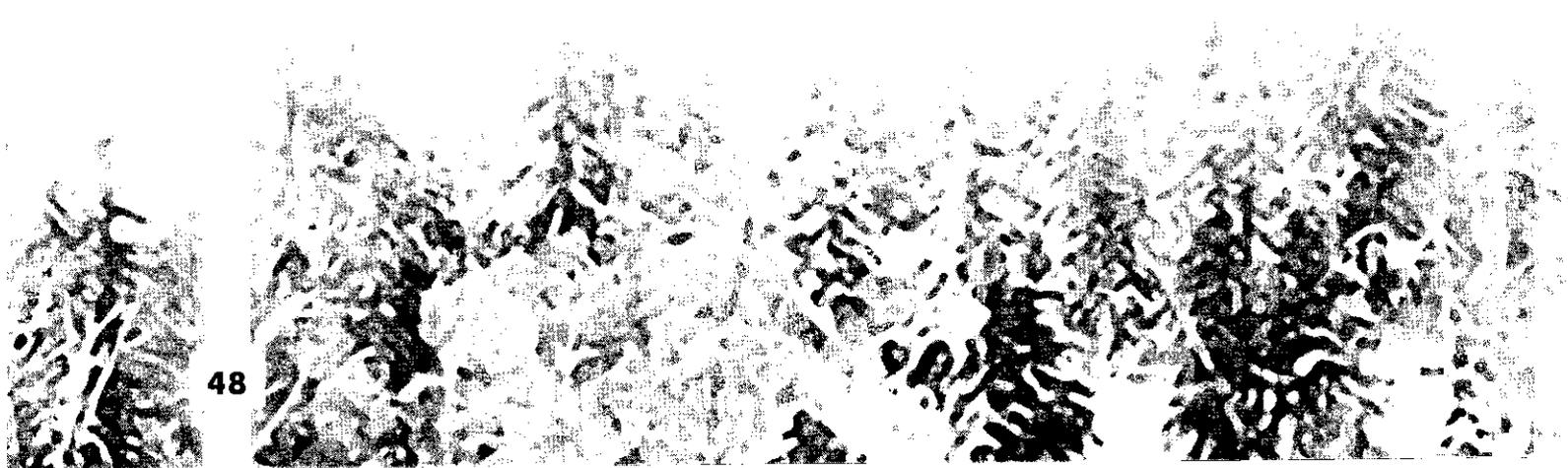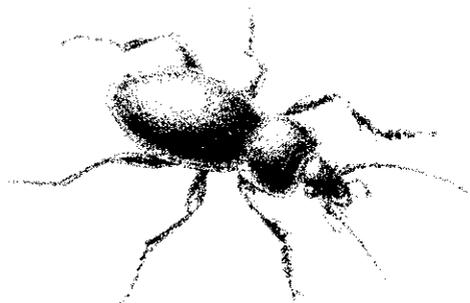
5.2.2.3. Ecosystems of Forest Steppes, Steppes, and Semi-Deserts

Steppes and forest-steppes have undergone the most severe transformation and complete destruction by man. Having featured a large-scale natural object in the past, they are presently on the verge of extinction in Russia. Today, small steppe fragments persist in the countryside dominated by arable lands, fallows, pastures, and other elements of rural infrastructure. Steppes and forest-steppes in the European part of Russia have been exploited by man and transformed to farmlands since ancient times (40-90% have been put to cultivation by now). The extent of the transformation decreases eastward, with 20-30% of steppe landscapes in Siberia remaining only slightly changed. Where steppe ecosystems experience heavy human pressure, they have virtually lost the ability for self-recovery. Being abandoned by man, such areas fail to develop normal successions of the vegetative cover characteristic of natural steppe associations and instead give room to alien communities. Highly efficient management is needed if natural steppe features are to be reconstructed on these territories.

The critical condition of forest-steppe, steppe and semi-desert ecosystems is aggravated by high human population density and concentration of agricultural activities, and also by the fact that increasing numbers of people in intensified farming areas are no longer seeing steppes as a natural and cultural phenomenon valuable of itself and worthy of conservation (in contrast to the view of forests).

Any possibility to rehabilitate forest-steppe, steppe and semi-desert communities may be completely lost as soon as the first half of the 21th century unless extraordinary measures for their salvation are taken. Biodiversity conservation of both natural ecosystems and stable natural-cultural complexes is an indispensable prerequisite for the conservation of the fertility of these lands which are the main source of agricultural production for the country.

Major threats to biodiversity of steppe ecosystems

● Extensive use of chemical products and industrial technologies in agriculture leading to:
– disappearance of all pieces of fallow land and excessive grazing;
– inadequacy of agricultural technologies to specific agro-climatic and ecological conditions of steppe landscapes;
– monocultural agroecosystems;
– excessive use of fertilizers and pesticides;
– loss of diversity of cultivated plants and domestic animals;
– spread of pests and animal diseases, weed infestation.

● Destruction of floodplain forests and insular groves in the forest-steppe zone leading to desiccation of the soil aeration zone and aridization of meadow steppes.
●Over-exploitation of natural populations of animals and plants in the form of poaching, collecting wild-growing food and medicinal plants (especially their subterranean parts such as roots, bulbs, etc.), direct extermination of important species of animals and plants.
● Radioactive pollution of Kursk, Lipetsk, Voronezh, and Tambov regions affected by the Chernobyl accident; pollution in

the Chelyabinsk region and south-west part of Novosibirsk region brought in by multistaged missile fragments which are shed as the flight progresses and fall down to the ground.

●Accidental and planned introduction of alien species, pests, and agents of plant and animal diseases.

● Frequent uncontrolled and untimely burning of vegetation.

Consequences of human impact on steppe ecosystems

● Soil degradation due to over-grazing, enlarged areas exposed to water and wind erosion. Erosion affects about 60% of the arable land in the European part of Russia and rapidly developes in its Asian regions by virtue of the uncontrolled use of agricultural technologies designed for the European steppe zone.

● Decline in species diversity and the diversity of steppe communities and ecosystems; disturbed biocenotic structure of steppe communities, loss of ability for self-regulation and spontaneous recovery.

● Aridification resulting from deforestation and extensive ploughing.

● Locust and other pest outbreaks provoking the use of chemicals for their control.

● Epizootics of rabies and other endemic diseases in wild animals.

Priority measures for conservation of steppe ecosystems

Sustainable development in the steppe zone is possible only if a complex of natural ecosystems and agroecosystems is capable of self-regulation and requires minimal management to maintain ecological balance. Special measures to this effect should take into account specific features of the steppe zone in European Russia, West, Central, and East Siberia.

The following actions are necessary:

● Application of ecologically safe agricultural technologies, transition from the extensive use of chemicals and industrial technologies to adaptive agriculture:

– development and application of methods adapted to regional and local soil and climate conditions;

– changes of land use strategies including conversion of marginal agriculture areas, strict regulation of the use of land with a high agricultural potential;

– specialization of agriculture in the steppe zone, restoration of traditional cattle breeding taking into account natural and socio-economic conditions of different regions;

– cultivation of plant and animal species and varieties adapted to local conditions; optimization of livestock structure and composition;

– optimization of grazing strategies with regard for conservation of biodiversity of wild plants and animals;

– development of infrastructure for sustainable processing and trade in agricultural produce;

– reconstruction of historical and ecological centres of traditional agriculture; estimation of the efficiency and ecological safety of traditional agricultural practices;

– development of ecologically stable agro-landscapes, enhancement of their structural diversity.

● Development of a network of specially protected natural and historico-cultural territories. Today only few specially protected natural territories in the steppe zone covering its negligible percentage in relation to the total area. Sustainable conservation of natural ecosystems is feasible only in the framework of an integrated system of specially protected territories connected by "ecological corridors" in the form of forest and brushwood belts, roadside groves, vegetation surrounding

man-made constructions, and other lands unfit for agriculture. Such a network must include the existing nature reserves and newly created protected areas. The cluster siting of nature reserves is recommended in correspondence with the distribution of habitat diversity of a landscape. New nature reserves are needed in frontier areas betweeen administrative regions of Russia and along its borders with other countries such as Kazakhstan, China, and Mongolia. Certain lands (especially former military holdings) should be reserved for further designation as specially protected natural territories. Planning biodiversity conservation must take into consideration structural features of agricultural landscape.

● Maintenance and rehabilitation of the existing protective forest belts (Stavropol, Krasnodar, and Rostov regions); creation of new forest belts (West Siberia, Central Selenga depression in Buryatia) and protective tree and bush cover to combat erosion (Central Chernozem regions).

● Fixation of sands in dry steppes and semi-deserts (Buryatia, south-east of Stavropol region, and Kalmykia).

● Conservation of steppe ecosystems and their species diversity in military holdings.

● Development and enforcement of legislative mechanisms for the protection of steppe ecosystems on agricultural lands.

● Ecological rehabilitation of steppe landscapes including reconstruction of typical steppe and bush ecosystems, ravine forests, insular and floodplain forests, and wetlands.

● Creation of economic incentives for an alternative (non-agricultural) use of steppe areas.

● Protection of aquatic ecosystems and natural water sources, reconstruction of traditional sources of water supply.

● Shaping positive attitudes towards steppe conservation; formation of public consciousness to the same end.

Regions and objects of biodiversity requiring special attention:

– true and meadow steppes of European Russia most heavily affected by man;
– dry steppes and semi-deserts in the south of European Russia supporting viable saiga populations (Kalmykia and southern part of the Volga basin);
– Central Siberian and Transbaikalian complexes of dry steppes and semi-deserts (Tuva, Buryatia, and Dauria).
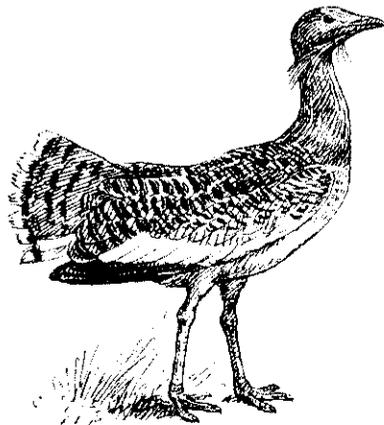
5.2.2.4. Mountainous Ecosystems

Mountains cover approximately a quarter of Russia's territory; they occur in 43 of the 89 administrative units of the Russian Federation.

Mountainous ecosystems play a unique role in the maintenance of global biodiversity. They are characterized by an extremely high species and ecosystem diversity and support many endemic forms. High evolution and speciation rates are a charecteristic feature of mountain biota. It accounts for mountainous ecosystems harbouring a large fraction of global biological diversity and greatly contributing to its active formation.

Mountains give home to a variety of historico-cultural ethnic complexes with unique traditions of sustainable nature use. Mountains are a great tourist attraction and provide numerous opportunities for ecological tourism.

Mountain ecosystems are characterised by high vulnerability to anthropogenic influences due to a high rate of downward matter transfer and high risk of natural and technogenicdisasters. The biotic component of mountain landscapes serves as the most important stabilizing factor and provides a solid basis for the sustainable development of these regions. However, recent strategies of exploitation of mountain complexes have led to the loss of biodiversity, destruction of biota, and destabilization of mountainous ecosystems and landscapes.

Threats to biodiversity of mountainous ecosystems

- Extraction of minerals and mining industry.
- Abusive exploitation of forests, clearing of forest lands for the development of - agriculture.
- Unsustainable agriculture and over-grazing.
- Over-exploitation of economically important species, first of all mammals.
- Invasion by spreading plants and animals.
- Growth of uncontrolled tourism.
- Climatic changes.

Consequences of human impact on mountainous ecosystems

- Erosion of mountain slopes, catastrophic landslides and mudflows.
- Degradation of soil cover.
- Decline in species and ecosystem biodiversity, replacement of highly specialized mountain forms by invasive species, destruction of biocenoses, loss of their ability for self-regulation and self-recovery.
- Destruction and disappearance of ecologically-balanced natural-cultural complexes, loss of environmentally friendly forms of traditional nature use and management

Priority measures for conservation of mountainous ecosystems

- Elaboration of a national policy of sustainable development of mountain regions taking into account specific local conditions and concrete needs of biodiversity conservation.
- Organization of federal and regional co-ordinating centres for the sustainable development and conservation of biodiversity of mountainous ecosystems. Such co-ordination is indispensable for the implementation of a policy of conservation and sustainable use of biodiversity because many mountain regions are jointly controlled by several regional administrations of the Russian Federation.
- Further development of the network of specially protected natural territories in mountain regions. Granting special status to territories occupied by indigenous peoples and national minorities with their traditional subsistence economies beneficial for ecological equilibrium of mountain ecosystems; development of a network of historical-cultural territories.

Regions and objects of biodiversity requiring special attention

- the Caucasus;
- Khibiny Mountains;
- the Urals;
- mountain massifs in the southern Far East;
- Altai Mountains

5.2.2.5. Marine and Coastal Ecosystems
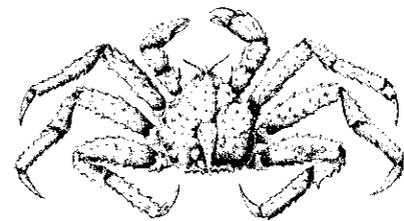
Russia is bounded by thirteen seas: the Sea of Azov, Caspian, Black, Baltic, Barents, White, Kara, Laptev, East-Siberian, Chukchi, Bering Seas, the Sea of Okhotsk, and the Sea of Japan. Considerable portions of their coasts undergo anthropogenic transformation. Some marginal areas of the Barents Sea (the Kola Bay), Arctic (Ob, Lena, Yenisey, and Kolyma Deltas) and Pacific (Peter the Great Bay, certain areas of the Sakhalin Shelf in the Sea of Okhotsk) seas are fairly free of pollution. Ecosysyems of the Sea of Azov, Caspian and Blak Seas are severely affected by regulation of large rivers, such as the Volga, Don, and Dnieper. They also suffered from the man-assisted invasion of alien species, e.g. Mnemiopsis.

Natural annual fluctuations of aquatic species composition must be taken into consideration when it comes to the elaboration of measures for biodiversity conservation in the marine environment.

Major threats to biodiversity of marine and coastal ecosystems

● Pollution by:
- hydrocarbons and drilling fluids during oil-field developments and as a result of oil spills from pipelines in the south-eastern part of the Barents Sea, the northern part of the Caspian Sea. and on the north-eastern shelf of Sakhalin;
- waste matter from sea vessels and ports;
- industrial and municipal effluents containing heavy metals, phenols, surfactants and other pollutants;
- agricultural waste containing phosphorus, nitrogen, pesticides, etc.;
- radioactive and toxic substances from military facilities, testing sites and bases.
● Engineering works and mining activities in the coastal zone.
● Invasion by alien species.
● Legal and illegal over-exploitation of natural populations of marine organisms (fishes, invertebrates, and algae); use of fishing gear and techniques undermining natural communities.

Consequences of human impact on marine and coastal ecosystems

● Disturbance of marine and coastal ecosystems resulting from pollution, regulation of river channels and flow of sediments they carry into the sea, eutrophication.
● Reduced numbers and biomass of valuable aquatic species resulting from their over-exploitation.
● Sharp decrease in abundance of aboriginal marine organisms resulting from invasion by alien species.

Priority measures for conservation in marine and coastal ecosystems

● Prevention of pollution of the coastal environment by industrial waste and petroleum hydrocarbons extracted and transported in shelf areas.
● Development and application of methods to control dangerous alien species.
● Cessation of excessive exploitation of marine biological resources (regulation of catches); implementation of multi-species fishery strategies for better conservation of natural diversity of marine species and ecosystems; development and use of ecologically safe fishing gear and techniques.
● Establishment of protected marine natural territories (nature reserves and sanctuaries) starting from the extension of buffer zones of the existing inland nature reserves to the adjoining offshore waters.

Regions and objects of biodiversity requiring special attention:

- Baltic Sea;
- coastal areas of the Barents Sea;
- breeding grounds of marine mammals on the coastline and islands of the Arctic and Pacific Oceans;
- seabird colonies on the coastline and islands of Arctic and Pacific Oceans;
- coastal areas of southern Primorye and Sakhalin Island;
- Caspian Sea;
- Sea of Azov;
- Black Sea.

5.2.2.6. Freshwater Ecosystems
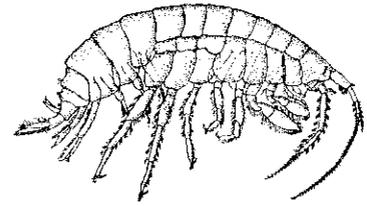
The quality of surface water in the majority of Russian water bodies fails to meet the relevant criteria despite a decline in industry and reduced discharge of waste matter. The situation is especially serious in the Volga basin, north-western regions, certain regions in the North, and in the basins of the Don, Kuban, Ob, Yenisey, and Pechora Rivers whose waters are described as polluted (heavily polluted in their tributaries). The total volume of polluted effluents emptied annually into the surface run-off is estimated at 55 cub.km including 20.3 cub.km undergoing poor preventive treatment or no treatment at all. Negative effect of pollution on Lake Baikal, a World Heritage Site, has never been stopped. The welfare of aquatic ecosystems will further deteriorate while the anthropogenic pressure remains at the present level.

Major threats to freshwater ecosystems

- Hydroengineering works cause degradation of natural complexes in large rivers and lakes. Regulation of river channels disturbs reproduction and migration of hydrobionts, construction of dams leads to the loss of spawning grounds for acipenseriform fish, fluctuations of water level in artificial reservoirs affect many other species leading to the drying up of their breeding sites. Risk of catastrophic accidents increases because of the poor condition of hydrotechnical constructions.
- Pollution:
  - by industrial discharges;
  - by domestic and municipal effluents;
  - as a result of agricultural activity;
  - as a result of oil developments;
  - as a result of forestry and logging;
  - by motor vehicle emission;
  - secondary pollution of lakes and water reservoirs by harmful substances accumulated in bottom sediments;
  - as a result of trans-boundary aerial transport of pollutants including acid rains (especially harmful for small and medium-sized lakes in the north of Russia).
- Ecologically-unsound water use by industries and other economic activities and direct transformation of natural freshwater ecosystems.
- Excessive and poorly controlled norms of water consumption for industrial, agricultural, and domestic needs.
- Invasion by alien species including their release with water from ballast tanks.
- Excessive catch of commercial hydrobionts and poaching.
- Destruction of aquatic habitats by dredging river channels for navigation, sand and gravel extraction.
- Navigation.
- Explosions related to the exploration for mineral deposits and construction work.
- Regional and global changes of climate.

## Consequences of human impact on freshwater ecosystems

- Poisoning of water bodies by heavy metals, phenols, hydrocarbons, and other toxicants.
- Upset of the balance of nutrients carried into water bodies, altered equilibrium between production and decomposition processes in freshwater ecosystems, disturbed natural cycles of biogenic elements, eutrophication of water bodies resulting from pollution by agricultural and domestic waste.
- Acidification of water bodies by atmospheric precipitation containing products of fossil fuel combustion and other production processes. This type of contamination is especially dangerous for northern freshwater ecosystems because of their low capacity for neutralizing acid precipitation.
- Thermal pollution of water bodies by cooling water of thermal and nuclear power plants changes their temperature regime and promotes eutrophication.
- Disturbance of natural succession of ecosystems including that by altered hydrological conditions.
- Disappearance of "key species" of hydrobionts leading to degradation of food chains and ecosystem structure.

Priority measures for conservation of freshwater ecosystems

- Prevention of negative effects of hydroengineering works, co-ordination of water discharge past the dams of hydroelectric power plants during fish spawning seasons with fish industry and research institutions, improvement of sanitary and technical conditions of reservoirs, bank strengthening.
- Preliminary measures aimed at preventing discharge of all kinds of pollutants into rivers and water bodies, application of resource-saving and environmentally friendly technologies, improvement of water purification techniques, preventive treatment of waste water.
- Use of ecologically safe technologies in agriculture and forestry.
- Decrease in wastage of water in production processes, use of recycled water, decrease of water consumption, application of fish-protecting devices.
- Control of permitted catches of commercial hydrobionts. Protection of species and ecosystem biodiversity in natural complexes through the implementation of multi-species fishery strategies.
- Recovery of the most important natural spawning grounds.
- Prevention of invasion by alien species.

Regions and objects of biodiversity requiring special attention:

- deltas and estuaries of large rivers;
- lakes Onega and Ladoga;
- freshwater ecosystems in northernmost regions;
- water bodies and small rivers in the Central-Chernozem, North Caucasus, and Southern administrative regions; Lake Abrau;
- the Volga River basin, especially its smaller rivers;
- the Ob River basin;
- lakes of Altai;
- Lake Baikal and its basin;
- lakes of Transbaikalia
- Lake Khanka.
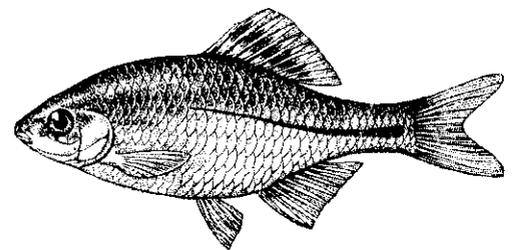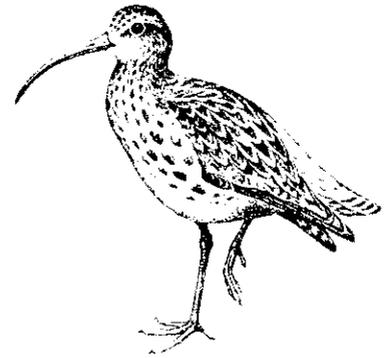
5.2.2.7. Peatland Ecosystems

Peatlands occupy over 20% of the territory of Russia. They provide a variety of functions including maintenance of biological diversity and regulation of the global carbon and water cycles. Peatland ecosystems support high species diversity due to their frequent location in frontier areas between other types of ecosystems. This creates favourable conditions for co-existence of organisms belonging to different ecological groups while highly variegated environment promotes spontaneous hybridization, adaptive evolution, and development of new morphological traits. Peatlands represent the sole type of habitat for many groups of organisms. Also, they form a characteristic landscape element in many regions. Large mire systems provide a source of many indispensable resources including peat and medicinal plants. They are extensively exploited by agriculture, forestry, and commercial hunting.

Peatland ecosystems have been changed significantly as a result of large-scale, often unwise drainage for agriculture and forestry, extraction of peat for fuel and fertilizers, and ecologically-unsound hydrotechnical works. Marked regional differences in the extent of human exploitation and economic value of different types of mires account for a significantly different magnitude of their anthropogenic modification.

Major threats to peatland ecosystems

- Changes in natural hydrological conditions after the construction of roadways, oil and pipelines, and other linear structures and hydrotechnical works.
- Agricultural use and extraction of peat in regions with small mire massifs.
- Tree cutting in floodplain swamp forests at the southern border of the forest zone.
- Pollution of peatlands by agricultural, industrial, and domestic waste and runoff from highways.
- Disturbance and pollution caused by oil developments.
- Haphazard siting of kitchen-gardens, week-end dwellings, and second homes in floodplains and other lowland mires in densely populated regions.
- Use of surface and underground water sources feeding peatlands for domestic and technological needs.
- High recreational activity, collection of berries and mushrooms, hunting (in certain regions).

Consequences of human impact on peatland ecosystems

- Conversion of natural peatland systems into agroecosystems and urban areas; disturbance of natural succession of peatland vegetation.
- Man's interference with natural carbon and water cycles, turnover of other elements and substances, hydrologic, climatic, and other regulatory functions intrinsic in peatlands.

- Changes in peatland function as a source of natuiral resources and in other economically and socially important functions.
- Disappearance of organisms and groups of organisms characteristic of peatland ecosystems.
- Adverse effects on migratory birds associated with peatlands.

Priority measures for conservation of peatland ecosystems

- Forbidding extraction of peat as a practically non-renewable resource, for fuel.
- Decrease of peat extraction as a fertilizer in regions with a poorly developed network of mires.
- Prevention of disturbances to the natural hydrologic balance of peatlands resulting from hydrotechnical and other construction works.
- Prevention of negative consequences of oil and gas extraction and transportation.

- Minimal reclamation of new peatland areas for agriculture and forestry, promotion of the sustainable use of the previously reclaimed areas including their rehabilitation.
- Limitation on the conversion of floodplain and other lowland mires in densely populated regions.
- Prevention of pollution by agricultural and domestic waste and runoff from highways.
- Control of water consumption from water sources feeding peatlans.
- Prohibition of tree-cutting in floodplain forests at the southern border of the forest zone.
- Priority designation of peatlands of international importance as Ramsar sites.
- Incorporation of peatlands into the system of specially protected natural territories at regional and local levels.
- Rehabilitation of peatland ecosystems in regions of their intense degradation.
- Regulation of harvesting berries and mushrooms and hunting on heavily exploited peatlands.

Regions and objects of biodiversity requiring special attention:

- peatlands designated to the Ramsar List by the Decree of the Government of the Russian Federation No. 1050 of 13 September 1994; also, those included in the Shadow List of internationally important wetlands in Russia;
- floodplain and other lowland mires in densely populated regions;
- peatlands at the southern limit of their distribution;
- northern peatlands with poor ability for spontaneous recovery in oil and gas-development areas;
- peatlands traditionally involved in subsistence economy of local communities.

5.2.2.8. Agroecosystems

Integration of agricultural production into natural territorial complexes leads to the formation of agroecosystems which replace former natural ecosystems. Extensive use of chemical products and industrial technologies in agriculture throughout the second part of the 20th century has led to a marked decline of biodiversity, loss of ecological stability, disturbance or destruction of historically and ecologically valuable natural-cultural complexes.

Consolidation of rural settlements in the 1960s-1970s gave rise to new developments, such is intensified farming in the core parts of new large agrucultural enterprises and reduced exploitation of their marginal portions. As a result, peripheral fields and meadows soon became overgrown by the tree and bush vegetation. In the end, part of biodiversity of traditional ecologically-balanced natural-cultural complexes was lost.

A large part of Russia's population live in countryside, and the bulk of food production comes thereof. Hence, the primary objectives of conservation and restoration of biodiversity are as follows:

— maximum enhancement of the ability of ecosystems for biocenotic self-regulation, minimization of their dependence on human management for the maintenace of ecological stability;

— promotion of ecological safety;
— maintenance of agricultural productivity;
— formation of healthy and comfortable human environment.

Major threats to biodiversity of agroecosystems

Extensive use of chemical products and industrial technologies having the following repercussions.
- Excessive application of fertilizers, pesticides, and other chemical products.
- Pollution by effluents from cattle and poultry farms.
- Unification of agricultural techniques without regard for the diversity of regional and local conditions.
- Maintenance of only few highly productive species, varieties, and breeds; disappearance of local breeds and varieties.
- Appearance of vast monotonous stretches of agricultural land.
- Soil erosion and dehumification, loss of soil fertility and diversity of soil ecosystems.

Priority measures for conservation of biodiversity of agroecosystems

Of primary importance is the transition from the extensive use of chemicals and industrial technologies to the adaptive, evolutionary and ecologically-sound agricultural production.

● Conservation of the remaining natural ecosystems, animal and plant species, ecologically-balanced natural-cultural complexes.

● Optimization of the proportion of natural and anthropogenic elements in agrolandscapes; maintenance of the integrity of natural ecosystems and ecologically balanced natural-cultural complexes by preventing their fragmentation and establishing ecological corridors connecting them.

● Development of agroecosystems on the principle of biocenotic self-regulation with the maximum closeness of biogeochemical turnover.

● Strengthening of environmentally friend-

ly aspects of agroecosystems and their resource-restoring function.

● Conservation and restoration of traditional ecologically-balanced natural-cultural complexes and agrolandscapes.

● Consideration of the diversity of regional and local conditions and the use of relevant methods of agricultural production, breeds and varieties of animals and plants, optimal combination of various lands (fields, meadows, forest belts, groves, etc.).

● Conservation of the diversity of animal breeds and plant varieties adapted to specific local conditions as a part of cultural heritage of a given region.

● Reconstruction of historico-ecological centres of land reclamation and cattle breeding.

● Promoting awareness and control of the use of genetically engineered organisms, products of modern biotechnologies, especially in open systems and in the centres of origin of aboriginal forms of domesticated and cultivated animals and plants.

Regions and objects of biodiversity requiring special attention:

— regions with a high agricultural potential in the steppe and forest-steppe zones and transition zones on the fringes of the conurbations subject to maximum deterioration of the environment where ecosystems fail to support productive agriculture and man's physical surroundings fit for normal life;

— regions with fairly well-preserved ecologically-balanced natural-cultural complexes capable of maintaining the diversity and stability of agrolandscapes.
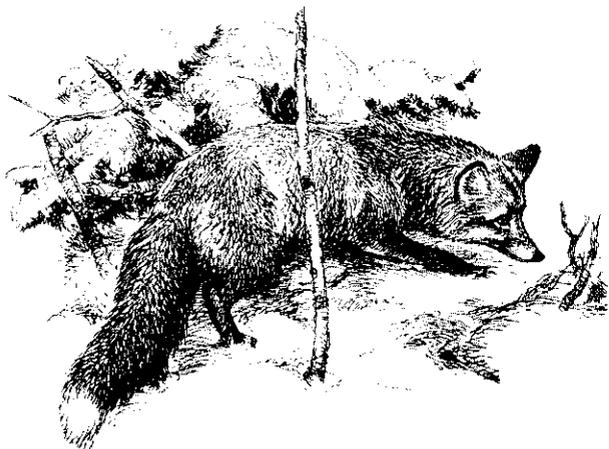
5.2.2.9. Ecosystems of Urban Areas

Ecosystems of urban areas have been maximally changed by man. Urbanization has led to practically complete conversion of natural ecosystems and their replacement by blocks of multi-storey buildings and extended traffic systems with only isolated plots of living nature in between. A gross neglect of nature conservation priorities in the course of urban development especially in the period of its intensive growth throughout the second part of the 20th century resulted in the destruction of ecosystems, sharp decline in biodiversity, and the loss of historically and ecologically valuable natural-cultural urban complexes. Meanwhile, conservation of living nature in urban concentrations is a necessary condition for the creation of comfortable and pleasing environment for city dwellers.

A sinificant part of Russia's population live in cities, large and small. Hence, the necessity to
- form healthy and comfortable physical surroundings;
- ensure ecological safety;
- conserve the existing natural and natural-cultural diversity.

Biodiversity of urban ecosystems enjoys but poor legislative protection; indeed, the existing federal laws do not even touch upon their use and conservation.

Major threats to biodiversity of urban areas
- Construction of buildings, communications, roads, and other urban installations without regard for the spatial structure of ecosystems and conservation of their biodiversity.
- Chemical pollution of air, soils, and water by motor vehicle emission and industrial waste.
- Concentration of domestic refuse.
- Uncontrolled recreational activity; destruction of plant and animal life.
- Noise pollution.
- Thermal pollution (elevated mean air temperature in urban areas).
- Light pollution from industrial and street lighting.
- Electromagnetic pollution from transmission lines, radio and TV stations, and industrial objects.
- Introduction of alien species prevailing over local ones.

### Priority measures for conservation of biodiversity of urban areas
- Minimization and prevention of all types of pollution.
- Conservation of natural ecosystems, individual animal and plant species.
- Conservation and restoration of ecologically-balanced historically valuable natural-cultural complexes.
- Optimization of the proportion of natural and anthropogenic elements in urban areas; maintenance of the in-

tegrity of natural ecosystems and nat-
ural-cultural complexes by establish-
ing ecological corridors connecting
them.
● Construction of ecosystems on the prin-
ciples of rational ecological engineering
and landscape planning; improvement of
their environment-forming and protecting
functions.
● Elaboration and observance of architec-

tural norms ensuring conservation of liv-
ing nature in urban areas.
● Strict control of the abundance of synan-
thropic animals and plants.
● Prevention of penetration of alien species
aggressive towards local ones and harm-
ful to natural-cultural complexes.
● Siting of recreational attractions with re-
gard for optimal conservation of natural
and natural-cultural complexes.

Regions and objects of biodiversity requiring special attention:
– natural complexes of the greatest urban agglomerations and industrial areas;
– historically valuable and ecologically-balanced natural-cultural complexes in the cit-
ies (garden-park complexes, urban forests and forest parks, squares, boulevards,
etc.);
– suburban natural complexes.
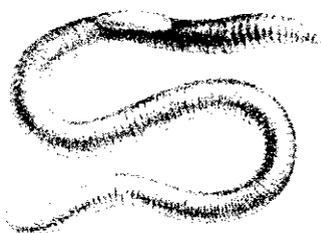
5.2.2.10. Soil Conservation

Protection of soils as a basic components of terrestrial ecosystems and the environment
of numerous plants, animals, and micro-organisms must be given special attention in the
context of biodiversity conservation. Indeed, the overwhelming majority of the known
species of living organisms are connected with soil. The soil cover represents a unique
complex of biotic and abiotic components, i.e. a specific type of ecosystem whose normal
development is vital for the very existence of terrestrial life. Soil formation is a very long
process and its disturbance by human actions may have catastrophic consequences.

In Russia, the condition of the soil cover and soil biota on agricultural lands, on a signifi-
cant part of forest land, and especially in urban areas and those alloted for traffic, transpor-
tation, and other requirements is extremely poor and in many regions critical. About 56%
of the agricultural lands are exposed to water and wind erosion. Both soil erosion and risk
of erosion increase from north to south. They are highest in the chernozem zone and slight-
ly lower in chestnut soils. The area of erosion-ridden lands and the intensity of leaching
correlate with relief patterns. They are smallest on flat lowlands, increase on morain hilly
plains, and reach a maximum on elevations cut by intermitting plains and ravines. In the
European part of Russia, the soils of the Central Russian and Volga Uplands, High Transvol-
ga area, the Cis-Urals, Stavropol Upland, and the foothill areas of the Caucasus are at the
highest risk of leaching. The forest-steppe and dry steppe zones are also affected by soil
erosion unlike natural steppes.

Major threats to the diversity of soils and soil biotas

- Extensive use of chemical products and industrial technologies in agriculture and large areas of arable land account for erosion-related degradation of the soil cover, transformation and disappearance of natural soils, degradation and death of their biota. During the last 50 years, the rate of erosional processes has increased 30-fold. Agricultural lands constitute 11% of all land resources in terms of area, and 6.8% of them are arable lands.
- Soil pollution by industrial waste, motor vehicle emission, effluents from cattle breeding farms, pesticides, radionuclides, oil and other hydrocarbones, and domestic refuse.
- Degradation of forests communities leads to soil erosion in mountain and arid regions and to bogging in the north. Inadequate logging techniques are responsible for the destruction of forest litter and soil.
- Both drainage of wetlands and bogging in the absence of adequate drainage schedule and techniques lead to the upset of regional water balance, intensive soil mineralization, and destruction of peat massifs.
- Non-sustainable irrigation leading to the saturation of the soil by water and to soil salinity.
- Flooding lands upstream from dams.
- Lacking reconstruction of soil amelioration systems installed in previous years.
- Environmentally unfriendly activities (ever increasing use of off-road vehicles, oil pollution in the permafrost zone leading to heavy erosion and decomposition of the thin surface layer of northern soils).
- Allotment of land for construction works and mining and its degradation (a total area of such land has thus far been relatively small but rapidly grows now).
- Invasion of soils by pests and agents of infectious plant diseases.

Consequences of human impact on soil ecosystems

- Degradation and disappearance of natural soil types.
- Water and wind erosion leading to the disappearance of the most productive surface soil layers and sometimes to the complete destruction of soil and its biota.
- Dehumification, i.e. decreased humus content on arable lands compared with normal values, due not only to erosion but also to accelerated mineralization and enhanced nutrient extraction by crops.
- Suppression of soil biota and sterilization of soils.
- Soil acidification caused by the application of acidic mineral fertilizers to lime-poor soils.
- Deterioration of soil physical properties (increased compactness, decreased porosity and penetrability).
- Secondary soil salinization and alkalinization resulting from irrigation.
- Loss of valuable properties of the soil on ameliorated lands due to upwelling of ground water, bogging, and secondary salinity related to the lack of reconstruction of ameliorative systems.
- Desertification, formation of open areas of sand and shifting sands (documented in 26 administrative regions of the Russian Federation).

Priority measures for conservation of soil ecosystems

Conservation of biodiversity and stability of ecological systems requires an adequate and sustainable proportion of various lands including specially protected natural areas and lands used for a variety of purposes (land reclamation, ameliorative agriculture, livestock breeding and grazing , forestry, etc.). All economic and protective measures should be thorougly differentiated in accordance with zonal and regional characteristics of the soil cover.

- Elaboration of a national policy of soil protection. Improvement of mechanisms for inter-sectoral co-ordination and adoption of the Complex Action Plan of soil use and protection.

- Transition from the excessive use of chemical products and industrial technologies in agriculture to ecologically-sound adaptive land use.
- Compilation and publication of the Red Data Book of especially valuable and rare soils and their biotas. Organization of direct and indirect protection of soil objects. Elaboration of a national system of monitoring protected soils. Elaboration of those sections in the Land Cadaster of the Russian Federation and its administrative regions which concern soil protection.
- Consideration of the criteria for soil protection in planning the network of specially protected natural territories. Setting up soil sanctuaries, reserves, and soil natural monuments.

Regions and objects of biodiversity requiring special attention:
- soils of the forest-steppe zone (dark-grey forest soils including those with a secondary humic horizon; forest-steppe chernozems);
- soils of the steppes zone (chernozems and amorphous solonetz, black-meadow soils and meadow solonetz);
- soils of dry steppes and semi-deserts (dark-chestnut micellary-carbonates, dark-chestnut farinaceous-carbonates, dark-chestnut and resting-carbonates, chestnut, and light-chestnut soils);
- soil complexes of dry steppes (chestnut soil, solonetz and solonchak);
- soils of wetlands, swamp soils in the upper reaches of rivers.
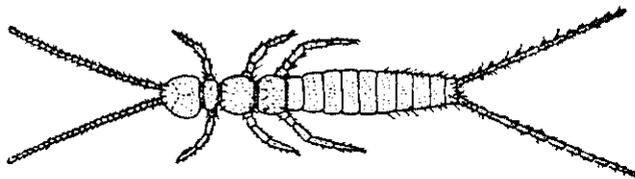
5.3. Priority Species, Ecosystems and Regions with Special Conditions of Biodiversity Conservation

At the federal level, the main attention should be paid to the groups of species and ecosystems which are either threatened or crucial for conservation of national and global biodiversity. This goal requires co-ordination of relevant measures within the country and at the international level. Main regions of biodiversity conservation are also identified below.

5.3.1. Priority Species

The following groups of species require special attention:
- rare and endangered species;
- migratory species;
- commercially exploited species;
- species endemic to Russia;
- rare and threatened breeds of domestic animals and varieties of plants.

Rare and endangered species

Rare and threatened species are those facing the threat of extinction or decline of their abundance and range due to effect of economic activities and also species potentially vulnerable to this effect by virtue of their biological characteristics (naturally rare, narrow-ranged, and relict). These species require special measures of protection and monitoring. Certain rare species are legally protected by elisting them in the Red Data Book of Russian Federation, an official legislative document. National Strategy for conservation of these species has been elaborated in Russia.

Migratory species

These species need special attention because they depend on a wide range of seasonal habitats often situated far from one another and sometimes in different countries. Moreover, these animals are especially vulnerable to edverse impacts during migrations, and their increased mortality in this period needs to be compensated. Conservation of these species requires inter-regional and international co-ordination of relevant protective measures and setting quotas on their catch or harvest.

Commercially exploited species

Species exploited for commercial purposes or household use should be considered as priority objects of conservation for the following reasons:
- permanent pressure and numerous forms of exemption from nature influencing not only the abundance but also the intra-population and intraspecific structure of the species;
- probability of escape of commercial exploitation from the government control, risk of excessive and/or destructive exploitation;
- high commercial value of these species;
- their importance for the existence of national minorities and maintenance of their cultural traditions.

Conservation of economically important species is ensured by using methods and technologies of sustainable exploitation and strict control of commercial activities and population condition.

Species endemic to Russia

These species are designated as priority species because Russia bears exclusive responsibility for their conservation. Many endemic species have narrow ranges and are rare or endangered which gives reason for special attention to their present status.

Rare and threatened breeds of domestic animals and varieties of plants

These species are priority objects of conservation for the following reasons:

– any organism modified by man is a carrier of unique genetic information coding for its inheritable properties (of economic value or not) including yet unknown one that may prove useful in future;

– diversity of races and varieties is a necessary prerequisite for the maintenance of ecologically balanced (adaptive) agriculture in Russia with its enormous diversity of natural and socio-economic conditions; it determines the possibility of selection forms rapidly responding to changes in ecological (including climatic), economic and social situation and is therefore indispensable for the sustainable development of agricultute and reliable food supply.

– local breeds and varieties are integral elements of traditional cultures of nature use ("living cultural heritage").

5.3.2. Priority ecosystems

Priorities of conservation of major categories of terrestrial and marine ecosystems described as being in critical condition in Russia are identified at the federal level. These ecosystems include forest-steppe, steppe and semi-desert ecosystems; ecosystems of the Caspian Sea, the Sea of Azov, the Black and Baltic Seas.

Ecosystems of lower levels requiring special attention are considered in relevant paragraphs.

Forest steppe, steppe, and semi-desert ecosystems

In Russia, these ecosystems have undergone maximum transformation by man.

At present, they persist as small isolated sites and many lost the ability for self-recovery. To conserve these ecosystems at the territory of Russia, it is necessary to protect all the remaining natural communities, take active measures necessary for their recovery, and develop ecologically safe agricultural and land use technologies.

Ecosystems of the Caspian Sea, the Sea of Azov, the Black and Baltic Seas

These marine ecosystems are in critical condition due to intense complex modification by adverse anthropogenic factors (pollution, over-fishing, invasion by alien species, etc.). Immediate active measures at the federal level are necessary for their conservation.

5.3.3. Priority Regions and Ecoregions

The following regions require special attention:
- unique natural complexes, centres of endemism and regions of great value for the conservation of global and national biodiversity including UNESCO's natural and cultural heritage sites;
- regions with special conditions of biodiversity conservation distinguished by the complexity of problems and ways of their solution where a significant effect may be reached only in the framework of ambicious programs (regional biodiversity conservation strategies with relevant action plans).

Unique natural complexes, centres of endemism and regions of great value for conservation of global and national biodiversity

- Courland Spit,
- coastal waters of the Barents Sea,
- the Caucasus,
- primary forests in the North of the European part of Russia and Siberia,
- Volga Delta,
- Caspian Sea,
- Putorana Plateau,
- Altai,
- Lake Baikal,
- Transbaikalia,
- southern quarters of the Russian Far East (Primorye),
- Kamchatka Peninsula,
- Chukchi Peninsula,
- Wrangel Island.
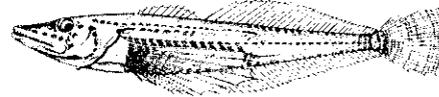
Regions with special conditions of biodiversity conservation

Primarily mining regions: nortern part of European Russia, West Siberia, northern part of Krasnoyarsky Kray (territory), Sakhalin, probably gold-mining regions of East Siberia and the Far East.

Prevailing regional features: one or two dominant branches of industry, with mining employing the overwhelming percentage of labour force; transient population of contract workers showing little interest in biodiversity and its conservation for the benefit of small resident communities; high ecosystem degradation rate attributable to heavy pollution and direct destruction by mining operations.

Necessary conservation measures: improvement of mining techniques, designation of areas of traditional nature use by indigenous peoples and legal prohibition on mining operations at these territories, encouragement of contribution of mining industries to biodiversity conservation as a means of shaping the ecologically attractive face of a company.

Southern part of European Russia

Prevailing regional features: conversion of ecosystems or the loss of ability for self-recovery, intensified resource-consuming farming, water deficit, low per capita income and educational level of the population, large number of religious people, little concern for environmental problems on the part of residents.

Necessary conservation measures: conservation of all remaining natural communities; formation of a networks of specially protected natural and historico-cultural territories and active management of their ecosystems, establishment of ecological corridors; exemption of unproductive agricultural lands from economic use for the reconstruction or rehabilitation of natural ecosystems, elaboration and implementation of water use projects and protection of water bodies.

Regions of concentrationed industry (the southern Urals, Kuzbass, the city of Moscow and Moscow region, etc.)

Prevailing regional features: high level of man-induced ecosystem transformation, intense economic activity and predominance of energy-consuming industries, high risk of environmentally-significant losses and the necessity of repair; challenging opportunities for the implementation of nature conservation projects.

Necessary conservation measures: decrease of pollution and resource consumption for industry, development of a network of specially protected natural territories, establishment of ecological corridors.

Land and sea frontier areas of the country

Prevailing regional features: inflow of pollutants and threat to biodiversity from the territories of other countries.

Necessary conservation measures: establishment and management of specially protected natural territories, international co-operation, support of traditional nature use, measures for biodiversity conservation at military holdings and bases, strengthening of frontier regime.
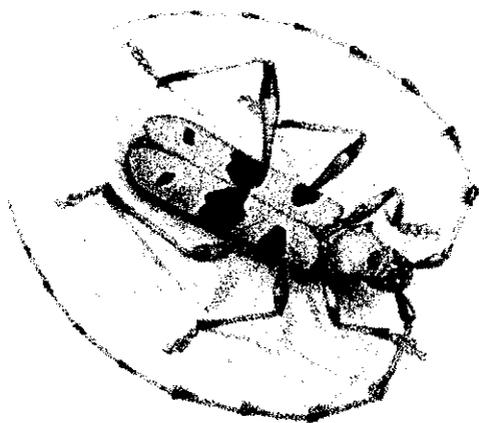
5.4. Challenging Economic and Other Activities

• Development of environmentally friendly and low-level-waste technologies, decrease of energy and resource consumption including water consumption in industry and transport. Development of technologies using resources recycled for repeated use. Control over dumping of hazardous wastes.

• Prevention of environmental pollution and minimization of harm to natural ecosystems caused by mining especially in the permafrost zone. Rehabilitation of disturbed ecosystems after the termination of mineral extraction. Support of traditional nature use by indigenous peoples in areas of intense mining activity. Reduction to a minimum of a damage inflicted on hunting grounds and agricultural lands.

• Transition from the extensive use of chemicals and industrial technologies in agriculture to adaptive evolutionary and ecologically-sound agricultural production. Introduction of ecologically safe technologies to agriculture. Conservation of the diversity of breeds and varieties of domestic animals and plants, cultivation of those best adapted to local conditions. Consideration of the diversity of regional and local conditions in the development and application of various modes of economic activities. Enhancement of spatial diversity of agroecosystems. Formation of complexes of natural ecosystems and agroecosystems requiring minimal management for the maintenance of ecological balance. Optimization of the spatial structure of natural-economic complexes.

• Raising awareness of the principles governing the use of genetically engineered organisms, products of modern biotechnologies, potentially hazardous to the environment or human health especially in open systems and centres of origin of selected plants or animals.

•Further development of quarantine control practice and regulations for the prevention of introduction of alien species with imported agricultural produce and other commodities or their release with water from ballast tanks.

• Revision of modern forestry activities with special emphasis on biodiversity conservation as an indispensable precondition for the sustainable development of forests with regard for their role in maintaining viable ecosystems. Logging, reafforestation, and management operations must ensure conservation of forest species and ecosystem biodiversity.

• Transition to ecologically-sound strategies of commercial hunting and fishing including marine fishery. Planning for hunting and artificial reproduction of game animals with due regard not only for species and population numbers but also for the conservation of their genetic, spatial, sexual, age, and social structure and habitat protection. Also, potential repercussions of hunting one species on other species of the ecosystem must be taken into account.

• Design and construction of hydroinstallations, roadways, pipelines, power lines, etc. in a way preventing animal mortality. The siting of linear constructions excluding disturbance of the spatial structure of natural ecosystems, populations, and species, their migration routes, nesting sites, etc.

• Conservation, monitoring, and studies of biodiversity at military holdings and bases, reservation of these areas for further designation as specially protected natural territories after their recovery from the possession by the armed forces. Biodiversity conservation in frontier areas. Prevention of environmental pollution by military facilities, spacecrafts, and related technologies. Prevention (minimization) of harm to biodiversity during military exercises.

• Development of evironmentally friendly technologies for the removal and treatment of domestic refuse and municipal effluents.

• Development of ecologically safe tourism harmless for natural systems. Taking into consideration requirements for biodiversity conservation when planning recreational activities and installations.

5.5. Development of the Network of Specially Protected Natural, Historical and Cultural Territories

● Development of networks of protected natural territories and areas of traditional nature use.

● Priority extension of the network of specially protected natural territories in the steppe zone.

● Priority enhancement of the proportion of specially protected freshwater and marine ecosystems in the network of specially protected natural territories.

● Enhancement of functional diversity of specially protected natural territories including
− territories of traditional nature use occupied by indigenous peoples and other minorities practicing subsistence economies that ensure maintenance of the functional potential of natural ecosystems;
− old-aged forest stands as reservations of biodiversity of climax forest communities;
− territories for conservation of valuable soils;
− wetlands of international importance;
− ecologically balanced historico-cultural complexes and landscapes;
− territories for conservation of especially valuable local objects of biodiversity (bird colonies, spawning grounds, breeding sites of hoofed mammals and seals, walrus rookeries, polar fox dens, etc.);
− areas to be designated as specially protected territories.

● Differential approach to the planning of networks of specially protected natural territories depending on the extent of anthropogenic transformation in a given region:

− establishment of "ecological corridors" in heavily impacted regions;
− protection of the most valuable objects of biodiversity in poorly-developed regions undergoing intensification of economic activity.

● The choice of protective measures depending on specific regional conditions:
− at slightly disturbed territories with natural complexes occupying large areas, new developments must ensure minimal interference with their integrity and/or rehabilitation, as appropriate;
− at territories undergoing moderate economic development with small natural ecosystems persisting within relatively small areas, strict and selective protection should be combined with regulated use of natural resources;
− at small isolated territories with severely disturbed natural complexes on reclaimed lands, specialized measures of conservation and/or restoration of natural objects are needed.

● Integration of specially protected natural and historico-cultural territories into the socio-economic structure of a given region, enhancement of their positive influence on the life of the region, encouragement of the interest of local population in specially protected natural territories, involvement of members of national minorities and other residents in joint activities related to environmental conservation.

● Organization of research at specially protected natural territories.

6. Implementation of the Strategy

6.1. Mechanisms of Strategy Implementation, Control and Correction

6.1.1. Action Plan

The Action Plan is formed to promote realization of the National Strategy of Biodiversity Conservation in Russia and attainment of its goal. According to the Convention on Biological Diversity (article 6), each contracting party elaborates national strategy, plan, and programs of conservation of biological diversity or adopts corresponding strategies, plans or programs in conformity with its specific conditions and reqirements. With this in view, the national Action Plan envisages the following actions:

_- co-ordination between Russian state programmes (federal, regional, sectoral, intersectoral) and projects of non-governmental organizations (Russian and international funds and public bodies) in the area of biodiversity conservation;

_- identification of gaps in the activities pertaining to biodiversity conservation;

_- elaboration of additional plans and programs and their incorporation into the Action Plan.

The Action Plan should be formulated based on the consideration of project applications submitted by all subjects of the Strategy and their selection for subsequent implementtion. The applications must be collected and Action Plan corrected in an open manner and the results conveyed to the public through the agency of the mass media.

The Action Plan is realized by joint efforts of all subjects of the Strategy. Federal and regional government bodies use it as guidelines to formulate applications for budgetary funds and substantiate relevant task programs. Projects included in the Action Plan are supported by the government, non-governmental and international nature conservation organizations, private companies, and other domestic and foreign partners.

The Action Plan is a document of short-term planning subject to correction in line with changing ecological and socio-economic situation in the country, available funds, and progress in the development of new methods and technologies.

A co-ordinating consultative council is set up for the development of the Action Plan. To ensure participation of various sectors of the society in the planning process, the council must include representatives of federal executive and legislative powers, scientific institutions, private companies, funds, nature conservation organizations, general public, and mass media.

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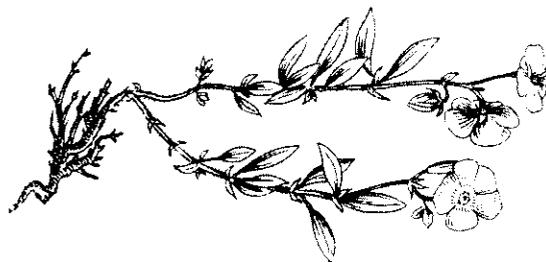
6.1.2. Control and Efficiency Criteria for the Implementation of the Strategy

Effectiveness of Strategy implementation is evaluated in the course of its realization and after the completion of individual projects, based on the following criteria:
- quantitative and qualitative changes in the condition of objects of biodiversity at various hierarchical levels (populations, species, communities, and ecosystems);
- changes in public consciousness, legislation, and economic activities influencing biodiversity;
- changes in nature use concepts and technologies;
- size of the network of specially protected natural territories;
- efficiency of measures employed for Strategy implementation (estimation of ecological effect per unit of the resources utilized).

Parameters and methods of estimation are corrected depending on the available information and the quality of Strategy substantiation. Monitoring implementation of the Strategy is an important prerequisite for its success if it brings about regular data on the completed and on-going projects of the Action Plan, difficulties encountered and measures necessary to overcome them.

A comprehensive assessment of the implementation of the Strategy should provide a basis for the elaboration of further actions and measures.

6.1.3. Analytical and Informational Support of the Strategy

Informational and analytical support of the Strategy, formulation of Action Plan and its realization are crucial for an efficient organization of the Strategy process.

Equally important is the establishment of an efficient tool in the form of an interdepartmental analytical and informational centre to function as a link between national remediation mechanisms and those stipulated by the Convention on Biological Diversity.

Another important activity of this centre is to organize information support for the decision-making process at different levels and to ensure access to information for all interested users, its efficient application and distribution.

6.1.4. Sources for Funding Nature Conservation Programs

- Reform of taxation policy. Collection of adequate rental incomes from exploitation of natural resources. Present-day Russia is a country with resource-oriented economy, and taxation with an ecological slant may give impetus to the development of high-technology production.
- Increased revenue in budgets of various levels may be the main source for funding biodiversity conservation.
- Support by international ecological foundations including compensation for limitations on economic activities in behalf of nature conservation, e.g. in the Lake Baikal area, old-aged forests of Karelia, and the Caspian Sea.
- Incomes from privatization of property including objects of biodiversity.

- Ecological insurance funds.
- Selling licenses and similar benefits.
- Funds accumulated from fines and suits for damage to biodiversity.
- The "debts to nature" mechanism for the use of budgetary funds in nature conservation in Russia which must be taken into consideration in settling debt-servicing obligations among countries and with international financial organizations.
- Market mechanisms of the Kyoto Protocol related to quotas on discharges of hotbed gases.
- Funds-in-trust investments and incomes from highly profitable economic activities. Multi-purpose private funds arising as an inevitable response to strict ecologic regulations of investment projects.

6.2. Approaches to the Elaboration of Regional Strategies and Action Plans for Biodiversity Conservation

Substantial regional differences in natural and socio-economic conditions, anthropogenic pressure, and the extent of transformation of natural systems dictates the necessity of regional approach to Strategy implementation.

Regional strategies should be based on the principles of the National Strategy. At the same time, they must take into consideration specific natural and socio-economic conditions of individual regions. A regional strategy may reflect the needs of a given administrative unit or those of a group of ecoregions (river basins, lakes and seas, mountain systems, etc.)

The process of elaboration of regional strategies consists of the following principal stages

● *Inventory of regional biodiversity and analysis of its condition*. At this step, it is first of all necessary to estimate the suitability of the available data on regional biodiversity and a necessary scientific background for the elaboration of the strategy. An efficient strategy is elaborated based on the information about the current state of biodiversity, tendencies in its dynamics and underlying causes. In the absence of such data, relevant surveys should be planned and conducted.

● *Identification of priority objects for conservation*. The core problem in the elaboration of regional strategies consists in identifying the starting point and the main targets that require priority funding. Attempts to immediately conserve everything are as a rule doomed to failure. Rare species and natural complexes of national and international importance must be given special attention in regional strategies and relevant criteria employed to identify them and objects of biodiversity in need of conservation. The correct choice of such objects

is an indispensable prerequisite for the successful management at the lowest possible cost.

● *Analysis of natural and anthropogenic factors directly and indirectly influencing objects of biodiversity*. It is important to analyse the widest range of interfering factors and identify their origin whether purely natural (e.g. climatic or geological) or anthropogenic (even if mediated through environmental changes, such as depletion of food resources or increased abundance of enemies). At this stage, it is necessary to conduct an inventory of nature users and identify sources of pollution in a given region.

● *Analysis of socio-economic conditions* (regional peculiarities of economic activity, legislative system, social processes, and public consciousness influencing biodiversity).

● *Identification of factors responsible for the deterioration in the state of objects of biodiversity*. Anaysis of natural and anthropogenic factors influencing biodiversity. No measure for their conservation will give effect until the main cause of the unfavourable situation is eliminated.

● *Estimation of the adequacy of the existing system of biodiversity conservation and protective actions*, including the assessment of representativeness and efficiency of the regional network of protected natural and historico-cultural territories.

● *Identification of priority socio-economic mechanisms* necessary for the conservation of biodiversity in the region including the improvement of regional legislative acts, elaboration of economic incentives, formation of public opinion and education.

● *Propagandistic campaign in support of measures for biodiversity conservation,* their broad discussion, elaboration of new ones, and attaining concensus as regards thier application in the future.

● *The choice of methods for conservation of biodiversity objects.* Generally speaking, those management modalities should be given preference which ensure optimal conservation of a given object in its typical environment.

● *Territorial planning of biodiversity conservation* taking into account the spatial structure of biosystems and territorial zonation.

● *The choice of concrete forms and ways of realization of selected conservation*

methods (including elaboration of relevant tools and measures); measures needed for the promotion of education and formation of public opinion, economic and legislative mechanisms for the prevention of adverse anthropogenic effects based on the analysis of socio-economic conditions in the region, available resources and facilities.

● *Estimation of ecological and economic efficiency* of the newly elaborated measures.

● *Elaboration of the regional Action Plan* implies the search for the sources of funding, identification of the participants, and working out a schedule for its realization.

6.3. International Co-operation

International co-operation is one of the most important instruments for attaining the goal of the Strategy. The system of international ecological legislation is based on the balance of obligations of different countries concerning environmental conservation and their sovereign right to use natural resources. International co-operation in the field of environmental protection is regulated by a number of global, regional, and bilateral conventions, involves a large number of programs and organizations, and uses numerous databases and information networks.

According to the Decree of the President of Russian Federation No 236 of 4 February 1994 On the State Strategy of Russian Federation for Protection of Environment and Ensuring Sustainable Development, biodiversity conservation is one of the main lines of the country's activity in the solution of global ecological problems.

Russia is involved in international co-operation by multi-lateral conventions and

agreements on biodiversity conservation, European Strategy on biological and landscape diversity, bilateral conventions on the protection of migratory birds, and agreements on environmental conservation. Also, it co-operates in the field of biodiversity conservation with governmental and non-governmental organizations and participates in many international programs. Of special importance is its co-operation on biodiversity protection in the framework of the Commonwealth of Independent States (CIS).

Russia's enormous territories virtually undisturbed by human activities make the country a most important actor in international processes and the largest region on the planet preserving the biodiversity of northern Eurasia. In view of this fact, Russia's efforts to prevent threats to the global environment must be given an adequate support from the world community and considered in the development of international economic and financial mechanisms.

A principal objective of international co-operation of Russia in the field of biodiversity conservation is to mobilize resources in support of priority protective measures to be implemented in the framework of the National Strategy of Biodiversity Conservation.
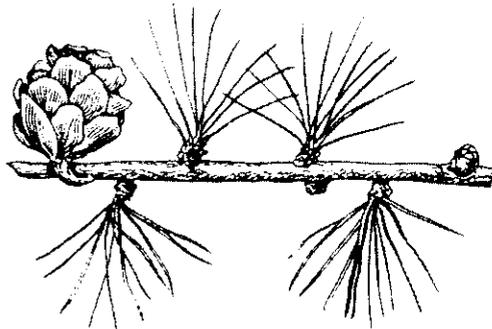
International co-operation of Russia in the field of biodiversity conservation should develop along the following main lines.

● Fulfillment of obligations of the country as a party of international agreements and participation in the work of international organizations concerned with biodiversity conservation. The following aims should be reached in this respect:

— efficacious inter-sectoral co-ordination for the fulfillment of the country's international obligations as regards biodiversity conservation especially in the context of the Convention on Biological Diversity and other agreements on nature protection at the global and regional levels; co-ordination of collaboration with international organizations with special reference to accounting and information.

— development of mechanisms to ensure acsess of interested national institutions to relevant information and its rapid distribution;

— elaboration of systems of measures to be implemented in the framework of international agreements on biodiversity conservation;

— involvement of regional administrations in the realization of international obligations of the country concerning biodiversity conservation.

● Maximally efficient use of all channels and instruments of international co-operation for its further development and mobilization of necessary resources for the protection and sustainable development of biodiversity in Russia. This work pursues the following aims:

— collaboration with international agencies and financial organizations in the further development of biodiversity conservation taking advantage of international experience in this field;

— use of facilities and financial resources of international donors for the implementation of priority measures for biodiversity conservation in Russia;

— use of facilities for the joint implementation of projects on biodiversity conservation and mutually beneficial sharing and application of their results.