

National Strategy for the Conservation and Sustainable use of Biological Diversity in the Republic of Belarus

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National Strategy for the Conservation and Sustainable Use of Biological Diversity in the Republic of Belarus

Dramatic reduction tendencies in biological diversity and in possibility of sustainable use of biological resources in many parts of the Globe compel the peoples of all countries to search jointly for ways of preventing the depletion of natural ecosystems that we belong to. Leaders from more than 100 countries, including the Republic of Belarus, signed the Convention on Biological Diversity in Rio de Janeiro in June 1992 confirming the readiness and the desire of the people in these countries to undertake active actions aimed at the conservation of natural biological diversity. The Republic of Belarus ratified the Convention. In accordance with Article 6 of the Convention, the National Strategy and Action Plan for the Conservation and Sustainable Use of Biological Diversity in the Republic of Belarus was prepared under the leadership of the Ministry of Natural Resources and Environmental Protection with the participation of scientists of the National Academy of Sciences of Belarus, other leading scientific institutions and other ministries and organisations connected with study, conservation and usage of facilities related to flora and fauna, as well as organisations controlling the impact on them.

This document was approved by the Government (Resolution No. 789 of the Council of Ministers of 26.06.97) and in the immediate future it will become a guideline for the implementation of practical steps for the conservation of biological diversity of the country in the interest of the present and future generations.

Chapter 1 - The System of Management, Scientific Support and Control over the Use of Natural Resources

The System and Structure of State Management Bodies

The Ministry of Natural Resources and Environmental Protection is the major governmental body ensuring the implementation of the State policy of environmental protection and rational use of natural resources in the Republic of Belarus. It fulfils its activities through its central organisation (including 6 Departments and 2 Committees) as well as through specialised Inspectorates of State Control, regional committees and district inspections. The Ministry of Forestry, the Ministry of Agriculture and Food, the Ministry of Emergencies and Protection of the Population Against the Consequences of the Chernobyl NPP Incident, the Department of Protected Territories, Forestry and Agriculture in the Administration of the President's Affairs of the Republic of Belarus play a decisive role in the management and conservation of natural resources within the respective sectors of economy. The Ministry of Health, the Ministry of Education and other ministries have their specific functions in carrying out environmental activities as well.

The Republican Commission on Problems of Biological Diversity was established to co-ordinate activities of relevant ministries and other governmental bodies involved in bio diversity conservation, as well as to develop and implement the National Strategy and Action Plan for the Conservation and Sustainable Use of Biological Diversity within the framework of the obligations arising from being a Party to the Convention on Biological Diversity (signed in Rio de Janeiro in 1992). The Commission was formed by Resolution No. 470 of 28.08.1995 of the Cabinet of Ministers.

The System of Scientific Support

The studies performed by academic and sectoral (departmental) scientific research institutions cover a wide range of problems in the most important social and economic sectors pertaining to the conservation and sustainable use of biological diversity in agriculture, industry, forestry, hunting, fishery, water management and land reclamation, fuel and energy, transport and road construction as well as urban and rural planning and construction. Research in the defence sphere, tourism and recreational activities is far more restricted at present.

The system of scientific support is represented by the following institutional groups:

- a) Academic scientific research institutions (The National Academy of the Republic of Belarus and the Academy of Agrarian Sciences)
- b) Sectoral scientific research institutes attached to the Ministry of Natural Resources and Environmental Protection, the Ministry of Forestry, the Ministry of Health, and others
- c) Higher educational establishments

Non-Governmental Organisations and Associations

More than 50 non-governmental organisations and associations are registered and operate in Belarus whose activities are linked, to some extent, to ecological problems and, in particular, to issues related to the conservation and sustainable use of biological diversity. However, in more than 30% of the cases their activities are not supported by real and practical steps mostly because of insufficient financial support and logistics, lack of encouragement on the part of policy-making authorities and other governmental bodies, as well as low social activity of the population in solving environmental problems. Only few organisations pay attention to some aspects re-lated to the biodiversity problems.

Chapter 2 – Biological Diversity in Belarus

Historical Backgrounds of Biological Diversity

The current structure of the flora and fauna of Belarus began to shape about 250 000 years ago after the end of the third glaciation (the Dnieper glaciation) which was the most powerful occurred during the Pleistocene when the territory of the country was fully covered with glacier. Since the two glaciers did not cover the whole territory of Belarus, the development of certain natural complexes in the South (Polessye) is older than that of the complexes in the North (Lake District). The boundaries of both the ancient glaciers and the largest water-sheds of the Black Sea and the Baltic Sea pass through the Belarusian territory. These decisive historical and geographical factors have affected the shaping, differentiation and dynamics of the regional biological diversity.

The changes of abiotic factors and human activities, especially in recent centuries, have resulted in extinction in the territory of Belarus of more than 20 species of terrestrial vertebrates in the period from the early XVII century. These species include two species extinct world-wide: Urus (*Bos primigenius*) and Tarpan (*Equus caballus*). Some others are not encountered here any-more: Sable (*Martes zibellina*), Arctic Fox (*Alopex lagopus*), Carcajou (*Gulo gulo*), Fallow Deer (*Dama dama*), European Wild Cat (*Felis sylvestris*), Desman (*Desmana moschata*), Great tundra Bustard (*Otis*), Little Bustard (*Otis tetrax*), Glossy Ibis (*Plegadis falcinellus*), Spoonbill (*Platalea leucorodia*), White Pelican (*Pelecanus onocrotalus*) and some others. Since the beginning of this century Lamprey (*Lamperta fluviatilis*) and 11 species of fish have become extinct, including Beluga (*Huso huso*), Sturgeon (*Acipenser guldenstacdtii*), Baltic Sturgeon, Vimber (*Vimba vimba*), Rutilus (*Rutilus frisii*), Salmon (*Salmo salar*), Bull-trout (*Salmo trutta*). Within the last 80 years, there has been no evidence of 238 species of invertebrates that were present in the region in the past.

Forty-six species of native vascular plants have disappeared from the Belarusian flora in the last 100-120 years under the influence of anthropogenic factors. Moss flora has lost approximately the same number of species. However, over the same period of time, especially in the last decades, it has been replenished by a much greater number of alien species as a result of a wide synanthropisation process. Changes in traditional agricultural technologies in Belarus have made about 50 species of weedy plants that were widely spread in the past rare or even vanishing.

Review of the Current Diversity of Flora and Fauna

Current structure of flora. Species diversity varies considerably within different taxons of vegetation in Belarus.

Flora of higher vascular plants has been studied best of all. It includes 1 638 species: about 430 moss species, 477 lichen species and over 2 200 species, types and forms of algae. About 1 250 species of edible mushrooms and toadstools, 500 species of wood-attacking fungi and a variety of parasitic fungi are known. Microflora is supposed to comprise about 7 000 species, mostly micromycets. Thus, vegetation in Belarus is represented by approximately 11 500 species (of them, about 2100 higher and 9 000 - 9 500 lower species). Belarus does not have endemic species. There are more than 130 rare relict species among the vascular plants (8% of the flora), 124 of them are included into the Red Data Book of the country. Mosses include 90 relict species which constitutes 20% of the total number in Belarus.

Current structure of fauna. The presence of 457 vertebrates and of more than 20 000 invertebrates is an indicator of biological diversity of fauna in Belarus.

Mammals are represented by 73 species, in 6 orders. One of the most unique mammals is the European Bison (*Bison bonasus*), belonging to the Belovezhskaya line (form). Its population amounts to 300 specimens.

The southern border of the Brown Bear steady habitat goes through the territory of Belarus. There are 100 - 120 bears in the forests of the northern part of the country. In contrast to most of the European territory, the Wolf with a population size of about 2 000 exerts significant influence on the populations of many animal species, particularly hoofed mammals. For this reason hunting reserves encourage wolf hunting.

Among the vertebrates, birds are the most widely represented with forest and wetland species as dominant. About 10 species of birds have become extinct in the last 1.5-2 centuries, but 13 new nesting species have settled on the territory of Belarus in the last 2-3 decades alone. The territory of the country is of special importance for 17 European endangered bird species. At least 5% of the European populations nests in Belarus and the Belarus population of Grass-drake (*Crex crex*) and Aquatic Warbler (*Acrocephalus paludicola*) represent about half of the European population (Table 2.1).

Table 2.1: European endangered bird species nesting in Belarus, % of the total population

	SPEC categories	% of the European population
<i>Ciconia nigra</i>	3	14.6
<i>Ciconia ciconia</i>	2	8.7
<i>Anas querquedula</i>	3	5.4
<i>Aquila pomarina</i>	3	44.7
<i>Crex crex</i>	1	59.0
<i>Gallinago media</i>	2	7.0
<i>Limosa limosa</i>	2	10.7
<i>Tringa totanus</i>	2	23.3
<i>Chlidonias niger</i>	3	26.3
<i>Asio flammeus</i>	3	7.8
<i>Caprimulgus europaeus</i>	2	15.5
<i>Junx torquilla</i>	3	22.8
<i>Picus canus</i>	3	14.7
<i>Picoides tridactylus</i>	3	16.9
<i>Acrocephalus paludicola</i>	1	57.4
<i>Muscicapa striata</i>	3	19.0

The fauna of reptiles and amphibians is represented by 7 and 12 species, respectively. One species of turtles, 3 species of lizards and 3 species of snakes occur in our country. The northern habitat of the Pond Turtle (*Emus orbicularis*) passes through the Belarusian territory. There are 2 species of newts (*Triturus*), 10 species of the Ecaudate order (frogs (*Rana*), Toads (*Bufo bufo*),

Fire-bellied Toad (*Pelobates fuscus*) and Hyla (*Hyla*). The habitat border of Fire-bellied Toad, Hyla and Red-bellied Toad (*Bufo calamita*) passes through the Belarusian territory.

Ichthyofauna is represented by 59 species, 45 of them can be considered as native. Certain species are spread locally, partially they belong to the Black Sea basin exclusively, partially to that of the Baltic Sea.

Though endemic species are absent in the Belarusian fauna, a number of relicts from ancient epochs are present, e.g. some species of arctic origin, typical inhabitants of tundra and forest tundra, such as Willow Grouse (*Lagopus lagopus*), Golden Plover (*Pluvialis apricaria*), Black-throated Diver (*Gavia arctica*), etc., as well as inhabitants of steppes, widely spread on the Belarusian territory in the xerothermic times (Spotted Sousek (*Citellus suslicus*), Common Hamster (*Cricetus cricetus*), Stone-curlews (*Burhinus oedicephalus*), and Dove-hawk (*Circus macrourus*).

Invasive and introduced species. Only in the last decade alone over 120 new, mostly invasive plant species have been registered in Belarus. Invasive species indicate to the main tendency in the Belarusian flora development, i.e., synanthropisation. Different diaspores are introduced mostly with grain and agricultural raw materials. Water transport contributes to the dissemination of aquatic and river plants. Within a relatively short period of time (about 100 years), the quantity of synanthropic species increased by more than 2.5 times. About 1500 species of woody and shrub plants and more than 5000 species, forms and varieties of grassy plants are considered as introduced into the territory of Belarus from other regions. The most important among them are food, fodder, commercial and decorative plants. Some introduced plants have run feral and settled in both modified and natural communities. However so far neither invasive nor feral introduced species threaten the indigenous species of natural communities, though the possibility of such danger in future should not be ruled out. Economically valuable exotic species have been introduced into the Belarusian forests. About 50 introduced species grow in the forests and over 200 such species grow in the arboreta and old parks.

Amongst vertebrates, natural invasions are mostly characteristic for birds as the most dynamic group of fauna. Over the last 30 years, 13 species of this class of animals have settled in Belarus. Some of them such as Clared Dove (*Streptopelia decaocto*), Black Redstart (*Phoenicurus ochruros*), Serin (*Serinus serinus*), Wagtail (*Motacilla citreola*) and some newly settled species extinct in the last century such as Mute Swan (*Cygnus olor*) and Cormorant (*Phalacrocorax carbo*) have successfully naturalised and achieved sizeable populations.

Amongst few introduced species of fauna, 4 mammal species have been acclimatised as game. Those are Raccoon Dog (*Nyctereutes procyonoides*), North American Raccoon (*Procyon lotor*), American Mink (*Mustela vison*) and Musk Beaver (*Ondatra zibethica*). The Red Deer (*Cervus elaphus*) was re-acclimatised in the middle of the last century after having been completely exterminated. In the 50-s and 60-s, attempts were made to acclimatise the Daurian Partridge (*Perdix daurica*) and game Pheasant (*Phasianus colchicus*), but failed. Ichthyofauna today includes 14 fish species brought in at one time or another for introduction and acclimatisation. Crucian Carp (*Carassius auratus gibelio*), Carp (*Cyprinus carpio haematopterus*) and Common Eel (*Anguilla anguilla*) are the most widespread.

Migratory species. Among all taxonomic animal groups in Belarus certain bird species and bats can be classified as migrants, i.e., those which regularly travel over long distances. Some

migratory birds (104 species) nest on the Belarusian territory and regularly migrate for winter seasons; some birds (22 species) do not nest here but fly over the territory of the country in transit during the periods of seasonal migrations. Most birds migrate over the Belarusian territory in a wide front without clear-cut migration paths. Waterfowl and wading species are an exception as they usually keep river flood-plain tracks. The Pripjat flood plain is one of the most important migration "checkpoint" for waterfowl birds. Annually, about than 50 000 geese, 20 - 50 000 Widgeons (*Anas penelope*), 70 000 Ruffs (*Philomachus*) and many other waterfowl and wader species fly over this area. Another important course is the Dnieper flood plain stretching from the North to the South.

Rare and endangered species. Two hundred and fourteen plant species protected as endangered are registered in the National Red Data Book, of which the sec-ond edition was published in 1993. Of these species, 171 are higher plants and 43 species are lower plants Three species such as King-fern (*Osmunda regalis*), Wild Tulip (*Tulipa sylvestris*) and Water Lobelia (*Lobelia dortmanna*) are subject to protection at the international level. Besides, 46 species of rare vascular plants listed earlier in the Red Data Book have disappeared from the territory of Belarus (category 0 by classification of the IUCN). These data require further confirmation and in case of finding any specimens they are subject to protection.

The 97 most endangered vertebrates and the 85 most endangered invertebrates are included into the National Red Data Book. The share of species in different taxonomic groups included into the National Red Data Book varies significantly. Many animal species, especially birds, have both national and international protection status (global or European), or are protected in accordance with different Conventions, such as Bern, Bonn, CITES and others (Table 2.2).

Table 2.2: Species with international protection status

		Status	Number of species
Species of the European Conservation Concern (SPEC)	Birds	I	3
		II	13
		III	52
		IV	52
CITES	Mammals	I	1
		II	3
	Birds	I	2
		II	34
Bern Convention	Birds	II	
		III	31
Bonn Convention	Birds		1
		II	83

Species of particular significance. Under certain cir-cumstances a group of animal species could be set aside in view of their special, mostly negative role in the eco-systems or in certain sectors of the economy. For exam-ple, the Cormorant and the Grey Heron (*Ardea cinerea*) inflict serious damage to fishing ponds when they gather there in large quantities. For the last years the problem has been particularly acute in connection with the Cor-morant which population grows extremely fast. Mallard (*Anas platyrhynchos*) and Mute Swan also cause serious ecological,

health and biological problems because of their increased synanthropisation. It has been proved, in particular, that appearance of "hot" places of skin diseases in the recreation zones of water reservoirs are directly linked with the concentration of waterfowl.

Species that could play the leading role in the future biodiversity conservation are, first of all, big animals and birds, known for their endangered status, as well as globally endangered species protected in Europe and world-wide. In Belarus, these species are represented by most of big eagles (Golden Eagle (*Aquila chrysaetos*), Lesser Spotted Eagle (*Aquila pomarina*), Spotted Eagle (*Aquila clanga*), White-tailed Eagle (*Haliaeetus albicilla*), Osprey (*Pandion haliaetus*), Black and White Storks (*Ciconia nigra*) and (*Ciconia ciconia*), Woodgrouse (*Tetrao urogallus*), Common Crane (*Grus grus*), Corncrake (*Crex crex*), Aquatic Warbler (*Acrocephalus paludicola*), European Bison (*Bison bonasus*), Brown Bear (*Ursus arctos*), Lynx (*Felis lynx*), Eurasian Otter (*Lutra lutra*), European Mink (*Mustela lutreola*).

Biological resources in use

Forest resources. The dominant type of the vegetation cover of Belarus, that occupies 65.9% of the entire territory, is forest. The total area under vegetation is 8,676,100 hectares including 7,371,700 hectares covered with forests. The major part of the forests (77.6%) is managed by the Ministry of Forestry of the Republic of Belarus. Considerable forest resources are in possession of collective and state farms (10.9%); 5.2% of forests is located in the protected territories. Part of the forest areas (6.3%) is managed by other departments.

According to their economic use, the forests in the country are divided into two categories. Green belts around major cities and industrial centres, recreation forests, restricted areas along rivers, lakes and artificial water reservoirs, shelter belts along railroads and highways as well as reserved and park forests belong to the first category (41.9 %)

In view of the development of a network of specially protected areas, recreation and urban agglomerations, the share of the first category forests is expected to increase up to 48-50 % by 2000.

The second category forests are for economic use. They fulfil water protection and climate regulation functions, their proportion is 58.1% with the 584.9 million cubic meters of wood stock. An extremely low proportion (4.7%) of ripe woods exerts an adverse effect on the biodiversity.

In order to renew forest potential, artificial plantations (forest crops) have been established at different periods. At present, their total area constitutes about 1.6 million hectares (21.3% of all land under forest).

Natural flora resources. Many flora species are economically attractive and contribute significantly to natural resources. Herbs, essential oil food (berry, fruit, nuciferous, melliferous and other edible), commercial (tannic, tinctorial, percha and resiniferous, fibrous), decorative as well as fodder crops are the most important.

Game resources. There are 22 species of vertebrate mammals, 31 bird species, 1 species of reptiles used as game species; the invertebrate edible snail (*Helix pomatia*) has been procured in substantial quantities since the 1990s. Elk (*Alces alces*), Boar (*Sus scrofa*), European Hare and Alpine Hare (*Lepus europaeus* and *Lepus timidus*), European Beaver (*Castor fiber*), Squirrel

(*Sciurus vulgaris*), Wolf (*Canis lupus*) and Fox (*Vulpes*) are important natural resources for the national economy. Roe (*Capreolus capreolus*), Musk Beaver (*Ondatra zibethicus*), American Mink (*Mustela vison*), Marten (*Martes*) and Mole (*Talpa europaea*) could be of potential economic importance.

According to the data of the Ministry of Forestry more than 11 thousand hoofed animals were shot and 725 tons of meat were procured in 1990. Nine species of fur-bearing animals were industrialised, 84 000 pelts were sold to the State, 95% of which were hare and squirrel species. As the hoofed animals populations decreased sharply in 1994 State orders for killing were revoked and the game system was reformed. At present, only amateur hunting is allowed.

The most widespread game birds are Mallard (*Anas platyrhynchos*), making 65% of the whole duck population, Garganey (*Anas querquedula*, *Anas crecca*) (28-30%), Pochard (*Aythya ferina*) (2%), Tufted Duck (*Aythya fuligula*) (1.5-2%), and Gadwall (*Anas strepera*) (1%). Now, the total number of duck bird species in the post-nesting season reaches 1.5 million specimens. Of them, 30 - 40% are killed during summer and autumn hunting seasons

The Adder (*Vipera berus*) is one of the most valuable game reptiles. In the recent years, the development of industrial production and the processing of snake venom have resulted in taking 1 500 - 2 000 specimens of this species from the wild annually.

Among 45 indigenous fish species, 20 -25 species are of economic importance. These are Pike (*Exos lucius*), Pice Perch (*Lucioperca lucioperca*), Common Bream (*Abramis brama*), Burbot (*Lota lota*), Sheatfish (*Silurus glanis*), etc. Roach (*Rutilus rutilus*), Perch (*Perca*), Silver Bream (*Blicca bjoerkna*) and others are less important and are present in catches due to their numerous populations and predominance in the ichthyofauna of water reservoirs.

The total average annual catches amount to 1 500-2 000 tons of fish, amateur fishing accounts for one and a half or two times more.

Indigenous species as genetic resources. Certain indigenous wild fruit species (varieties) are important as genetic resources. Wild and cultured apple-trees (*Malus*), Common Pear (*Pyrus communis*), Sour Cherry (*Cerasus vulgaris*) are of prime importance. Frost-resistant forms of wild apple-tree are also important and are used as breeding material.

All species of wild soft fruit are useful as a source material for selection of species resistant to diseases and frost and containing higher volumes of biologically active matter. The short-sighted drainage of marshes made many species endangered, in particular, Marshberry (*Oxy-coccus palustris*) and Foxberry (*Vaccinium vitisidaea*).

Structural and functional diversity of ecosystems

Diversity of ecosystems and communities. Geographical and climatic conditions of Belarus have determined the predominance of forest, aquatic and wetland ecosystems. In the mid-XVIII century, the forest-covered area was two times greater (74% of the territory) and the swamp area covered 4.13 million hectares and amounted to 19.9 % until the late 50s. At present, forests are the predominant components of vegetation in Belarus. They cover 35.5% of the whole territory of Belarus which equals to 7.3 million hectares. Basic dominant aboriginal forest cul-tures are Pine (*Pinus*), Spruce (*Picea*), Oak (*Quercus*), Common and White Birch (*Betula pendula*, *Betula*

pubescens), Aspen (*Populus tremula*), Black and Speckled Alder (*Alnus glutinosa*, *Alnus incana*), etc. The structure of the forest vegetation is divided into four groups: coniferous, broad-leaved, small-leaved derivative forests and small-leaved indigenous bog forests. From the north to the south the proportion of coniferous (basically spruce) forests decreases whereas the area of broad-leaved (oak and hornbeam) forests increases.

Bushes and shrubs are the only type of vegetation which is progressively spreading, although more than 150 000 hectares have been transformed into agricultural lands for the last 30 years. At present, bushes occupy more than 600 000 hectares (3.1% of the territory) and are represented by three major ecological groups - xerophytes (34.2%) mainly spread on sand wasteland (mostly Juniper (*Juniperus*), i.e., bush growing after forest logging); hydrophitic bushes and shrubs (52.5%) spread on marshlands (mostly lower bogs) and swampy lowlands (mostly osieries); mesophytic bushes on flood lands that occupy only 13.3%.

Meadow ecosystems occupy 3.2 million hectares of the territory of Belarus (15.8%). Within the structure of the vegetation cover, meadows amount to 24% of the area. Meadows are classified into water (floodplains) - 5.2% and dry (outside floodplains) - 94.8%. Economically speaking, they are regarded as hayfields (53.2%) and pastures (46.8%). As habitats of meadow species, meadows are classified into rough, steppe, depleted, genuine, wet rich, wet depleted (waterlogged), boggy, and peat (open grass bogs). For the last 35-40 years, meadows, like marshland, have suffered from serious transformation and their area has decreased by almost 50%.

Wetlands or mires are very complex natural formations that have suffered from serious anthropogenic transformations. According to their genesis, stratigraphy and the nature of the vegetation cover, wetlands are divided into eutrophic grassy, hypno-grassy or fens (61.1% of wetlands), mesotrophic or transitional or sedgy-sphagnopratum (20.7%), and oligotrophic or upper sphagnum bogs (18.2%). Drainage and land reclamation activities have transformed 1.775 million hectares (42.4%) of marshes and waterlogged lands into agricultural domains. Large-scale drainage took place between 1965 and 1975, it was less intensive until 1985 and even later. Only 2.3 million hectares of wetlands and marshlands remain in natural condition today, and 7.9 million hectares (33.5%) or 3.8% of the territory of the Republic are open. Forest bogs (swamps) occupy 1.15 million hectares (48.3%) or 5.5% of the territory of the country.

The territory of Belarus is lavishly watered and rich in aquatic and riparian ecosystems. There are 20.8 thousand rivers with the total length amounting to 90 000 km. They belong to the Black Sea (the Dnieper and the Pripyat draining 56% of the territory), and the Baltic Sea (the Narev and the Boug, the Neman, the Western Dvina and the Lovat, draining 44% of the territory). The water-shed for the Baltic Sea and the Black Sea is the Belarusian Ridge. There are 6 rivers of over 500 km long - the Berezina, the Neman, the Sozh, the Pripyat, the Western Dvina and the Dnieper. There are more than 10 000 lakes with a total area over 2 000 km². Nine of them are relatively large with an area of over 20 km² (the Naroch, the Osveya, the Chervonoye, the Lukoml, the Drivyaty, the Neshcherdo, the Vygonoshchanskoye, the Snudy, and the Svir).

Ecosystems formed as a result of arrangement of artificial water pools acquire greater importance. About 130 water reservoirs have been built to regulate ground waters and humidity of adjacent ameliorated lands. The biggest are Vilia, Zaslavl, Krasnaya Sloboda, Soligorsk, Lyuban, Chigirin, Pogost, Loktyshy, and Osipovitchy. The total area of water reservoirs is 799 km². There are 11 large fishing farms set up for fish breeding, their total area being 173 km². A

considerable part of the territory is crossed by drainage canals, 17 051 km long on the whole, of which 9 095 km are in the Pripyat basin.

The distribution of various wetland systems on the Belarusian territory is uneven. Low-eutrophic lakes, mostly in forest environments, large upper bogs and rivers with indistinct flood plains are located in the north. In the south and south-east of Belarus, water systems are characterised by profusely and moderately watered river floodplains (the Pripyat, the Dnieper and their tributaries in downstream regions). Here, a significant number of fishery facilities are concentrated. Water resources of the central part of the country are low-water rivers and artificial pools.

Due to the structure and correlation of habitat types, the character of terrestrial fauna is represented by forest species and species inhabiting mostly humid areas. Over half of mammal species live in forests. Forests are habitats for practically half of the wildfowl, 36% of nesting birds are originally hylcolous. The share of aquatic and riparian birds is practically the same.

The proportion of natural and anthropogenic ecosystems. At present, the proportion of natural and man-made ecosystems is about 55% and 45%, respectively. It is known that the extinction of 20% or even 10% (depending on the ecological importance) of species leads to a loss in ecological equilibrium, while conservation of 10% of natural ecosystems permits conservation of about 50% of species. The results of scientific research have revealed that in conditions of some ecological optimisation of extensively and intensively cultivated lands the balanced proportion of natural, modified and transformed ecosystems is as follows: specially protected areas - 10%, extensively cultivated lands - 40-45%, and intensively cultivated lands - 45-50%.

Priorities for conservation of ecosystems and communities. The main types of natural complexes covering practically all spectrum of most rare and sensitive species of flora and fauna and landscapes of natural origin, requiring top-priority protection, are represented by marshes and fens of the Belarusian Polesye, mesotrophic (transitional) bogs of the Belarusian Lake District, glacial drifted landscapes of the Lake District, open landscapes with remnants of pontic (steppe) faunal elements, European broad-leaved forests, taiga and spruce and small-leaved forests. Special attention should be given to ecosystems of the low anthropogenic impact as they reflect the historical distinctness and the natural structure of biological diversity in the country.

Highly eutrophic lakes and lavishly watered medium and long river floodplains (2.6% of the total river network length) are scarcely represented on the protected areas. They are characterised by distinctly unique features and a variety of fauna and deserve special attention in view of the conservation of the wildlife diversity.

Present reserves and national parks are characterised by their diversity of flora; the same is true for the forest reserve "Nalibokskaya Poushcha" and the projected Svislotch-Berezina reserve with the fauna composition comparable to that of other reserves in Belarus.

In view of the modern anthropogenic impacts and consequences, it is very important to conserve not only those ecosystems that are relatively pristine, but also man-modified territories that are characterised by rich floral and faunal diversity. Today, about 30% of species included into the National Red Data Book is present in man-modified landscapes. More than half of them in fact prefer such habitats or can be found only in these territories.

Amongst the most important types of man-transformed territories which play a significant role for the conservation of the diversity of fauna species are various man-made fish ponds and water reservoirs that are analogous to natural water reservoirs in the most productive eutrophic stage; open drained areas of wetlands, earlier drained shrub-covered plains and floodplains; unique mature artificial forest stands, first of all old landscape parks, analogous to natural forests but frequently more diverse in the composition and structure of the vegetation cover and other ecological characteristics used as habitats for original and rich faunal complexes; agro-ecological zones of peculiar vast territories with traditional land cultivation technologies and other economic activities. These are usually rich biotic complexes and very often without prototypes in the natural environments.

Territorial differentiation of biodiversity and landscape-ecological zoning in Belarus

Belarus is situated on the border of two geobotanic regions: the Eurasian coniferous (taiga) region and the European broad-leaved region. Territorially, the border between them practically coincides with the western limit of climatic determination, thus dividing the territory of the country by the degree of continentality. To the east, a gradual shift from light maritime climate to light continental climate is observed. Three distinctive geobotanic subzones (oak-dark coniferous, hornbeam-oak-dark coniferous and broad-leaved-pinaceous forests) practically coincide with the three agro-climatic regions: the Northern moderately warm and damp, the Central warm and moderately damp and the Southern warm with variable dampness.

Practically all types of soils (according to their granulometric composition) are found in Belarus: from loose sands to heavy clays, and the entire range of boggy and wetland soils (about 14.0% of the territory). Three geographical soil provinces can be differentiated in Belarus: Northern (Baltic), Central (Belarusian) and Southern (Polessye). According to the combination of soil and climatic conditions, each province is divided into 7 districts and 27 soil-geographical regions.

Zoning in the country according to the conditions of the formation and the structure of the relief testifies to the geomorphologic discontinuity. Four geomorphologic districts are distinguished as large regional formations that appeared as a result of glaciation and are characterised by definite height levels. Seventy-seven geomorphologic regions have been defined to become a basis for flora community's territorial differentiation.

Landscape diversity is illustrated by five landscape provinces: Lake District, Belarusian Highland, frontal Polessye, East Belarusian and Polessye. Regional and local differences of the environment are reflected in 55 landscape regions by specifics of the vegetation cover territorial differentiation.

All this shows a considerable potential for biodiversity conservation in the territory of Belarus due to the available natural landscape variety.

Major tendencies of the present biodiversity dynamics

Anthropogenic factors in their multiplicity, i.e., agricultural production, forestry, industries, transport, urban and rural development, recreational and other factors exert the decisive impact on the flora and fauna diversity. These activities result in shrinkage of wetlands and natural meadows that are transformed into arable lands and artificial meadows. Drainage and residual drainage impact of melioration activities in the past may lead, in future, to full extinction (with

the exception of re-serves) of hydrophilic herbaceous, sedgy, sedgy-grassy, hypno-sedgy, sphagno-hypno-sedgy, sphagno-sedgy communities of lower and transitional bogs. The xerophytisation of mesophytic and mesohydrophilic floodplain communities has been observed. Phytocenoses with the domination of miry and meadow-miry plants are disappearing, first of all, on sandy soils with low water retaining properties.

The straightening of river beds and their channelling lead to the elimination of certain macrophyte populations and to worse conditions of their growth. Drainage of bogs adjacent to lakes results in the fall of the water level, increased eutrophication and even to desiccation of lakes. The process of lake eutrophication is a general characteristic in the country. The rate of this process increases with the growth of cultivated areas that are subject to wind and water erosion (1/3 of arable lands). Water reservoirs accumulate alien chemical substances, i.e., waste of industrial and agricultural production, transport and communal services; their water temperature gradually rises. This promotes the growth of macrophytes, though their species diversity becomes poorer.

The impact of a series of anthropogenic factors radically changes the state of the flora and fauna within time intervals that are absolutely insufficient for adaptation to new conditions. The outcome is degradation and elimination of populations of the most vulnerable species, particularly of those that are rare or exist on the borders of habitats. This inevitably depletes the genetic stocks. Anthropogenic impacts, considered in their integrity, may result in changes asynchronous with the character and the speed of natural historical development of flora and fauna and with general tendencies of the natural evolution process.

Chapter 3 – Threats to Biological Diversity in the Territory of Belarus

Natural threats

Global changes. The analysis of the temperature trends for the last century shows that the air temperature has raised in different regions of Belarus by 0.2 to 0.9 0C. Annual precipitation rates have increased by 100 mm (20% of the standard rate) for the last three decades. Precipitation growth is especially evident in winter and summer. This phenomenon is most pronounced in the Lake District in the north. In the south of the Republic, the decrease of precipitation rate has been marked in cold periods of the year, i.e., the trends in these areas are opposite to the trends in the north.

The natural tendency of reduction of the environmental humidity levels is aggravated by anthropogenic impacts (drainage of most marshlands and bogs). This results in the degradation of the hydrophilous populations and a further reduction of mesophitic plants, and, finally, in xerophitisation alongside with the pauperisation of the vegetation layer when it acquires a more "southern" eco-logical outlook (steppe-like).

Examples of the apparent direct impacts of global warming on the fauna are the rapid shrinkage of the snow grouse habitat and population, and the introduction in the territory of Belarus of new bird species typical for steppes and forest-steppes. One of the most pronounced manifestations of changes in the ecology of certain bird species caused by technogenic thermal pollution of the water reservoirs and the global climate warming is the rapid increase of species variety and populations of wintering helobious birds. Before 1970, twelve species of wintering helobious birds had been registered in Belarus, now this number has increased up to 35. Along with some positive aspects of the formation of wintering groups of various bird species, catastrophic consequences for these wintering populations may follow in the most severe winter seasons.

Interspecific competition and predatism. Human interference and the appearance of introduced or invasive species may breach the evolutionary established distribution of ecological niches of indigenous species and mechanisms of population regulation and may lead to a reduction or even full extinction of certain species. Examples of species reduction as a result of increased competition with others that have sharply increased their populations for different reasons may be quoted: competition between the Smew (*Mergus Albellus*) and the Garrot (*Bucephla clangula*) for dissepiment hollows, competitive substitution of the White Bluebill (*Aythya*) by the Red-eyed Bluebill, of the Red-necked Grebe (*Podiceps*) by the Great Crested Grebe, etc. In the coming years, certain changes in the composition and, more important, in the size of the populations of many helobious birds may take place because of intrusion and catastrophic growth of the cormorant and the herring gull populations in Belarus.

There are numerous examples when excessive populations of predators have led to the decrease of victim populations: Wolf (*Canis lupus*) - ungulates, Pine Marten (*Martes martes*) - Smew and Garrot, and Carrion Crow (*Corvus corone*) - waterfowl. Although cases when predation was the reason for the full extinction are unknown.

Introduction, invasion, hybridisation. In many cases competitive interrelations between introduced species, on the one side, and rare, weakly adaptable species, on the other side, are of significant threat to fauna diversity. Below are the examples of such mutually-exclusive interrelations in the fauna: competitive substitution of the European Mink by the American Mink,

hybrid substitution of disperse populations of the European Mink by the population of the Polecat (*Mustela putorius*), competitive pressure exerted by the introduced Raccoon Dog (*Nyctereutes procyonoides*) on the populations of native weasels (Polecat, Marten (*Martes*), and Badger (*Meles meles*)).

Anthropogenic Threats to Biological Diversity in Different Social and Economic Spheres

General background. Most sensitive negative changes in the Belarusian wildlife have been caused by intensive anthropogenic pressure, both direct (killing and extermination of animals) and indirect (dramatic changes or a complete destruction of their habitat). These phenomena are still in progress. Particularly adverse are extensive economic activities with encroachment on new natural territories, ecologically unjustified reclamation of marshlands and mires with further negligent operation, technological violations in the application of chemical sprays and fertilisers, pollution with industrial waste, poaching, recreational pressures resulting in intrusions into ecosystems, and the development of the transport network. They are made even more serious by the ecological ignorance and irresponsibility of the managers and the population at large and lack of economic mechanisms to stimulate environment protection.

Almost all factors, enumerated for wildlife, are fully valid for vegetation (except poaching and stress factor). Ecologically ignorant use of the plants resources (berries, drug plants, herbs and mushrooms), violations of the adopted rules and terms of collection by means of disallowed implements as well as non-observance of the allowed time period for the collection of natural resources may result in considerable damage to these renewable resources.

Urbanisation. Water resources are especially vulnerable to the pollution from cities and industrial centres. The discharged waste leads to enhanced eutrophication of the water systems with consequent distortion of the diversity of flora and fauna. Blue-green algae vigorously develop as a result of eutrophication (algal blooming of water). This is a real ecological disaster for rivers and water reservoirs.

The surface run-off (pluvial and melt) from urban territories which in most cases is not subject to any treatment is a powerful pollutant of water systems. It contains mostly suspended matter, oil products and heavy metals. The State Committee on Hydrometeorology reports a 40-45% increase of the total water pollution defined by the pollution index when measured downstream (20-25 km downstream from discharge sources of bigger cities) compared to upstream measurements.

Thus, in the present conditions, towns may be considered as a permanent threat to the biological diversity of the Belarusian water ecosystems.

Transport and road construction. Highways with most intensive traffic on the territory of Belarus are parts of the European thoroughfares Brest-Minsk-border of Russia, Vitebsk-Mogilev-Gomel and Brest-Pinsk-Kalinkovichi-Gomel. The threat to biological diversity and the populations of certain species arising from transport and road construction in Belarus is exhibited in the breaches of historical conditions of ecosystems functioning (road beds and other engineering structures of motor-roads and railways and physical extermination of animals during their daily and seasonal migration). This threat is especially acute when transport arteries cross protected areas like the Berezina Biosphere Reserve.

Agriculture. Use of nature for agricultural purposes is one of the major territorially expressed factors that affect the biological diversity in the ecosystems. Croplands and grasslands occupy 40% of the territory. It should be borne in mind that agriculture is the oldest intensive human activity that radically changed the territorial structure and functional features of the vegetation in Belarus. In general, land cultivation, especially when accompanied by land drainage, results in the decrease of natural habitats and, later on, in the reduction of natural habitats for different species of plants and animals which, in the long run, diminishes the habitat areas and changes the configuration of their borders. On the other hand, both indigenous and invasive species are resettled in new agrobiocenosis with the rearrangement of habitats.

Forestry. At present, the forest vegetation, flora and fauna are undergoing considerable changes in view of intensive forest management. Forests are unevenly distributed, some regions are seriously deforested. More than 21% of the forest area is covered with forest cultures, i.e. phytocenoses with the depleted floristic basis and simplified structure. At the same time, the share of forest cultures in the forest plantation is permanently increasing. Afforestation inevitably results in the depletion of natural genetic resources of forest varieties. Resistance to diseases and pests falls and the micro-evolutionary process degrades. Changes in the natural conditions of afforestation lead to a decrease of communities with dominating large-leaved woods (oak, hornbeam, etc.) and spruce (zonally located in the territory of Belarus). This is accompanied by an increase of small-leaved forest areas which contributes to the deterioration of the floristic diversity in the lower floors of phytocenoses. Younger forests dominate in the age structure (about half of the territory covered with forests) and aged forest stands are found on 5% of the territory. This leads to succession "re-juvenation" of phytocenoses and prevents their achievement of the climax phase of development which is characterised by the richest floristic diversity.

A significant factor for changes in the biodiversity situation is the use of forest areas for pastures and hay-making, which adversely affects the process of renewal of many plant species. Excessive populations of wild ungulates exert a similar effect. It is reflected, above all, in the destruction of the undergrowth and new growth with the consequent degradation of forest ecosystems. The phenomenon is observed on the territory of the Belovezhskaya Poushcha National Park. High recreation loads (in amenity forests and recreation zones) degrade forests, disbalance the cenotic integrity, and the inner structure and causes synanthropisation of the floristic variety.

A vivid example of negative consequences of incorrect forest management is the irreversible process of extinction of the Polessye great grouse population, which lives here on the border of the habitat and is particularly sensitive to unfavourable conditions.

Hunting and fishery. Most of the economically valuable species of fauna experience adverse impacts as a result of hunting and increased stress. These factors determined a considerable decrease of greater predators (Brown Bear (*Ursus arctos*), Lynx (*Felis lynx*)), particularly sensitive to stress. Poor control of hunting and poaching has often led to a sharp decrease of populations or even to the local extinction of particularly valuable species (Otter (*Lutra*), Elk (*Alces alus*), Beaver (*Castor*) and Black Game (*Lyrurus tetrix*)). It is evident that the reduction of the species population as a result of hunting accelerates the process of their full extinction.

The condition of ichthyofauna, apart from the impact of fishing, depends on other factors exerting negative influence on the quality of the habitat. This leads to changes in the structure of the

population and ichthyocenoses as a whole. The introduction of new species seriously affect ichthyocenosis and results in a catastrophic reduction of the native species population. The practice of introduction of new species into water reservoirs started in the XX century and has been particularly intensive in the last 30-40 years.

Water management and land reclamation. Large-scale land-reclamation practices and bog drainage, the creation of a network of water reservoirs, straightening of almost 60% of small river beds, the industrial use of water from natural water sources and the annual discharge of more than 65 million cubic meters of waste, the land cultivation to the border of water reservoirs and many other activities have changed the ichthyofauna and water sources' biocenoses as a whole. The decrease of fish catch in the water reservoirs of Polesye has been caused by intensive land reclamation operations in the catchment area and a lowering of ground waters.

Changes in the water regime, increase of turbidity, siltation of spawning areas caused by deforestation, land reclamation, and regulation of rivers' run-off are the results of irresponsible economic activities. A variety of fish has disappeared within the last 50-100 years from the water reservoirs of the Republic, the populations of valuable species have decreased, whereas the populations of low-value species have increased. Suffocation of fish has become widespread as well as cases of toxemia and diseases.

The problem of salination of the Soligorsk Water Reservoir deserves special attention in view of potassium production in the vicinity. The hydrochemical conditions are changing and stenobiont fish fall out from the ichthyocenosis.

Drainage of land exerts a particularly harmful impact on the biological diversity. It was especially widely practised mostly in the southern Belarus in the 60s and 70s. More than 2.6 million hectares of marshlands were drained and reclaimed for agricultural use and 1.1 million hectares were introduced in ploughing turnover. This has resulted in the destruction of natural ecosystems of this unique natural region. The territorial geobotany integrity was not simply modified: it underwent deep structural and functional transformations.

One of the reasons for the catastrophic consequences of land reclamation in Belarus is the ignoring of scientifically grounded requirements to preserve pristine regions amid reclaimed areas as elements for the maintenance of the sustainable biodiversity.

The consequences of a large-scale land drainage concurrent with the tendency of the climate humidity decrease and the draining effect of tectonic movements on a definite part of the Belarusian territory lead to a rapid degradation of hydrophilic phytocenoses and their substitution with mesophilic and, later on, xerophilic phytocenoses. This is fraught with a substantial reduction of the biological diversity and a loss of genetic resources (including rare and relict plants), and, hence, with a further destabilisation of the natural and anthropogenic complex.

Fuel and energy and industrial sectors. Large industrial enterprises, like "Belaruskaliy" (potassium extraction enterprise), the Novopolotsk and Mozyr Oil Refineries, the Mogilev and Svetlogorsk "Khimvolokno" (producing chemical fibres), the Gomel and Grodno chemical plants have become known not only for their products, but also for their adverse impact on the environment. Certain Belarusian regions face a grave ecological situation. More than 1.5 million noxious substances are emitted by stationary sources. Almost the same share belongs to motor

vehicles. The situation is aggravated by the transborder transfer of pollutants to the Belarusian territory by the westerlies.

From the end of the last century to the mid-fifties of this century, the significant chemical impact on natural ecosystems came with organic substances penetrating waterways as a result of timber rafting operations and communal discharge.

In later years, with the development of industries and agriculture, chemical pollution of waterways became more intensive and dangerous due to great volumes of discharged toxic substances like heavy metal salts, oil products, phenols, surface-active substances, etc.

The fuel and energy sector and industries alongside with the transport facilities are the most significant air pollutant sources. Lichens and mosses are very sensitive to this pollution as they absorb moisture together with pollutants dissolved in it by their entire surface.

Basic adverse consequences are caused by environmental pollution with toxic industrial and communal waste, particularly with heavy metals. They accumulate in organs and tissues being transmitted through food chains and may result in different abnormalities, including genetic ones. Thermal impact on water pools resultant from the heat generated by the operation of power plants has caused serious changes in the biological cycles in the zone of warm waters discharge, though this impact is local at present.

Defence. In the past, the Republic of Belarus was the front-line in the confrontation between the major military blocs and became the owner of excessively large number of military facilities. These areas are often practically pristine forests and marshlands without any traces of irreversible transformations (especially on certain firing grounds).

These places are the habitats of absolutely unique animal communities typical for the region before any economical activities accompanied by a transformation of natural landscapes commenced. The economic use of these zones will inevitably lead to radical changes (land reclamation and cultivation, forest husbandry) and will create a threat to biological diversity. On the other hand, certain demilitarised zones are fully or partially transformed areas that suffered from chemical and technogenic pollution, thus requiring scientifically sound approaches to their rehabilitation.

Tourism and recreation activities. Today we are in the process of assessing and restoring our cultural and material heritage and of understanding the fact that Belarus possesses a unique ecological capital. The basis of this capital are national parks, reserves and other protected areas. However, there are two problems arising from their use for tourist purposes. The first problem is to maintain these areas for tourism and protect them from economic activities. The second one is to protect these areas from tourists themselves. Unorganised inflow of people may, by itself, become a factor for the destruction of natural complexes.

The vagueness of legislation and insufficient effectiveness of the regulations as regards tourism and recreational activities failing to balance the recreation pressure on natural ecosystems has a negative influence on the status of the whole range of flora and fauna species.

Radioactive contamination of the territory of the Republic of Belarus after the Chernobyl NPP incident

The Chernobyl NPP incident resulted in the radioactive contamination of 23% of the territory of Belarus when 3668 settlements have become contaminated with radionuclides (Ce-137 contamination density being over 1 Ci/km²). Immediately after the accident, Sr-90 contamination of water in the lower reaches of the Pripyat River amounted to 4.0-10 Ci/l, whereas at present it equals to 1.0-10 Ci/l. The current contamination processes are governed by secondary processes: exchange with river bottom sediments, radionuclides wash-off from the catchment area or together with melted and flood waters.

The current contamination of soil is determined by Ce-137, Sr-90 and Pu-238, -239, -240, -241. The highest Ce-137 contamination (apart from the zone of evacuation) is known in the Cherikov district of the Mogilev Oblast (146 Ci/km²). About 1,685,000 hectares of forests are contaminated with radionuclides.

The radioactive contamination of vast areas of Belarus after the Chernobyl NPP incident resulted in certain damage to biocenoses. Studies of radiosensitivity of natural flora representatives with different types of genetic systems have showed that plants with a low ecological adaptability and a great number of chromosomes are particularly sensitive to ionising irradiation. This is true for apomicts and perennial plants (particularly the ones that grow on the border of the habitat). These species are endangered in case of unfavourable conditions. There is a threat of changing the structure and decreasing the population, and weakening their stability. As a result this may lead to their exclusion from the natural communities.

Most vulnerable ecosystems and species

Historically, two basic anthropogenous processes have been the most important factors in the change of biological diversity of the terrestrials, i.e., wood cutting and a change of the hylile structure and marshlands drainage. Aquatic animals suffered most of all from the changes of the hydro-logical regime and water pollution. The area of hylile habitats decreased drastically within the first years after the Second World War. At that time, it was 22% of the territory and was further in-creased by forest planting and natural overgrowth of bare lands to 35.5%. The reclamation of wet-lands was far more catastrophic for aquatic habitats. Open marshes occupying 10% of the Belaru-sian territory and half of the wetlands were drained by 2/3 being converted into arable land. As a result, practically half of periaquatic birds have become rare and included into the National Red Data Book of the Republic of Belarus.

The relict species of the steppe habitat are faced with a threat of complete extinction in the territory of Belarus. Especially, these species have suffered the most from intensive anthropogenic transformations of the open landscapes, in particular, from afforestation and cultivation of steppe meadows and wasteland. Some representatives of this fauna have partly disappeared from the Belarusian territory, others are on the verge of extinction.

The most endangered species on the territory of Belarus (apart from those whose rarity is explained by living at the border of the habitat) are representatives of aquatic and uliginous and ma-ture forests. Most of the endangered species in Europe, with considerable populations in Belarus, belong to wet flood plains and floodplain forest environments. The availability of vast

wet flood plains and marshlands in the territory of Belarus, mostly in Polesye, is unique for the conservation of European biological diversity.

As to the flora of Belarus, the most heavy losses were incurred by the species characteristic of aquatic and helobious media, native dusky broad-leaved forests, native pristine wet meadows, springs and spring-well areas. The most favourable for the maximum variety of rare relict and endangered species are the places with ecologically balanced water regime.

Chapter 4 – Current State of the Problem of Conservation of Biological Diversity in Belarus

Setting New Policy and Social and Economic Basis for the Conservation and Sustainable Use of Biological Diversity

The concept of ecological policy in the Republic of Belarus is defined and governed by the Law of the Republic of Belarus "On Environmental Protection". The state ownership for land and the prevalence, until recently, of big land users represented by collective and state farms resulted in an excessive agglomeration of land units and a subsequent decrease of natural ecosystems. The landscape infrastructure components grew in number and density, thus laying additional material and energy burden on the used land. In the long run, this was the major cause of the depletion of the diversity of natural landscapes and of the degradation of biological diversity in some Belarusian regions to a critical level.

The adoption of the Code on Land of the Republic of Belarus (in 1991) and the Law "On the Right for Land Ownership" (in 1993) became the legal basis for the establishment of other forms of land ownership, including private, which may gradually lead to a positive change in the territorial structure and the functionality of landscapes.

It should be admitted that, at the initial stages of land reform in Belarus, there are frequent cases of territorial and planning decisions on shaping new forms of land ownership taken without solid ecological and economical grounds. As a result, the special land resources for individual farmers are often allotted in boggy and shrubby areas with a low soil fertility. These areas play an important role in environmental protection and conservation of biological diversity.

The Effectiveness of Legal Basis

The legal relations on the conservation of biological diversity in the Republic of Belarus is represented by general and special laws, administrative regulations on the use of nature and environmental protection and by individual legal regulations of administrative and civil legislation. The general legal acts are the Water Code (27.12.1972), the Code on Subterranean Resources (18.06.1976), the Code on Land (11.12.1990) and the Forests Code which is under consideration now. These documents legally define the use and protection of waters, subterranean resources, forests and lands with their flora and fauna.

Special legal acts on the conservation of biological diversity are the laws of the Republic of Belarus "On Environmental Protection" (26.11.1992), "On Specially Protected Territories and Sites" (20.10.1994), "On Protection and Use of the Wildlife" (06.09.1996), and "On the State Ecological Expertise" (18.06.1993). The bulk of the regulatory documents on biological diversity are secondary acts represented by resolutions, provisions, rules and regulations. It should be borne in mind, however, that these documents were adopted by the Government, ministries or state committees at different times, therefore, they are not always interrelated and sometimes contain contradictory provisions. Secondly, some legal acts are not based on laws or at variance with the contemporary general and special legislative acts. Thirdly, some legal acts in force were adopted by the former USSR bodies and require urgent revision and adaptation on the basis of recent key legal acts.

There are provisions on responsibility for poaching and extermination of rare animals, birds, etc. in the administrative and penal legislation.

The central and local state authorities as well as state and local self-government bodies are entitled to exercise control over the administration of law that makes this management function vague and hardly effective. Some legal standards on ecological control are declarative in nature; the functions and authorities of control bodies are multiple and indistinct; these bodies often interfere with each other's responsibilities; and there are legal breaches in the issues of control over biological diversity. The budget and finance legislation also requires improvement. In general, the expenditures for the organisation of environmental protection are low and constitute less than 1% of the GNP.

International Treaties and Agreements

In June 1993, the Supreme Council of the Republic of Belarus ratified the Convention on Biological Diversity. Articles 5 and 18 of the Convention require co-operation, either direct or through competent international organisations, for the conservation and sustainable use of biological diversity. These organisations are the UN Environment Programme (UNEP), the UN/UNESCO Programme "Man and Biosphere" (MAB), the International Union on Conservation of Nature (IUCN), and others.

The Republic of Belarus, represented by governmental and non-governmental organisations cooperate, internationally, within the framework of the following Conventions related to biological diversity and its preservation:

- Convention on Protection of the World Cultural and Natural Heritage, known as the Paris Convention (1972)
- The Ramsar Convention (1971)
- CITES (1973)
- The Bonn Convention (1979) (CMS)
- The Convention on Biological Diversity (Rio de Janeiro, 1992)

The Republic of Belarus have ratified the following Conventions: Paris (1972), On Biological Diversity (1992), and Washington (1994). At present, the question of joining other Conventions is being considered.

In-situ Conservation of Species

By 1995, the total area of specially protected territories had reached half of the area suggested and approved by the Government in the "Plan of Rational Location of Specially Protected Natural Areas of the Republic of Belarus" with due account of the corrections made in 1995. The possibilities for future development of the protected areas network within the frames of practical implementation of the plan for expansion and modernisation of this network are significant.

The State reserves (146 000 hectares) include two natural reserves: the Berezina Biosphere Reserve and the Pripjat Landscape and Hydrological Reserve; one memorial reserve called "Kupalovsky"; two National Parks: "Belovezhskaya Poushcha" and "Braslav Lakes"; 81 State refuges (or special-purpose reserves) of Republican significance including 12 landscape refuges, 15 hydrological reserves, and 54 biological reserves. The Polessye Radiation-Ecological Reserve has been created in the zone affected by the Chernobyl incident. These protected areas occupy 1.1 million hectares.

Ex-situ Conservation of Species

Botanic gardens are important means to maintain and restore rare plant species. The Central Botanic Garden of the National Academy of Sciences of Belarus seems to be the only institution closely involved in bioecological research of rare and protected plant species. About 100 rare species of local flora have passed the introductive testing. About 60 of them are in the National Red Data Book of Belarus.

The Belarusian Scientific Research Institute of Fruit Growing possesses a collection of 300 wild species and varieties of apple-trees and 1500 selected hybrids obtained through hybridisation of wild species with cultivated varieties. The collection includes varieties of pear (250), cherry (160), bird-cherry (40), apricot (42), and grapes (27). Apart from these, there are cultures of walnut and other fruit and berries. The available materials include hybrids that do not require chemical treatment against pests and diseases and may serve as a basis for production of ecologically clean products.

The Institute of Microbiology of the National Academy of Sciences stores about 1000 strains of micro-organisms that are able to destroy highly toxic compounds that have polluted considerable part of the Belarusian territory. The collection of the Institute also includes more than 500 typical, reference and industrially applicable micro-organism, i.e., strains including enzyme producing strains (peptinase, cellulase, lipase, esterase) of protein, lipids, carotinoids, ethanol and other microbe varieties. The studies of micro-organism groups enhancing the regeneration of the ecosystems damaged by human activities deserve special attention. The value of the collection is in its unique character of selected strains, characteristic of the Belarusian territory only.

Ecological Education, Training and Propaganda

Activities in information and training of the population and ecological programmes

The Laws of the Republic of Belarus "On Education" and "On Environmental Protection" establish the priority of ecological education, compulsory introduction of environmental protection programmes into all educational institutions and the principle of considerable ecological awareness of managers in industries during their certification. In 1991, the Government adopted the National Programme on education in environmental protection defining the purposes and principles of organisation of ecological education. It introduces compulsory environmental protection training courses in all spheres of education. In accordance with the programme, the subjects of nature studies are included into the "Programme of Education in Kindergartens". A course called "Environmental Protection and Efficient Use of Natural Resources" has been introduced in vocational schools and colleges. In certain higher educational institutions, new chairs of ecological profile have been opened. For 20 years, the Biological Department of the Belarusian State University has been training professional ecologists. Courses on ecology and

environment are available at the Geographical Department of the Belarusian State University and in the Belarusian Technological University.

Museums of natural history play an important role in the educational process in secondary and higher educational institutions. The Zoological Museum of the Belarusian State University is a centre for storage and study of faunistic collections.

Certain attention is given to ecological problems at different personnel retraining and refresher courses. Special attention is paid to national and international seminars, workshops, scientific and applied conferences dedicated to environmental problems. Belarus, with the financial support of international institutions, has staged several seminars and conferences. These seminars and conferences have been devoted to such topics as the economic reform and the environment, the strategy of Belarus in the field of environmental protection, the actual problems of biodiversity conservation, the decrease of production and consumption of ozone-depleting substances, practical questions of development national projects in the sphere of environmental protection, transport and ecology, etc. They have been organised in co-operation with international organisations. Detailed information on the state of natural resources and environment is available in annual statistical reports and in integrated annual reports on the balance of mineral resources and in the digest "State Forest Resources of the Republic of Belarus" (forest inventories are done every 5 years).

Evaluation of the population involvement and ecological education of different strata of society. The attitude of individuals to the problem of wild life conservation and changes in the environment is different. Sociological research reveals, however, that the majority of the population is indifferent to environmental problems. Despite the tendency for greater interest in the problem, consumer philosophy and efforts to achieve higher life standards remain invariable.

Mass media involvement in ecological education and propaganda

Print and electronic media can be very effective in informing the wide public. It should be stated, however, that ecological problems find insufficient reflection in mass media. Up-to-date information on ecological problems is supplied to the population through mass media: the oldest in the Republic ecological magazine "Rodnaya Priroda", the newspapers "Ecologichesky Vestnik" (national) and "Ecologiya Minska" and the monthly radio programme "Rodnaya Priroda". V and some other national editions cover these problems are rather regular.

Problems of Study of Biological Diversity and State of the Art

Scientific knowledge and inventory of different taxonomic groups

The results of study of the species composition of higher plant flora and vertebrate fauna (fish, amphibian, reptiles, birds and mammals) found in Belarus have been summarised. Lists and identifiers are available, though most of them require revision and improvement. Several collective monographs and identifiers on separate groups of insects have been published.

Invertebrate animals' biological diversity is less studied because of lack of professionals. There are no specialists in many fields and few are trained in the country. In fact, no region in the country has been exhaustively studied as to its fauna; reserve areas are not an exception in this respect. As a result, there are difficulties in identification of population sizes of specific species

including rare and endangered. In these circumstances, populations and even species may disappear unnoticed.

Organisation of monitoring of the current biological diversity

An integrated system of the biodiversity monitoring does not exist in the country. However, active efforts are being taken today to create this system within the framework of the National system of environmental monitoring. State and institutional local networks of forest monitoring have already been created as well as fragmentary meadow and aquatic vegetation monitoring. There are no special programmes for monitoring of aquatic, meadow and other categories of the vegetation. The National forest monitoring network operates in accordance with the "Methodological Programme on the Organisation and Operation of Regional Monitoring of Forests in the European Part of the USSR" that was prepared on the basis of general European guidelines.

So far, there has been no all-Belarusian special monitoring of fauna organised as long-term recording of biodiversity changes. More or less long-time observations of separate groups or species of animals in specific locations, on restricted areas, including reserves were done before and some are performed now. The system of monitoring of certain populations, particularly of economically important animals (hoofed, periaquatic, gallinaceous, natatorial and some others) and of rare and endangered species correspond to the purposes of monitoring. This system exists in the reserves, in the National Park "Belovezhskaya Poushcha" and in some hunting zones (Babinovitchy, Moshanskoye, Negorelskoye, Teterinskoye, etc.) with effective game-keeping services. As regards fish, only fishery facilities monitoring has been carried out.

Development of the scientific background for the State control over the status and the use of biodiversity

In order to improve the control by the State over the status and the use of natural resources, Belarus maintains the following State Cadasters: cadasters for forest, flora, fauna and peat resources.

Flora and fauna cadasters are the most important for the conservation of biodiversity. The fauna cadaster is almost completed. According to the Provisions on the State Fauna Cadaster of the Republic of Belarus, the cadaster is a summarised code of renewed data on distribution, biological diversity, quantitative tendencies, character and intensity of use of wild animals living permanently or temporarily on the territory of the country in natural, restricted or partially restricted conditions. The cadaster should also contain basic data on conditions of habitation and on biotechnical, protective and other measures.

Scientific Information on Biological Diversity in Belarus, Its Localisation, Forms of Storage, Renewal and Processing

The following institutions collect information on biodiversity: scientific research institutes of the National Academy of Sciences (the Institute of Zoology, the Forest Institute, the Institute of Use of Natural Resources and Ecology, the Institute of Experimental Botany, etc.), the Academy of Agrar-ian Sciences, the Ministry of Health, higher education establishments of the Ministry of Education, subordinate organisations of the Ministry of Natural Resources and Environmental Protection (the Belarusian Scientific Research Centre "Ecology", the National Centre of Radiation Control Over the Environment, etc.), national parks and reserves, scientific and production enterprises, centres and associations.

Scientific collections and herbariums

More than 9 000 species, forms and varieties of shrubs, decorative, fodder, aromatic plants and herbs are collected in the Central Botanic Garden of the National Academy of Sciences. 1500 tax-ons are represented in the dendrological collections. An arboretum has been created with about 500 species and forms of the East-Asian flora and 400 species of North-American flora. There are collections of introduced plants in the Belarusian Agricultural Academy, at the Zhornovo experi-mental forest station, in the botanic gardens of the Belarusian State University (Minsk Region), the Belarusian Technological University (the Negoreloye Forestry), and in the old parks (Gomel, Nes-vizh, the village of Porechye, Pinsk Region, v. Verdolichi, etc). Collections of introduced gramine-ous plants exist in the Institute of Genetics and Cytology of the NAS, the Belarusian Scientific Re-search Institute of Potatoes, the Belarusian Scientific Research Institute of Olericulture, the Belaru-sian Scientific Research Institute of Husbandry, etc.

The collection stock of the country includes 400 000 herbarium specimens. The Institute of Ex-perimental Botany of the NAS preserves 300 000 plant species of natural flora, including 100 000 vasal plants, 30 000 anophytes, 140 000 lichens, and 40 000 fungi. The Central Botanic Garden owns the herbarium of introducents, the Belarusian State University has a herbarium of indigenous plants and plants from neighbouring countries. There are collections in the Gomel University, the Brest Pedagogical University, the Vitebsk Pedagogical University, in the reserves (Berezina and Pripyat) and in the National Park "Belovezhskaya Poushcha".

Chapter 5 – Major Current Activities for the Conservation and Sustainable Use of Biological Diversity

Formulation of Policies and Improvement of Legislation in the Field of Conservation and Sustainable Use of Biological Diversity

Development and adoption of the Concept of State Policy in the field of environmental protection and rational use of natural resources must precede the development of a system of legal acts and regulatory documents aimed at ensuring biological diversity, since the Concept of environmental protection, recently adopted by the Supreme Council of the country, touches only the problems of environmental protection and does not specify problems related to efficient use of nature.

The Concept of State Policy in the field of environmental protection and efficient use of natural resources should stipulate the development and adoption of the following documents:

- Code on land;
- Code on subterranean resources;
- Forest code;
- Water code;
- Law on the use and protection of vegetation world;
- Law on improvement and restoration of natural resources;
- Law on fees and taxes for the use of natural resources.

Apart from the above, some other legal acts have to be adopted too.

The aforementioned natural resources codes should contain provisions related to the conservation of biological diversity in the Republic of Belarus.

Development of special laws regulating the use of specific types of natural resources and the application of technologies and facilities dangerous for the environment is important for the conservation and sustainable use of biological diversity.

Apart from the development of new laws, it is necessary to improve the current legal standards. The Law of the Republic of Belarus "On Specially Protected Natural Territories and Facilities" adopted in 1994 requires revision and amendment.

The Penal Code of the Republic of Belarus and the Code of the Republic of Belarus "On Administrative Offences" must contain relevant sections "On Ecological Crimes" and "On Ecological Offences". A supplement on the liability for indemnification of the ecological damage should be included into the Civil Code.

Development of Management and Economic Regulations on the Use of Biological Diversity

The strengthening of the institutional structure and the development of inter-departmental cooperation should stipulate the improvement of the organisational structure and the reinforcement of personnel of the Ministry of Natural Resources and Environmental Protection as well as the creation of an efficient inter-departmental council on biological diversity. The major target

should be the elimination of inter-departmental contradictions creating serious difficulties in the implementation of the National Strategy and Action Plan on Biological Diversity.

The involvement of non-governmental ecological organisations has been weakened due to the economic recession and the taxation pressure imposed on them by the Government. As a result, over the past 2 - 3 years, many of these organisations have discontinued their activities.

Relations between the governmental institutions and the public should be more active in order to strengthen the role of the public in solving problems of biological diversity conservation. Public relations divisions should be organised in relevant ministries and institutions. Representatives of non-governmental institutions should participate in different projects with potential ecological implications. They should participate in discussion of state environmental protection projects. It is advisable that they should be admitted, on a competitive basis, to the implementation of scientific, technological, educational and other programmes related to problems of biological diversity.

Two levels of management should be created for effective conservation and sustainable use of biological diversity. While defining general conditions of the biological diversity conservation, the first (upper) level of management should specify the necessity of separation and independent functioning as a new ecological subsystem within the structure of national economy alongside with material production and non-productive sphere. The lower level should ensure the development of a specific economic mechanism for biological diversity conservation.

Both levels should be built up on a base of a new system of relations in the sphere of the use of nature based on the ecological rent. The cost parameter of the rent must guarantee and, at the same time, stimulate the reproduction of live nature and its components. The minimum level of the ecological rent standard in the GDP and national income should be legally established.

An ecological bank may become an organiser of the targeted and well-ordered flows of ecological investments required to solve ecological problems. This bank must be opened under the auspices of the Ministry of Natural Resources and Environmental Protection. The main part of the bank capital should be constituted by ecological taxes and allocations, on the one hand, and by the profits raised as a result of the production of ecologically clean products due to the introduction of environment-friendly technologies, on the other hand.

The basis of the ecological capital in Belarus are the forest, water and mire and wetland systems. Their practical significance goes far beyond Belarus. Our "wood-water-mire" specific attracts attention of the world community to the problems of sustainable development of the European continent. Therefore, the basis for a stable financing of specially protected territories containing unique ecological values should be established at an international level. The international ecological rent may be the basis for this. An extra-government fund for the conservation of the genetic resources of the Earth and wild life could play a decisive role. Belarus should participate actively in international efforts to create such a fund.

Development of Basic and Applied Science in the Field of Conservation and Sustainable Use of Biological Diversity

Key tasks for the basic and applied science in this field are study of the current status and projection of the biodiversity dynamics. Creation of data banks is very important for efficient analysis of data accumulated in the course of study of different factors affecting flora and fauna. These data banks will include the information on the status of the major faunal and floral complexes and their habitats with due consideration of the degree of anthropogenic transformation. These data will serve as an important basis for subsequent modelling and prognosticating the dynamics of species and groups of animals and plants, as well as for faunal and floristic complexes depending on the influence exerted by natural and anthropogenic factors.

Preparation of the National Report on the status, use and efficiency of the biodiversity conservation measures in Belarus in conditions of various impacts exerted by human activities will play a decisive role at the current stage.

Development of the General Prognosis of the status and trends of the biodiversity conservation by the beginning of the new millennium is no less important. This would make it possible to define priorities for the National Strategy and Action Plan for the Conservation of Biological Diversity.

When these problems are solved, science should provide scientific and methodological support for the State control over the status and the use of biodiversity. The inventory of the natural genetic resources of the country, the inventory by the State of the natural resources and their use and the preparation of state cadasters for various resources are major mechanisms for the solution of this problem.

As regards the conservation and sustainable use of biological diversity, the development of methodology for ecological and economic evaluation of biological diversity is one of the most complex tasks of science. Such approach will make it possible to create a special economic mechanism for the conservation of biological diversity with due account of the specific place of ecology in the economic relations.

Development of the System of Specially Protected Natural Territories and Conservation of Species

The existing network of specially protected natural territories (SPNT) in Belarus has no ecologically-grounded, elaborated and, which is more important, legally-based spatial-and-planning structure that would unite them into a single entity, thus providing the conditions for the migration of live organisms. The following scientific and technical problems must be solved to fill the gap.

1. Scientifically and theoretically justified territorial and spatial parameters ensuring a stable conservation of biological diversity at population, species and ecosystem levels should be elaborated.
2. Feasibility studies of the expediency of restoration of natural ecosystems on the lands currently in use in some regions of the country should be carried out.
3. Assessment of the status and conditions of the biological diversity conservation in the landscapes used for agricultural, forestry, hunting, and recreational purposes and arising

from various alternatives of the territorial and spatial combinations of the protected territories with landscapes in economic and recreational use should be made.

4. Definition of limiting anthropogenic impacts on various landscapes ensuring acceptable levels of biological diversity conservation should be made.
5. Functional and ecological zoning of the territory of the country should be carried out and territorial and spatial optimisation with consideration of modes of selected zones, including protected areas, should be justified.

Thus, the structure and protection schemes have to be optimised so to increase the efficiency of the SPNT. In the course of solution of these problems, the borders of SPNT may be revised and their management plans reviewed. If necessary, certain limitations on economic activities in bordering zones may be imposed (buffer zones).

Since reserves and national parks play a special role in the conservation of the genetic resources, the inventory and monitoring of all biotic groups should be compulsory in such territories. For the purpose of monitoring, the protected zones within SPNT require paramount attention. In future, specialised reserves may be included into this sphere of activities.

All territories included into protection plans should form a unified, functionally integrated system by natural migration tracks, including territories of neighbouring countries where similar systems should be created too. Collectively, all these systems may create a Pan-European Ecological Network. Natural migration tracks are an independent component of the SPNT network in Belarus. Therefore, they should be given an official status with a corresponding legal definition and should be surveyed by aerophotography and delineated on the ground and on maps of land and forest management.

Since SPNT do not embrace all natural biological diversity of the country, species (specifically, rare birds, species and communities of animals and plants, and separate habitats of rare animals) outside the SPNT should also be protected. With due account of peculiarities of various species and their requirements to habitats, special target programmes (national and international) on conservation of the most vulnerable ones should be developed and implemented. In fact, this has been done in some countries. Such plans of protection provide for definite chances for the spreading of species or at least for the expansion of the area under protection for a given population.

Botanic gardens and zoological parks, specialised nurseries and laboratories (clean cultures method), designed to support the existing species by artificial means should play an important role in the conservation of genetic resources. Cultivation eliminates the threat of full extinction of species, though it cannot secure natural genetic resources on the whole. These measures are relevant to all species included into the National Red Data Book, especially in cases of real threat to the existence of certain populations. The creation of the National genetic stock by joint activities of academic and institutional scientific research bodies as well as higher educational establishments is on the immediate agenda.

Ecological Improvement of Scientific and Technical Activities, Optimisation of Natural Resources Use in Different Social and Economic Sectors

Ninety-five per cent of the Belarusian territory is subject to economic activities and their impact is felt in some specially protected natural territories. Therefore, measures need to be identified to reduce negative consequences of different forms of economic activities on the biological diversity. Besides, natural ecosystems are exposed to aggregate impact of economic activities carried out in other countries (global environmental pollution is the major component).

Effective conservation of biological diversity is impossible without ecologically sound territorial organisation and planning in the region. This means that improvement of **land use and town planning** is of primary importance. This implies a critical analysis and a review of the current practices of distribution of regional planning zones that differ in their functions. The process of formation of the ecologically-balanced planning is complicated by the necessity of redistribution of land use between land users and landowners. This process is slow and should be planned for many decades.

Ecologically-balanced planning of the territory should comply with the following requirements: selection of the location and the area of urbanised, agricultural, forest husbandry and environmental protection zones (reserves, refuges) should guarantee a normal functioning of the nature and its components and the preservation of historically established conditions of evolution of genetic resources. Taking into account the traditional location of the natural complexes that have been preserved and highly urbanised zones of Belarus, the balanced planning structure should be based on a highly dispersed distribution of territories where natural ecosystems, united into the integrated regional system by natural migration tracks, should prevail. They should alternate with highly urbanised territories.

Alongside the formation of ecologically-optimised planning structure, it should be necessary to solve the problem of regulation of man-induced impacts on the environmental and territorial complexes. This problem should be solved on the basis of the territory functions.

The development of **transport and road construction** should be planned so to decrease the motor-road network impact on the natural ecosystems and migration of the biota. Environmental impact and requirements to the road construction must be logically motivated measures. First of all, it is necessary to provide unconstrained migration of biota in flood plains. Trestle-type bridges should be built over flood plains instead of solid road embankments. Similar actions are needed in other places of migration ways. Therefore, all construction projects of important roads should be subject to a qualified ecological expertise. Special areas near highways must be left for natural vegetation, and arable land must be outside such special areas. This will provide a natural barrier on the way of dissemination of diaspores of transported plants, since, normally, they have a low competitive capacity. The existing road traffic network should be updated and the existing roads should be equipped with facilities simplifying migration of animals. These tasks require scientific re-search and project development activities.

The development of a perspective direction in the field of **tourism and recreation activities** means the use of specially protected territories in conditions of lacking experience in the organisation and management of the national parks. This brings about at least two problems. The first problem concerns the protection of such territories from the influence of economic entities and the second one is the protection from visiting tourists. Attention should be paid to the

location of these service facilities, and control over recreational standards is required to solve these problems. Experience of foreign countries may be useful to solve all these problems successfully.

The current status of the Belarusian economy and the relatively low incomes of the population are a major constraint to the development of tourism. Therefore, it should be aimed, first of all, at attracting foreign capital through the organisation of joint ventures. It seems relevant to create a special marketing service for the organisation of tourism in specially protected territories. This does not mean that other problems are less important. Appealing and informative advertising will invite tourists to attractive and ecologically-valuable protected territories of the Republic.

Measures for the conservation of the biological diversity in the **agricultural context** should go along the following main lines.

The quality of vast uniform agricultural territories as habitats of animals and plants could be improved by their ecological planning and by balanced alternation of annual and perennial crops.

Methods of land cultivation causing minimum erosion and destruction and limiting fertile layer carryover outside arable area are badly needed.

The agricultural machinery should be equipped with protective equipment to prevent incidental damage to animals. Measures may be foreseen to stimulate agricultural workers who care to protect wild animals when using mechanised methods of work.

Limitations on the application of pesticides and herbicides are welcome. Fertilisers should be strictly applied following technological requirements. Aviation services for chemical treatment are undesirable.

Maximum attention should be paid to prevent erosion processes and depletion of fertility resulting in wasteland formation and consequent fallowing areas with natural vegetation.

The basic principle in forestry should be the organisation of continuous and sustainable forest use. This practice is widely accepted in the world and ensures the conservation of biological diversity. Forestry management should remain with the State under any forms of ownership. The technology of forest husbandry should be changed to "continuous forest husbandry", ensuring forest cadaster support and monitoring of forests and of the environment.

Though in the next two decades reforestation will remain artificial (by creating forest cultures), it is vital to increase considerably territories of natural forest regeneration. Ideally, areas of artificial and natural forest regeneration should be approximately equal.

The percentage of forest land in different regions of the Republic varies from 10 to 56%. The decrease of this indicator below 15% is ecologically undesirable, therefore, plans for the afforestation of wastelands should be elaborated and the allotment of these lands for other purposes should be restricted. Planting of wind-belts (total area about 15 000 hectares), protective afforestation of gullies (about 20 000 hectares) and sand wastelands (about 100 000 hectares), as well as protection and sanitary and recreation zones around certain towns, settlements and the ecologically un-safe enterprises should be arranged. Such forest belts would

have protective and recreation functions and relieve a pressure from the biological diversity of wild forests and more valuable forest ranges.

A unified system of selection and seed service, greenhouse and seed-plot service, forest seed and stock culture services should be organised.

Forests of Belarus are vulnerable to fires due to their age and species structure. All services of the State forest fire departments should be supplied with transport, means of communication and fire extinguishing to improve the protection of forests against fire.

To assure forest protection, it is necessary to design an integrated system for the protection against pests and diseases, the optimisation of the phytosanitary situation, the increase of the biological resistance of forest biocenosis and the maximum decrease of damage caused by pests and diseases. Pest control should be restricted to areas affected. In so doing, it is desirable to apply biological methods to avoid considerable damage to natural trophic chains in forest systems.

While planning major cutting of woods, it is desirable to leave areas of forest that are important for the biological diversity and areas that are valuable for their ecological, biological and genetic features. In the course of cutting (particularly major cutting), maximum preservation of undergrowth is highly desirable. This is particularly important in respect of valuable species and the live top soil layer. This may be achieved through gradual (by portions) felling and the use of less bulky and heavy equipment. Compliance with these requirements will reduce the volume of preliminary ploughing before planting of forest cultures. Ploughing leads to destruction and exciccation and, in many cases, to a rapid growth of grass impeding forest restoration.

Reserves of basic forest species having reference, scientific and information importance play an important role in solving problems of optimisation of forest floor (reforestation and genetic and selection research).

To increase the economic effectiveness of production and use of forest land, the substitution of coniferous forests by deciduous forests should be stopped but more, the territory of coniferous forests should be increased to the optimum.

Natural forest land fertility may be supported by breeding mixed cultures instead of monocultures. This will be conducive for the biological diversity. Genetically modified indigenous seeds are recommended for creation of forest cultures. To a certain extent, this will facilitate the conservation of biological diversity of the dominant forest species and strengthen their adaptive potential.

Handing over of forest lands currently owned by collective farms to the State forestry organisations will permit to organise the conservation of biological diversity in a more orderly way, as the latter employ qualified professionals.

In the field of **hunting and fisheries**, the conservation of biological diversity and sustainable use of natural resources may be achieved on condition of the development of new ecologically-oriented legal standards and their strict observance. The population should be instructed on the importance of preservation of rare species of fauna. While developing new fishing and hunting rules, it is necessary to foresee measures to prevent incidental extermination of rare and endangered species.

In the field of **water management and land reclamation**, maximum efforts should be exerted to prevent water pollution because it leads to the substitution of rare and relict species by ubiquitous. Land reclamation is a powerful tool for modifying ecosystems, thus, and it should not be unidirectional. It is necessary to use a two-way regulation of the water regime to preserve the optimum level of soil humidity, first of all, in reclaimed peat lands. Efforts should be made to increase the productivity of lands that have been introduced into cultivation and degraded. This is particularly pertinent for Polesye. This approach would permit the avoidance of unjustified following of natural complexes leading to further shrinkage of biological diversity.

Species in the Polesye water reservoirs are spring-spawning fishes, therefore, in time of spawning and hatching of eggs the water level should be sufficiently stable. In the summer time, the water level may be gradually decreased and kept at lower levels. It should be raised before the freeze up to avoid drawdowns resulting in fish death. The discharge of waste water from the territory of the Soligorsk potassium plants must be restricted as much as possible to avoid the penetration of chlorides into the Soligorsk Water Reservoir. Otherwise, chlorides will adversely affect monogenesis of water vertebrates and spawning of fishes.

The negative impact on biological diversity caused by the major **fuel and energy, mineral extraction and chemical industries**, like Production Amalgamation "Belaruskaliy", the Novopolotsk and Mozyr oil refineries, Mogilev and Svetlogorsk Production Amalgamations "Chemical Fibres", Gomel and Grodno chemical plants cannot be solved by limited local measures. Detailed National programmes to reduce the volume, toxicity and general environmental pollution of the discharge from these enterprises is required. Such projects may be justified by special scientific research and a comprehensive analysis of the data already accumulated and reports on the impact of major enterprises on biological diversity.

Considerable areas in Belarus are currently managed by the **Ministry of Defence**. They are currently being demilitarised, hence, an important field of activities aimed at the conservation of biological diversity is the elaboration and practical implementation of measures on ecological rehabilitation of the post-militarised zones and other facilities of the military-industrial complex. The greater part of militarised and post-militarised territories is unpopulated and is not subject to traditional economic pressure. Therefore, favourable conditions for the preservation of rare flora and fauna preservation exist. An integrated assessment of the ecological value of these zones and the potential for their conservation in the natural condition is highly desirable.

Ecological Education, Training and Propaganda. Training of Personnel

The Republican Programme on education in the sphere of environmental protection adopted in 1991 requires a thorough revision and definition of new targets and principles of organisation of ecological education, instruction and propaganda corresponding to the new political, social and economical situation. The programme should bring to the foreground the problems of conservation of biological diversity on the basis of modern knowledge and concepts.

Higher schools should be the basis for training ecologically educated managers and specialists. New chairs of the ecological profile should be established in higher educational institutions and their curricula should include both general and special courses and practical studies oriented at conservation of biological diversity.

A system of compulsory ecological education on the basis of an integrated programme for the primary and secondary schools is necessary.

The programmes of training and refresher courses for managers and other specialists, first of all for those directly involved in the use of natural resources, should contain a compulsory ecological component, including the linkage between the problems of conservation and the use of natural re-sources. National and international seminars, scientific and practical conferences devoted to envi-ronmental topics play an important role in education and propaganda. It is planned to elaborate programmes of such actions with participation and financial support from international organisa-tions.

It will be useful to publish a range of information and reference materials to inform the popula-tion, specialists and governmental bodies on the environmental situation and the use of natural re-sources.

Museums of natural history must play an important role in ecological education and in the in-struction of students and public. There are plans to create such museums in different regions of the country. The attention of mass media to problems of ecological education, propaganda and wide information of the public should be strengthened. These activities would improve understanding of the issues related to the use and conservation of natural resources and would attract the public to the ecological decision-making, primarily at the local level.

The National Action Plan for the Conservation and Sustainable Use of Biological Diversity in the Republic of Belarus

The National Action Plan for the Conservation and Sustainable Use of Biological Diversity in the Republic of Belarus includes a list of most important measures for the implementation of the basic provisions of the National Strategy, both at present, and in the years to come. It defines the priorities of practical steps for the current period of economic reforms as well as for the period of transition to new forms of management and control over the conservation and use of biological resources.

The National Action Plan will be reviewed and amended each 5 years on the basis of experience gained during the implementation of its provisions and in accordance with the development and improvement of the National Strategy and the expansion of knowledge and opportunities in the sphere of ecology and environmental protection.

Formulation of State Policies and Improvement of Legislation in the Field of Conservation and Sustainable Use of Biological Diversity

- Development and improvement of legislative documents that define the State policy aimed at the conservation and sustainable use of biological diversity and environmental protection in general.
- Legislative and regulatory support to the conservation and sustainable use of biological diversity.
- Introduction of the ecological (environmental protection) priority approach in all social and economical sectors over economic interests.
- Development of regulations on the State control over the status and use of natural resources.
- Development of the state environmental policy differentiated for the territories as applied in various functional and ecological zones and envisaging regulation of economic activities therein.
- Organisational support for the implementation of international agreements connected with the conservation and sustainable use of biological diversity to which Belarus is a Party. Joining by the Republic of Belarus to new international agreements related to the conservation and sustainable use of biological diversity.
- Introduction of rules and methods of conservation and sustainable use of biological diversity into all plans and project decisions related to social, economic and environmental activities.
- Stimulation of active participation of non-governmental organisations and the public in the study and the conservation of biological diversity and control over its use.

Improvement of State Management and Control Over Conservation and Use of Biological Diversity

- Strengthening of the institutional structure and improvement of inter-departmental coordination on the basis of the formation and development of a new ecological subsystem with corresponding functional mechanisms within the national economy.
- Formation and keeping of State cadasters and a natural resources accounting system.
- Optimisation of regulation of hunting activities by the State
- Monitoring of the biological diversity condition: forecast of its dynamics (within the framework of the National system of environmental monitoring).
- Perfection of the system of indicators of technogenic pollution of flora, fauna and habitats (maximum admissible concentrations, admissible levels, etc.).
- Development and implementation of the geographical information system (GIS) for evaluating the condition and dynamics of biological diversity in specially protected natural territories in Belarus, the creation of a GIS-based map of the biological diversity status for Belarus.
- Preparation of the National Report on the status and use of biological diversity in Belarus in accordance with the requirements of the Convention on Biological Diversity.
- Organisation of regular reports to the bodies of State government and the public on the status and use of biological resources.

Creation of Ecological and Economical Backgrounds for the Regulation of Conservation and Use of Biological Diversity

- Regulation of the use of flora and fauna through introduction of the principle of ecological rent and fees for the use of natural resources.
- Tangible incentives for the conservation and sustainable development of biological diversity on the basis of an economic evaluation of biological resources and determination of the true value of the ecological capital.
- Expansion and perfection of the incentives mechanism for the environmentally sound activities (economically justified unit prices for work related to environmental protection, financing and crediting, insurance of ecologically unsafe technologies and products, etc.) for legal entities of all forms of property.
- Evaluation of the ecological damage resulting from economic activities and natural calamities.
- Ecological examination with due account of projected and planned solutions and approaches to the problem of implementation of biological diversity conservation activities

Development of Fundamental and Applied Science in the Field of Conservation and Sustainable Use of Biological Diversity

- Development of guidelines and methods for the conservation and sustainable use of biological diversity on the basis of the implementation of the National programme of basic research.
- Development of the section related to the study, conservation and sustainable use of biological diversity within the framework of the existing State scientific and research programmes ("Nature Use", "Agro-Industrial Complex", etc).

- Fundamental and applied research of the status and trends of dynamics of biological diversity in different landscape zones of Belarus so as to create baseline information for the forecast and timely prevention of negative impacts.
- Studies of the structural and functional ties between natural and transformed biocenoses and of trends of population relations for working out optimum modes and scopes of conservation and use of the flora and fauna resources.
- Research in ecological and economic evaluation of biological diversity, development of the ecological rent theory and mechanisms of its application for solving problems of environmental protection and resource saving.
- Creation of the National Genetic Stock of plants, their studies and use.
- Development of principles and measures of biological safety. Organization of the center on problems of safety of biotechnology.
- Scientific and methodological support of the State control over the status of biological diversity (inventory, State accounting, cadasters, system of monitoring).
- Research in the field of optimised use of specially protected natural territories where biological diversity is preserved at the genetic, species, population and ecosystem levels.
- Study of the optimisation and restoration of ecosystems in the territories used for economic purposes, development of methods of their use and of the conservation of biological diversity with due account of social and economical interests of the society.
- Preparation and publication of basic scientific and applied works devoted to the investigation of the status of flora and fauna, compilation of identifications and manuals for inventory, conservation and sustainable use of biological diversity.
- Organisation and holding of the republican and regional scientific and scientific-practical conferences on problems of conservation and sustainable use of biological diversity.

Development of the System of Specially Protected Territories and Measures for the Protection of Rare and Endangered Species

- Practical implementation of the "Plan of Rational Distribution of Specially Protected Natural Territories of the Republic of Belarus" and its optimisation according to the requirements for the creation of the Pan-European Environmental Network.
- Optimisation of the management structure, environmental protection plans and functions of specially protected natural territories.
- Inventory of biological diversity in specially protected natural territories and the evaluation of their contribution to the preservation of the genetic resources of the biota.
- Development and implementation of special State and regional programmes for the conservation of species diversity, preservation of rare and endangered species and populations, typical and unique landscapes and ecosystems (including those laid down in international agreements, programmes and projects).
- Development and implementation of the action plan for the conservation of flora and fauna special outside their habitats (ex situ).

Ecological Improvement of Scientific and Technical Activities and Optimum Use of Natural Resources in Various Social and Economic Sectors

Territory and urban planning

- Development of the concept and the National programme for the optimisation of the territorial and spatial structure of natural resources of Belarus in order to ensure the ecologically balanced correlation of natural and transformed territories
- Development of a territorial plan for the Republic of Belarus with due consideration of conservation of biological and landscape diversity.

Transport and road construction

- Optimization of the existing and updating of the perspective motor-road and railway network of the Republic to improve the conditions of functioning of specially protected territories and adjoining transformed areas.
- Development of a system of engineering facilities for motor roads and railways permitting an unconstrained migration of live organisms within specific natural complexes including the regional level.

Agriculture

- Limitation of the expansion of arable lands at the expense of natural territories.
- Introduction of ecologically safe technologies aimed at mixed seeding of agricultural crops and support of biological diversity of pastures and hayfields.
- Development of effective measures for conserving the biological diversity by way of optimum formation of a mosaic structure of agricultural lands in the course of land reform and organisation of farms.
- Introduction of ecologically safe systems, technologies and means of application of fertilisers in different landscapes and regions of the Republic.
- Development of the principles and justification of ecologically compatible agricultural activities in water catchment areas, water reservoirs and specially protected wetlands.
- Introduction of ecologically safe technologies of waste disposal from cattle-breeding farms.
- Introduction of measures reducing eutrophication of water reservoirs and their pollution as a result of economic activities.
- Optimisation of the structure of hayfields and arable pastures for preserving natural grass (turf) varieties.
- Expansion of the programme of soil protection and management measures for the erosion-prone lands (types of soil).
- Development and implementation of measures for preserving natural and, in particular, small ecosystems in agricultural landscapes.
- Introduction of a set of measures for increasing the ecological safety of agricultural machinery and implements and work requiring mechanisation so as to protect wildlife.
- Introduction of a rational balance between agricultural, forest and hunting activities for the conservation and sustainable use of hunting game and other groups and species of wild animals.

- Publication and dissemination of teaching, methodological and visual aids (posters, notes, recommendations, audio and video materials) for raising the awareness of the ecological safety of the agricultural production and the conservation of biodiversity.

Forestry

- Implementation of the ecological concept on development of the forest husbandry and of a functional ecological and economic mechanism including measures for the conservation of biological diversity.
- Development of the State programme for optimisation of the forest cover in order to increase the area of woods, improve the cenotic forest structure, increase the scope of multi-purpose sustainable use of the natural resource potential and to stabilise the ecological situation in the country.
- Transition to of a new two-stage technology for forest harvesting by way of types and varieties, preservation of soil cover and underwood, selective felling, and processing of by-products.
- Development of the programme (action plan) for the restoration of forest systems on unused land.

Hunting and fishing

- Development and introduction of ecological and economic mechanisms for the restoration of biological resources of fish and game.
- Formulation of new hunting rules with consideration of the current social and economic situation and the reform of the system of land use.
- Development of ecological methodologies for optimisation of fisheries in different types of water reservoirs (lakes, rivers, water reservoirs) based on indicators of biological productivity.
- Establishment of conceptually new rules of fishing based on modern knowledge of the biology of fish.
- Fishing should be permitted on the ground of reliable biological estimates specifying limit fish catch for particular water reservoirs.
- Development and introduction of a water quality standards system for natural and artificial fishing pools.
- Rational use of biological resources of water reservoirs (regeneration of the valuable species of water animals and their introduction into natural water reservoirs).

Water management and land development

- Design of a concept of ecological optimisation of water management and land reclamation.
- Change in the structure of capital investments for land reclamation so as to reduce the damage and ensure conditions for the conservation of biological diversity.
- Reconstruction of land-reclamation systems for the purpose of their incorporating into rational nature-use systems.
- Rehabilitation of ecosystems transformed as a result of ecologically unsound land reclamation.

- Support of the surface and ground water regulation, ensuring the conservation and optimisation of habitat conditions and natural reproduction of aquatic species in water reservoirs and other complex water reservoirs.
- Design and implementation of measures for optimisation of animal and plant habitats in time of construction or reconstruction of land-reclamation systems and main canals.
- Use of peat deposits with maximum possible rehabilitation of functions of biospheric marshlands and re-naturalisation of peat deposits (secondary waterlogging).

Industries and fuel and energy sector

Timber industry

- Transition to a wider use of soft wood instead of oak timber.
Light, food and other industries and housing and communal facilities
- Construction of facilities for waste water treatment in towns and settlements; introduction of thorough treatment of household and industrial sewage by the existing biological purification facilities; construction of local decontamination installations at industrial enterprises for removing heavy metals and other contaminants from sewage.
- Decrease of the volume of untreated and poorly treated discharge into natural water reservoirs, introduction of rigid control, improvement of quality and introduction of sludge processing technologies.
- Ecologically motivated construction of new and reconstruction of the existing (including subsurface) dumping sites and waste-processing plants designed for burial and processing of industrial waste and solid urban waste.

Mineral extraction industries

- Introduction of up-to-date and prospective technologies for extraction and processing of different mineral raw materials (potassium salts, oil, peat, sand and gravel mixtures) in order to minimise transformation of natural landscapes.
- Improvement of engineering protection of land, surface and ground waters against contamination while extracting and processing mineral raw materials.

Defence

- Evaluation of the ecological value and assessment of the ecological status of demilitarised and militarised zones in Belarus, establishment of control measures to trace ecologically dangerous components.
- Development and implementation of ecological measures for rehabilitation of post-militarised zones and other areas formerly used for defence installations.

Tourism and recreation

- Definition of the priorities and strategic interests in the development of ecotourism and possible forms of international co-operation.
- Development of principles and mechanisms for the use of natural territories (including national parks, reserves and monument of nature) for tourist and recreation purposes.
- Licensing of ecotourism.

Ecological Education, Training and Promotion. Personnel Training

- Creation of a State and public network for providing the public with the information necessary for ecological education and instruction.
- Preparation of training and methodological materials (manuals, aids, computer and other programmes on conservation and use of biological diversity) for national educational institutions of different levels.
- Organisation of training and refresher system on the conservation and use of biological diversity for personnel at all levels of State government and control.
- Development of demonstration projects and systems involving different plans of land use

Sources and Ways of Attraction of Capital Investments and Technical Resources

- Attraction of foreign financial and technical assistance for the development and implementation of priority projects in the sphere of preservation and sustainable use of biological diversity.
- Establishment of a long-term project financing system within the framework of the National Action Plan by creating the Ecological Fund and/or the State Ecological Bank.