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Environmental Status Reports: 1990

Volume Three:

USSR

IUCN EAST EUROPEAN PROGRAMME

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FOREWORD

This volume, the third in the IUCN East European Programme Environmental Status Reports, has been presented in two parts. Part I was written by Professor Vladimir Flint, Dr Yuri Shchadilov and Professor Yuri Yazan, with the assistance of Lyudmilla Bogdan and Faina Gordina, and prepared specifically for this series.

Part II is the English translation of the official report compiled by the USSR State Committee for the Protection of Nature, on the state of the environment in the USSR in 1989. The latter report provides much detailed information on the USSR which would not otherwise be generally available. It is reproduced as faithfully as possible to the original translation and with only superficial editing by IUCN EEP.

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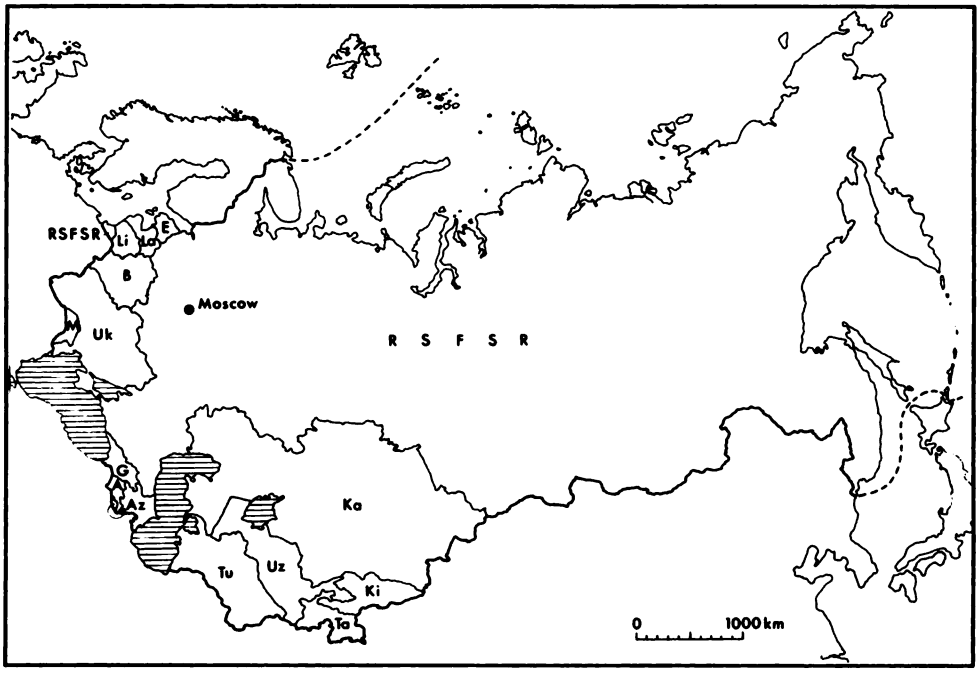

Frontispiece: Map of the Union of Soviet Socialist Republics

Key to the Republics:

A	Armenia	Li	Lithuania
Az	Azerbaijan	M	Moldavia
B	Byelorussia	RSFSR	Russian Soviet Federative
E	Estonia		Socialist Republic
G	Georgia	Ta	Tadzhikistan
Ka	Kazakhstan	Tu	Turkmenia
Ki	Kirghizia	Uk	Ukraine
La	Latvia	Uz	Uzbekistan

IUCN EAST EUROPEAN PROGRAMME

Environmental Status Report 1990

USSR

Part I

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Moscow, 1990

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INTRODUCTION

At the February 1988 General Assembly of the World Conservation Union (IUCN) held in San Jose, Costa Rica, a group of East European member countries adopted a resolution reflecting their common aspiration for the activisation and coordination of work on regional nature protection.

It was agreed that the first step would be the publication, under the aegis of the IUCN, of Environmental Status Reports, to be compiled by all East European countries in strict accordance with a model. (This document presents the Environmental Status Report for the USSR.) This would be followed by a series of initiatives aimed at the identification of the most important problems which, if solved by common efforts, would help to normalise the existing situation, preserve nature more effectively and improve living conditions.

The term "environmental protection" was first coined at the end of the 19th century when the deterioration of natural resources (plant and animal diversity and landscapes) as a result of man's activities became apparent. At this time the term had a purely biological meaning. The rapid impoverishment of mineral resources and widespread pollution of the biosphere in the 1930s led to the development of the phrase "conservation of natural resources".

The concept of "nature protection" (including the conservation of natural resources, their zealous and economic consumption and the prevention of environmental pollution) is better understood in the USSR today than the former two (Bannikov *et al.,* 1985). It should be noted, however, that these terms are so global and all-embracing that they can include all ecological, economic, socio-economic, medical and even some military aspects of human activity.

Nature protection is now understood to be the integration of the technical development of industry and agriculture with the preservation and rational use of natural resources, enabling further improvement of man's environment. It also demonstrates the importance of elaborating a balanced strategy for the economic use and restoration of natural resources, the preservation of natural areas for the needs of science and the prevention of irreplaceable damage and loss of the genetic diversity of biota. In conclusion, nature protection is the protection of the earth and of humanity itself.

During the second part of this century, and especially during recent years, the level of environmental pollution has risen catastrophically and become a global problem, demanding the development of effective strategies for nature protection and the rational use of natural resources. Water, atmosphere, soil and even food were so badly affected that pollution really presented a danger to people's lives. This environmental problem has now become one of national and even international importance, being on a par with the issues of peace, food supply, accommodation, employment and so on.

It is quite natural, therefore, that everything is being done in the USSR to put a strong and reliable restraint on the destructive activity of man.

CHAPTER 1: INVENTORY OF NATURAL RESOURCES

1.1 Air Protection

Air protection in the USSR is carried out under a special Soviet law "On air protection" adopted on 25 June 1980. The preservation of atmosphere is achieved through a number of technical, planning and organisational measures. Over recent years, technology policy for air protection has involved wide-ranging studies on maximum permissible concentrations (MPC) of pollutants for each source and industrial enterprise. The MPC standards are determined by the level at which pollutant emissions do not result in an increase above levels established by the USSR Ministry of Human Health. Standards for the maximum allowable concentrations of noxious elements in the atmosphere have been set since 1949. A strict monitoring system provides an assessment of the state of atmospheric pollution and is carried out continually by the USSR State Committee of Hydrometeorology, the USSR Ministry of Public Health and the USSR State Statistic Board, using a single methodology.

The main task of the state service for the supervision and control of noxious effects on the environment is to establish emission standards and monitor emission levels and their effects. This is required for the preparation of plans for air and nature protection policies;

Table 1. Principal indicators of air protection and noxious substance emissions

	1980	1985	1986	1987	1988
Quantities of controlled (rendered harmless) noxious substances rejected from stationary sources (millions of tons)	194.5	209.3	207.7	212.3	209.1
Specific weight of controlled (rendered harmless) noxious substances from the entire quantity of these substances rejected from stationary sources (percentages)	73%	76%	76%	77%	77%
Total emissions of noxious substances in the air (millions of tons)	110.8	105.0	103.6	100.5	97.5
including:					
from stationary sources	72.8	68.3	66.5	64.3	61.7
from traffic	38.0	36.7	37.1	36.2	35.8

Source: Environmental Protection and Rational Use of Natural Resources in the USSR. Collection of Statistics. Moscow, 1989.

to elaborate emission standards and assess their impacts; to regulate atmospheric discharges; to plan and design cities and industries (which emit atmospheric pollutants); to implement state control of air protection activities and to forecast likely changes in atmospheric quality.

The USSR Central Medical Inspection Service, which has departments in all cities and provinces, controls observance of emission standards in cities. All Sanitary Inspectors have the right to stop the work of any enterprise if MPCs are being violated.

Very large sums of money are allocated annually for nature protection through plans for national economic development. Special attention is given to the elaboration of new technologies to minimise air pollution. The plans also presuppose the closure of state enterprises with a high level of air pollution. Important indicators of air protection and noxious substances are given in Table 1.

Pollution by noxious substances in the USSR does not depend only on domestic sources, but also on transboundary movements. Two specialised systems have been established to monitor transboundary movement of pollutants and pollution of snow cover and atmospheric precipitation. These two systems cover the entire area of the USSR. Table 2 presents quantitative evaluations of noxious substances polluting mainland areas.

Air masses do not "acknowledge" state boundaries; the problems of air conservation are, therefore, of equal interest for all the countries of the world. The Soviet Union is actively cooperating with CMEA countries in the sphere of air protection and participates in a "joint programme on observations and evaluation of long-range pollutant movements in Europe". There is no doubt that the problem of air protection should be solved globally, with the active participation of all regions and peoples of the world.

Table 2. Calculation of densities (ton/km²) and mass (million tons) of annual pollution with noxious substances in the USSR mainland

	European USSR		Asian USSR		Portion in total	
	Density	Mass	Density	Mass	Density	Mass
Sulphur	1.04	5.6* 6.7**	0.45	7.4 8.1	0.59	13.00 14.80
$N\text{-}NO_3$	0.23	1.25 1.5	0.09	1.5 1.65	0.13	2.75 3.15
$N\text{-}NH_4$	0.4	2.17	0.24	3.6	0.26	5.77
$N\text{-}NO_3+NH_4$	0.63	3.42	0.33	5.1	0.39	8.52

* Outside cities
** Including cities

Source: Status of the USSR Environment in 1988. VINITI USSR Academy of Sciences. Moscow, 1989.

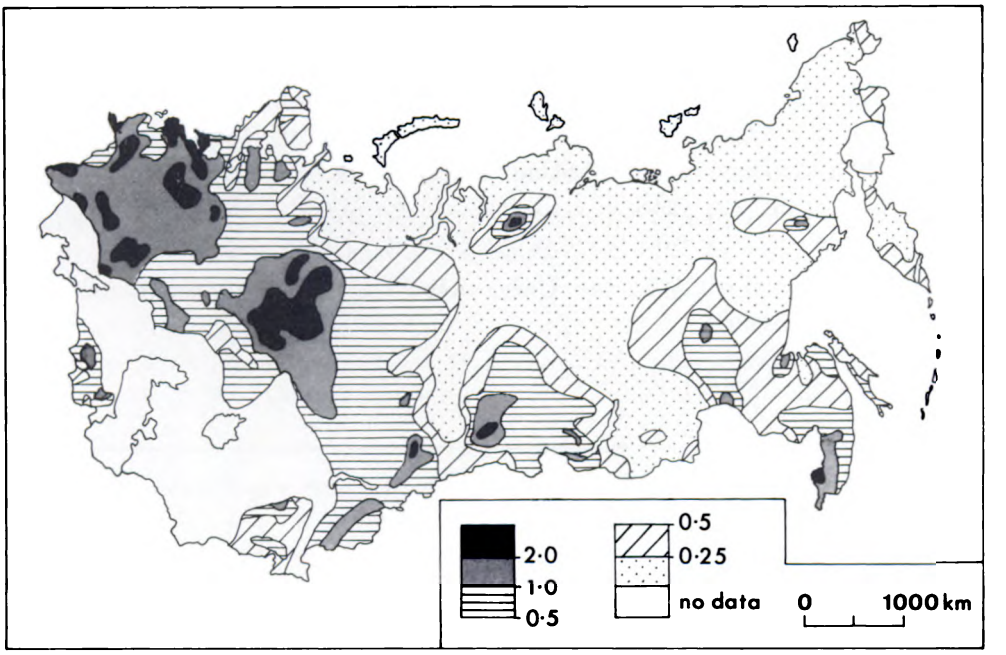

Figure 1. Average annual sulphate sulphur deposition (tons/km² per annum)
Source: USSR State Committee for the Protection of Nature, 1988

1.2 Water Protection

The USSR has one of the largest total volumes of river discharge flow: 4,740km³ on average. The regional distribution of surface waters is, however, quite uneven. This, combined with the constantly rising water consumption caused by rapid development of industry and agriculture, often causes a lack of water resources in a number of regions. The preservation and rational use of water has, therefore, become a problem of national importance today. Table 3 presents figures on water resources for the past decade.

In 1960 national water consumption was approximately 150km³, while in 1988 it had reached 286.3km³. This was distributed as follows: 31% to industry, 7% to domestic use, 61% to agriculture and 1% to other uses. Water consumption will continue to grow in the future. However, measures are being taken to reduce fresh water consumption and polluted sewage release. Thus, for example, standards for water consumption and loss have been developed for implementation by more than 1,700 branches of industry. For the period from 1972 to 1980, 928 enterprises and 109 cities and other settlements carried out water conservation measures based on scientific technologies for sewage purification and disposal and some closed industrial water supply systems. These measures have saved nearly 260 milliard m³ of water to the present day.

A series of complex schemes are being developed to optimise water consumption. More than 100 such initiatives have been elaborated since 1972, the most important among them being the complex utilisation and protection of water resources of the Sea of Azov, the Ural river, the White river, Ufa, the Kuban river, the Terek river, Sulak, the Western Bug, the Teesa river, Ili, Balkhash and so on.

The USSR state system of water resources protection combines legal, organisational, technical and economic elements which are regulated and standardised by the Fundamentals of the USSR, the Union Republics' water legislation and other constitutional legislation.

Table 3. Criteria for evaluation of contaminated surface and sea water for fisheries' water bodies

Ingredients and indicators	Limiting indicator of harmfulness	Maximum permissible concentrations (mg/l)
Dissolved oxygen	General requirements	Winter > 4.0 Summer > 6.0
Complete biochemical usage of oxygen	General requirements	3.0
NH_4^+	Toxic	0.5 (NH_4^+) = 0.39
Nitrate NO_3^-	Sanitary-toxic	40.0N (NO_3^-) = 9.0
Nitrite NO3-	Toxic	0.08N ($N0_2^-$) = 0.02
Petroleum and petroleum products	Fishery	0.05
Phenols	Fishery	0.05
Synthetic surface-active substances	Toxic	0.1
Fe^{3+}	Organoleptic	0.5 (0.05)*
Cu^{2+}	Toxic	0.001 (0.005)*
Zn^{2+}	Toxic	0.01
Cr^{6+}	Sanitary-toxic	0.001 (0.05)*
Ni^{2+}	Toxic	0.01
Pb^{2+}	Sanitary-toxic	0.03
As^{3+}	Toxic	0.05 (0.005)*
Formaldehyde	Sanitary-toxic	0.05

* Maximum permissible concentrations for sea water

Source: Status of the USSR Environment in 1988. VINITI, USSR Academy of Sciences. Moscow, 1989.

Table 4. Principal indicators of water protection and use

	1980	1985	1986	1987	1988
			(billions m^3)		
Water from natural sources: total	323.0	329.8	326.3	339.5	333.7
Water from underground horizons	30.0	29.1	34.3	34.2	31.4
Water losses from transportation	-	-	34.6	47.8	50.6
Total water use	288.0	289.5	280.2	285.8	286.3
Industrial use	104.0	109.5	108.7	108.7	107.2
Drinking water	8.6	8.1	9.8	9.5	9.5
Percentage from water used for industries	8%	7%	9%	9%	9%
Volume of circulating and consecutive water usage	193.0	242.0	250.9	264.2	274.0
Percentage from total water usage for industries	65%	69%	70%	71%	72%
Volume of purified sewage water	17.0	22.4	23.0	13.5	12.1
Percentage from total volume flow requiring purification	46%	58%	66%	47%	30%
Volume of polluted sewage fault (with no or partial purification)	13.0	6.9	6.5	6.7	8.1

Source: Environmental Protection and Rational Use of Natural Resources in the USSR. Collection of Statistics. Moscow, 1989.

During the last few years, land reclamation schemes have shown the need for and led to the development of a special programme constructing large-scale and technically perfect improvement systems. These have a high soil utilisation efficiency (minimising areas reserved for canals and other constructions), only small amounts of water are wasted in the process of filtration, and areas of cultivation are well-planned with special irrigation techniques to prevent soil erosion and a complex of soil cultivation methods including gypsumming of salt-marshes, liming of acid soils and the prevention of salinisation and water-logging. Agriculture has been abundantly supplied with modern equipment, water being transported through pipelines, ferroconcrete chutes and tile-faced channels. New closed horizontal and vertical drains are being constructed on saline soils. Highly productive irrigation systems, applying effective water-sprinkling machines such as "Fregat", "Volzhanka", "Kuban" and many others, have become widely practised of late.

It is planned to develop a system to keep water supplies pure and to prevent pollution in the immediate and distant future. This will establish the main design standards for water constructions, optimise the assimilative ability of water reservoirs, preserve underground waters, design the technical means for industrial sewage monitoring and the telemetric control system of physical and chemical parameters and sewage toxicity and develop the scientific and technical principles of automatised water preserving control systems (Poletajev and Shvetsov, 1982).

1.3 Land and Soil Protection

In the USSR, State Lands cover 2,231 million ha (their categories are presented in Figure 2), the largest territory in the world, and yet 72% of it remains unsuitable for cultivation due to the lack of heat and/or moisture. Arable lands cover 230 million ha. Land relations within the country are regulated by the Fundamentals of the land legislation of the Soviet Union and other Union Republics, adopted in 1968 by the USSR Supreme Soviet. State ownership of land allows the planning and constant implementation of measures directed to land protection and its rational use. On 1 November 1972, a special state land-book was established for the purposes of strict land control. Land tenure is rent free, a fact demanding an even more rational and careful utilisation of the resource. State land control is carried out by the People's Deputy Soviets. The status of land resources is unsatisfactory. About 250 million ha (nearly 50% of agricultural lands) are estimated to be undergoing erosion or are under threat (see Figure 2). On average, humus content in soils has decreased by 0.4% over the last 25 years. Black earths in European Russia have lost up to 25% of their humus. Unwise use of pesticides causes accumulation in soil, water and human foods. Above 10,000ha of agricultural lands contain residual DDT at levels exceeding maximum permissible concentrations.

An action plan has been developed in all regions to reduce soil erosion. State Plans for economic and social developments provide annual funds to construct facilities and plant forests to protect soil from erosion. An industry has been established to carry out agro-technical activities.

Areas destroyed by mineral developments, construction and other works comprise an area of about 2 million ha. By 1989, 1.7 million ha of destroyed lands had been restored, 464,000ha of which are pastures.

Land reclamation is of particular importance. Until recently, 35.7 million ha of agricultural lands had been reclaimed, of these 20.5 million ha are irrigated and 15.2 million ha drained. However, the status of these irrigated and drained lands is not satisfactory and their productivity does not meet the costs of their reclamation.

In 1988 a comprehensive programme was established on soil fertility improvement up to the year 2005. A charge for land resources will be introduced in the near future, as well as other economic mechanisms necessary to provide rational land use.

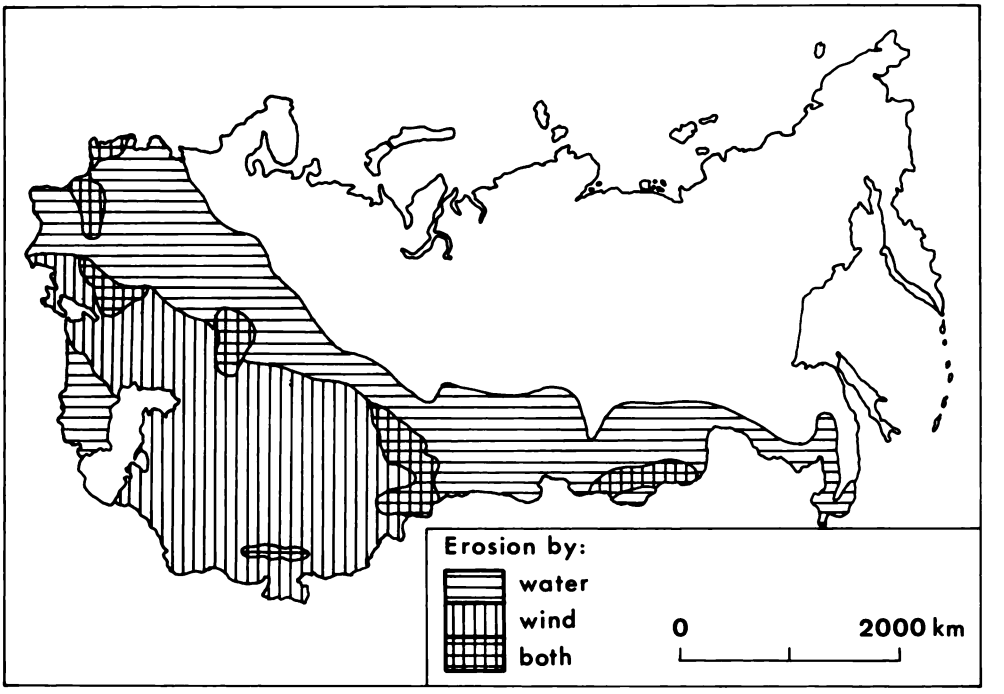

Figure 2. Areas subject to soil erosion by wind and water
Source: USSR State Committee for the Protection of Nature, 1988

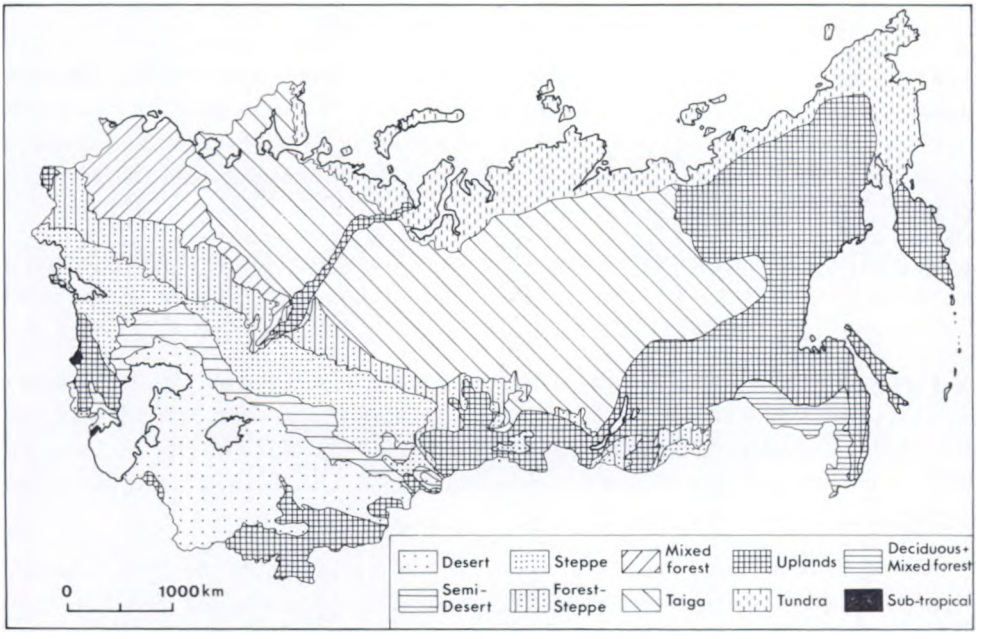

Figure 3. Landscape zones in the USSR

1.4 Mineral Resources Protection

The Soviet Union possesses very rich mineral resources. Some priority activities aimed at sustainable use of minerals are currently being carried out, but quite a large amount of these resources is wasted both during mining and at all stages of processing. Annual losses of coal are 95 million tons, iron ore 23 million tons and potash salts 74 million tons. The industries bear enormous losses during the course of mineral refining; less than one half of balanced potash salt, oil and condensate mined is being recovered. The use of oil and gas by-products is inefficient. In 1988 over 15 milliard m^3 of casing-head gas was wasted in jets. Many valuable subcomponents of mineral resources have not been extracted and are lost in the numerous spoil heaps and slag basins found near mining enterprises which cover an area of about 1 million hectares.

Until recently, there has not been an effective economic mechanism to encourage mining enterprises to ensure the wise and multiple use of their mineral resources. This has now been developed and the practical implementation of the Tarset complex programme for "the wise, complex use of mineral resources in the national economy for the period up to the year 2000" has started. Under this programme some new, ecologically friendly processing technologies should be implemented.

1.5 Natural Resources Protection

Man's ecological consciousness, preservation of the diversity and integrity of natural communities and the wise use of natural resources are the main principles of the system to ensure conservation of biological resources in the USSR.

Forest vegetation plays an important role in the functioning of the biosphere. The total area of the USSR forest is 1,254.2 million ha, with 23.6% of this found in the European-Ural area of the country. 2.2 million ha are cut annually, 58.6% of this in the European regions. In 1988, afforestation activities in woodlands of national value were carried out on an area of 2.2 million ha.

In 1988, 867.3 million ha were safeguarded from fire by ground and aerial techniques, 968,900ha were protected from pests and all kinds of disease with the use of biological controls and 400,800ha by use of chemicals.

Forest protection in the country is regulated by "The USSR and Union Republics forest legislation fundamentals". This law divided the forestry of the Soviet Union into three main levels, depending on the national economic value of the forests. Further sub-divisions are based on a protection classification, which was established to provide for the inexhaustible and wise use of forest.

Alongside woodlands, some other types of wild vegetation are also protected and managed. The USSR flora includes 60,000 species of fungi (macro and micromycytes), over 20,000 vascular plants, about 10,000 algae, over 5,000 lichens and 2,000 species of moss. About 600 wild relatives of cultured crops occur in the country. The USSR Red Data Book includes 603 species of vascular plants, 32 mosses, 29 lichens and 20 fungi.

Table 5. Estimated numbers and harvest of significant game species in the USSR in 1988

Species	Numbers (in thousands)	Harvest (in thousands)
Moose	791	88.2
Deer	1,271	152.0
Saiga	1,035	70.4
Wild boar	406	102.0
Roe deer	746	45.9
Squirrel	7,426	2,896.0
Hare	8,408	1,507.0
Fox	682	142.0
Musk-rat	3,564	1,259.0
Mink	335	70.3
Sable	946	254

Source: Environmental Protection and the Rational Use of Natural Resources in the USSR. Collection of Statistics. Moscow, 1989.

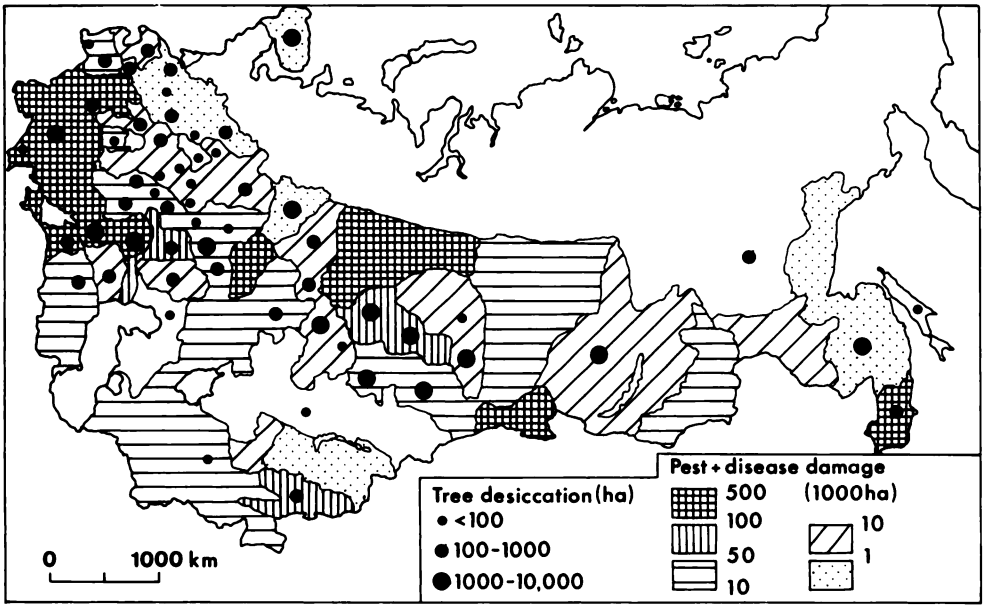

Figure 4. Pathological condition of forests (1988) by oblast, including tree desiccation through changes in soil water, severe weather, insect damage and pollution and area of forest affected by pests and diseases

Source: USSR State Committee for the Protection of Nature, 1988

The enormous diversity of the natural environment within the huge latitudinal and longitudinal extent of the country leads to the great scope of the country's wildlife. There are over 180,000 animal species, including 354 mammals, 803 birds and 1,700 fish. Some species (mainly of game) are of high economic value (Table 5). About 1 to 1.2 million tons of fish have been taken annually from inland water bodies over the past 40 years.

Under strong human pressure, wildlife is declining. The USSR Red Data Book includes 463 species and subspecies of animals (92 mammals, 80 birds, 35 reptiles, 9 amphibians, 9 fish, 19 molluscs, 202 insects, 2 crustaceans and 11 worms). Each Union Republic has compiled its own Red Data Book.

Among the other methods developed for the protection of wildlife, the most efficient are the establishment of a network of strictly protected areas, the breeding of rare species in special nurseries and species re-introductions (Table 6). In recent years, the development of a wildlife inventory at the national level has been started.

Table 6. Release of valuable commercial fishes (in millions)

Fish species	1985	1986	1987	1988
Total in the USSR	8,784.5	8,637.0	8,689.1	7,196.2
including:				
Acipenseridae	143.1	131.2	123.4	123.1
Oncorhydae	694.1	834.5	657.2	788.7

Source: Status of the USSR Environment in 1988. VINITI, USSR Academy of Science, Moscow 1989.

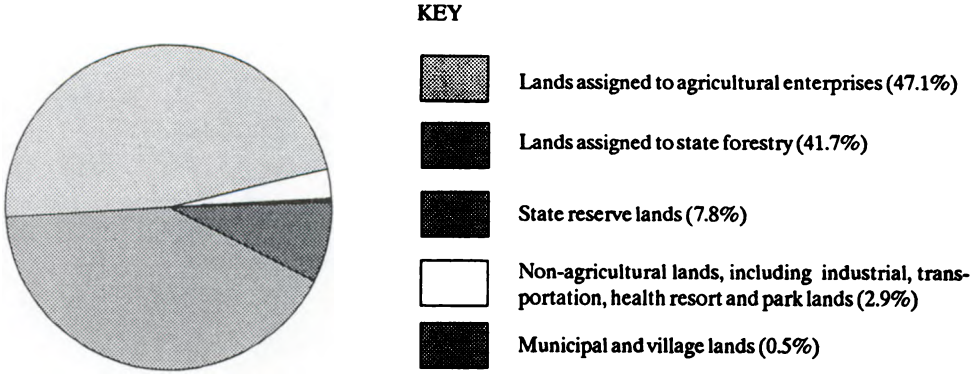

Figure 5. Classification of state lands (%)

Source: Status of the USSR Environment in 1988. VINITI, USSR Academy of Sciences. Moscow, 1989.

1.6 Protected Areas

The USSR system of protected areas involves the following categories:

- strictly protected areas (*zapovednik*);
- hunting-management units;
- reserves of different types;
- national parks;
- botanical and zoological gardens;
- natural monuments;
- watershed forests;
- buffer zones of cities and resorts;
- arboretums and some other specially protected objects.

Among these, 22 strictly protected areas have been declared Biosphere Reserves (UN List Category IX) and 12 areas have been nominated as wetlands of international importance especially as waterfowl habitats (Ramsar Convention). Table 7 gives the numbers and area of the main categories of protected areas. The distribution and basic characteristics of the main types of protected areas are presented in Appendix 1.

In the USSR, protected areas are sites of strictly regulated or special use. They are designed to ensure and support the ecological balance, for the preservation of the gene pool of biological resources, to obtain information and scientific knowledge on natural processes and human impacts on the natural environment and to provide opportunities for ecological education and training.

The USSR State Committee for Environmental Protection has been the central authority in charge of protected areas management since 1988.

Table 7. Numbers and areas of strictly protected areas, hunting-management units and nature national parks

	1980	1985	1986	1987	1988
Number of strictly protected areas	135	150	155	161	161
Area (in thousand ha)	11,060	17,549	18,904	19,644	21,597
Numbers of nature national parks	7	13	18	19	19

Source: Environmental Protection and Rational Use of Natural Resources in the USSR. Collection of Statistics. Moscow, 1989.

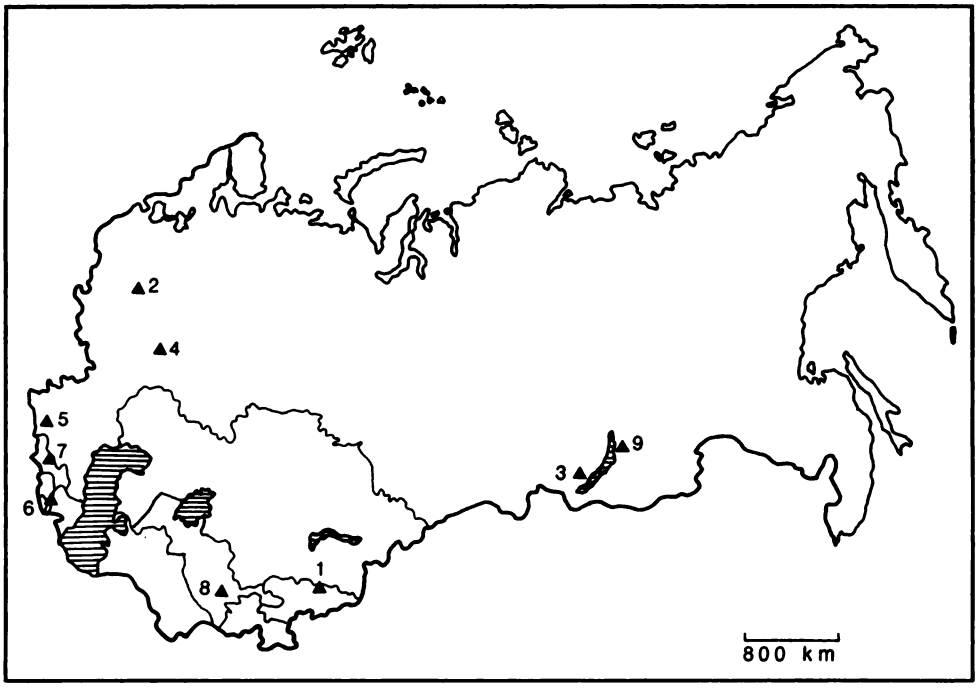

Figure 6. National Parks of the Central and Eastern Republics of the Soviet Union

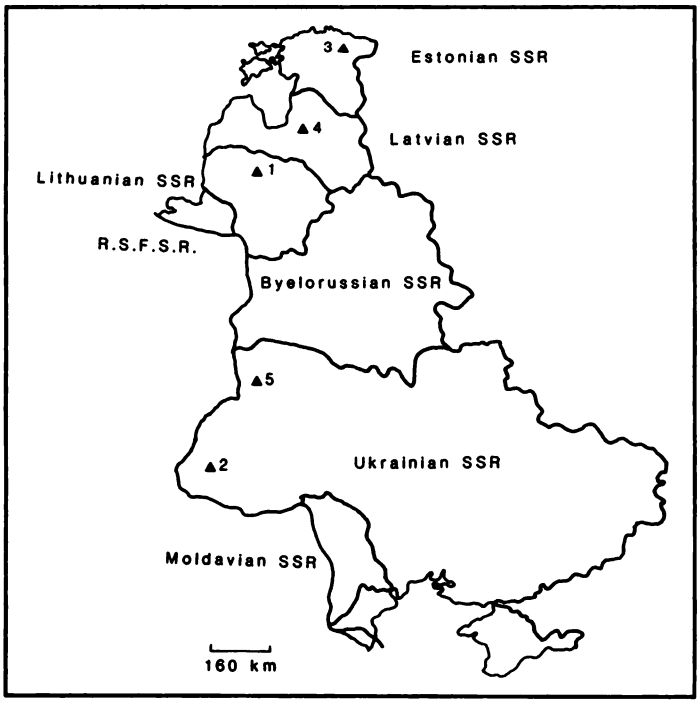

Figure 7. National Parks of the Western Republics of the Soviet Union

Key to Figure 6:

1 Ala-Archa
2 Losinyy Ostrov
3 Pribaikalski
4 Samarskaya Luka
5 Sochinskiy
6 Sevan
7 Tbilisskiy
8 Uzbekskoy
9 Zaibaikalski

Key to Figure 7:

1 Gauya
2 Karpatskiy
3 Lakhemaaskiy
4 Lithuanian
5 Shatskiy

CHAPTER 2: INSTITUTIONAL STRUCTURE AND LEGISLATIVE FRAMEWORK

2.1 Historical Background

The historical origin of nature protection in the USSR was in the middle ages. The high fines imposed in Kiev Russia, for illegal harvest of beaver in the 11th century are documented; even then people clearly understood that uncontrolled hunting of birds and animals may lead to the rapid exhaustion of resources. As early as the 13th century, parts of the nature reserve "Bielovezhskaja pusha" in Byelorussia were included in a prince's special law prohibiting hunting. There have been protected natural areas since that time.

The nature protection decrees of the 18th century Russian Tsar Peter I were particularly strict. They affected the status of some sites and also the protection and rational use of natural resources. River pollution was forbidden and the hunting of valuable animals, such as elk, sable and beaver, regulated.

In 1889, Askania-Nova, the first strictly protected area (zapovednik), was established.

The transition between the 19th and 20th centuries witnessed a deterioration in the environment; the growing decline of European forests, impoverishment of populations of fish, birds and wild animals and the pollution of reservoirs and air. Many new societies were created in Russia at that time, including those for the exploration of nature, lovers of natural sciences, anthropology and ethnography, societies of naturalists, for plant and animal acclimatisation, the geographic society, the protection of animals and nature and many others. These aimed mainly at the study, protection and rational use of natural resources. Many prominent and outstanding Russian scientists, including G.A. Kozhevnikov, I.P. Borodin, D.P. Anuchjin, A.N. Severtsov, later S.A. Buturlin, I.I. Galenkin, V.N. Makarov, B.M. Zhitkov, S.I. Ognev, G.P. Dementjev and many others, worked on these subjects at this time.

The nature protection movement emerged in the 20th century with the establishment of the Nature Protection Commission within the Russian Geographic Society. This Commission was made up of a mixed team of people from governmental and research institutions. The Decree "on the protection of natural monuments, gardens and parks" was passed in 1921. Under this Act, several natural sites and their resources were designated as entirely protected natural monuments.

Numerous pieces of legislation have been developed in recent years to regulate the use and conservation of natural resources. Although some nature conservation acts were adopted in all Union Republics from 1957 to 1963, until the 1970s there were no real opportunities to pursue environmental protection as a nationwide objective. In recent years, the intensive deterioration of the natural environment, a sharp decrease in

environmental quality in some regions, the general public's growing ecological awareness and interest in environmental matters and the activities of scientists to protect wildlife have resulted in stronger measures being taken. New laws and acts have been adopted and the USSR and Union Republics' State Committee for Environment Protection and Supreme Soviet Committee on ecology and wise use of natural resources have been established. Nature conservation has become a priority area in the national economy. In 1988 the budget proposed for environmental protection was 11,600 million roubles.

2.2 Administrative and Legislative Structure and Functions

2.2.1 Legislative structure

Environmental protection is legally ensured by the USSR Constitution and legislation introduced over the past ten to fifteen years (see Table 8). Article No. 18 of the Constitution reads: "all the necessary measures, taken in the USSR, directed at the protection and rational use of the Earth and its entrails, water resources, plants and animals, the preservation of purity of water and air, activity directed at the reproduction of natural resources and the improvement of the environment are carried out in the interests of the present and the future generations". Article Nos 67, 73, 131 and 147 oblige all citizens of the USSR to safeguard nature and its resources. Firm rights and duties for nature preservation are thus imposed on every body of state power and management.

The consumption of natural resources and nature conservation activities are regulated under the mechanism of administrative-legal responsibility, through the specific rules and regulations of environmental legislation.

Improvement of nature protection is one of the points covered by "The main orientations of economic and social development of the USSR for the period of 1981-1985 and up to 1990", confirmed by the 27th Congress of CPSU, and of many other resolutions of government and other organs of power and management.

All measures on nature protection are incorporated within general plans for the economic and social development of the country. These plans are usually worked out for a five-year period. As a rule, measures are first considered, discussed and specified at the special deputy sessions on nature protection. They are then confirmed by the Supreme Soviet, when the five-year plans acquire legal status and become compulsory for all ruling bodies.

All union, republic and local organs of power management (namely, the Council of Ministers' executive committees of the Peoples' Deputy Soviets at different levels) are required to implement these nature conservation measures.

2.2.2 Administrative structure

A special Environmental Protection Commission of the Presidium of the USSR Council of Ministers and of the Presidiums of the Council of Ministers of other Union Republics

Table 8. Chronology of progress in nature conservation in the USSR

11th century	Protection of single animal species in Kiev, Russia.
17th century	Acts aimed at limiting regulations, Tsar Aleksey Michailovich.
18th century	Nature Protection Act declared by Peter I.
1889	Establishment of the first strictly protected area "Askania-Nova".
1912	Establishment of the Nature Protection Commission, Russian Geographical Society.
1916	Establishment of the Barguzinski strictly protected area.
1918	Decree on the "Protection of natural monuments, gardens and parks".
1924	Establishment of the All-Russian Nature Protection Society.
1925	Establishment of Inter-institutional Committee on Nature Conservation under RSFSR NARCOMPROS and Inter-institutional Commissions in regions and republics.
1949	USSR Council of Ministers Act "on measures to control air pollution and improvement of sanitary situation in human settlements".
1955-1957	Establishment of the Commission on Nature Conservation within the USSR and Union Republics Academy of Sciences.
1957-1963	Laws passed concerning nature conservation in Union Republics.
1959	Council of Ministers Act "on measures taken to improve limiting management".
1965	Establishment of the Main Department of Nature Protection, Nature Reserves, Forestry and Game Farms within the USSR Ministry of Agriculture.
1968	Fundamentals of land legislation of the USSR and Union Republics.
1970	Fundamentals of water legislation of the USSR and Union Republics.
1975	The USSR Red Data Book publication.
1975	Establishment of the All-Union Research Institute of Nature Conservation and Reserves.
1977	Fundamentals of the USSR and Union Republics forest legislation.
1977	The new USSR Constitution.
1980	Atmospheric air conservation Act.
1981	Establishment of the USSR Commission of the Presidium of the Council of Ministers of Environmental Protection and Wise Use of Natural Resources.
1984	Second edition of the USSR Red Data Book.
1988	Establishment of the USSR State Committee of Environmental Protection.
1988	Formation of Ecological Union, Social-Ecological Union, All-Union Society for Animal Protection, Ecological Society, Association for "Ecology and Peace", etc.
1988	Establishment of the USSR Supreme Soviets Commission on ecology and wise use of national resources.

was created in 1981, directed by the heads of various administrative bodies, to improve nature protection in the Soviet Union.

The USSR State Committee of Environmental Protection and the Councils of Ministers of Union Republics represented by Committees for Nature Conservation are the authorities responsible for the national regulation of environmental conservation and the wise use of natural resources.

A special Union-Republic State Committee of Nature Protection was created in 1988, with a wide network of scientific research and information institutions. The decisions of this committee are obligatory for all departments. This considerably improved the general ecological situation and enabled strict control of scientific and technical policy for the solution of nature protection problems.

Each autonomous republic, region or lower administrative unit has its own Committee for Nature Conservation. The USSR Goskompriroda and its network is responsible for environmental quality and the use of natural resources.

The principal responsibilities of the USSR Goskompriroda are to:

- control conservation activities and use of natural resources;
- carry out state ecological research;
- monitor ecological standards;
- issue permits for use of natural resources;
- regulate controlled activities;
- commission and monitor progress on the USSR Red Data Book and national inventory of wildlife resources;
- promote environmental issues through education and training and to plan and manage international cooperation on nature conservation.

The USSR Goskompriroda is in charge of the preparation, coordination and presentation of proposals on nature conservation and the wise use of natural resources to the USSR State Planning Committee, for consideration and inclusion in the drafts of concepts and main trends in the socio-economic development of the USSR. It develops proposals to improve the ecological mechanisms of natural resource consumption and adopts ecological standards, regulations and rules.

Some nature protection functions have been vested with the Ministry of Fishing Industry, the State Forestry Committee and the State Hydrometeorology Committee.

The USSR State Hydrometeorological Committee, with a wide network of meteorological stations, Arctic and Antarctic Institutes and other research institutions, carries out ecological environmental control and works out long-range and daily forecasts of the weather and of other natural phenomena.

The State Planning Committee, the State Committee on Science and Technology and practically all departments of industrial enterprises have integral special units responsible for nature protection.

There are different nature protection societies in all 15 republics of the USSR, regulating and coordinating the nature protection activities carried out by all other social organisations.

Nearly 20,000 scientists, working in more than 1,200 research and higher education institutions, touch upon the scientific problems of nature protection, in one way or another.

All nature protection activities are therefore provided with a strong science base by the great number of research institutions working in this field, given legal status by state legislation and carried out in the provinces under the control of social and state nature protection organisations.

2.3 Environmental Education

National environmental education, training and creating awareness are currently the keys to encouraging new attitudes towards the environment and have become of priority importance. Perestroika of political and economical systems and the problems of the social and economic development of the country have revealed the deep interaction and interrelationship between the state of society and environmental quality, natural resources consumption, public ecological awareness and ecological values in national culture. Environmental education is defined as the promotion of general knowledge of ecological problems and the acquisition of a life-style incorporating ecologically sound decision-making and upbringing. The main forms of environmental education and training are introduced into the low/medium and high-level education teaching system. Special training courses for environmental experts to exchange know-how and the promotion of nature conservation ideas by the mass-media (press, radio, TV, etc.) are also important.

2.4 International Cooperation

The Soviet Union actively participates in international cooperation to ensure ecological safety and support the healthy biosphere of our planet. The country is an initiator of numerous environmental proposals, e.g. mutual cooperation among northern countries to protect the Baltic Sea, joint conservation activities in the Asian-Pacific Ocean region and coordination of efforts to encourage ecological safety under the Organisation of the United Nations. Much has been done to develop an adequate infrastructure of information supply and dissemination to ensure the uniformity of various scientific data (statistics, monitoring, etc.) obtained and used in different countries.

The USSR is widely involved in activities of numerous international organisations such as the Commission for Mutual Economic Assistance (CMEA), the United Nations Environment Programme's (UNEP) International Referral System for Sources of Environmental Information (INFOTERRA: over 50 projects through the Centre of International Projects, etc.), the Economic Commission for Europe (ECE), United

Nations (UN Convention on long-range transboundary air pollution, UN Declaration on low or non-waste technology, UN cooperation in flora and fauna conservation in Europe), World Conservation Union (IUCN), International Waterfowl and Wetlands Research Bureau (IWRB), International Council on Hunting (CIC) and Unesco's "Man and the Biosphere" programme. Significant environmental problems are also considered and have been achieved under some other international organisations such as the International Atomic Energy Agency (IAEA), World Meteorological Organization (WMO), World Health Organization (WHO) and United Nations Regional Commissions.

The Soviet Union is very active in developing conservation initiatives through international agreements and is involved in over 55 International Conventions and bilateral or multilateral treaties (e.g. Convention on long-range Transboundary Air Pollution, Convention on International Trade in Endangered Species of wild fauna and flora (CITES), the Ramsar Convention on Wetlands of International Importance, Agreement on Polar Bear Protection, Declaration on Baltic Waters Protection, etc.).

Bilateral cooperation through intergovernmental agreements is being widely developed. Over ten intergovernmental agreements are currently in operation with Belgium, Great Britain, Norway, USA, Finland, France, Germany, Czechoslovakia and Sweden.

2.5 Scientific Inputs

Intensification of environmental protection research is urgently needed in order to meet the objective of progressive social development and to find new ways for sustainable use of natural resources. This research is carried out by the Institutes of the USSR Academy of Sciences and several other institutions and bodies under the coordination of the USSR State Planning Committee and the Council of Ministers. There are numerous members of research institutes engaged with the investigation of various environmental problems. The traditional areas of long-term nature conservation research and development projects within strictly protected areas are the main research priorities for the All-Union Research Institute of Nature Conservation and Reserves, under the USSR State Committee for the Environment, the USSR Academy of Sciences and the Institute of Ecology and Animal Evolutionary Morphology. There are also numerous research institutes involved in the investigation of various aspects of environmental pollution. Some of the subjects of this research, e.g. risk technology, have been intensified in recent years, particularly following the Chernobyl tragedy. One of the priority tasks for consideration is the development of a scientific basis for ecological subjects.

However, the poor technical and technological back-up for environmental research seem to be limiting factors for intensive scientific developments and are currently preventing practical achievements of innovative environmental projects.

CHAPTER 3: ENVIRONMENTAL TRENDS

3.1 Modern Ecological Problems of Economic Development

Unchecked and wasteful economic development has undoubtedly had a harmful effect on the environment of the USSR. The bureaucratic sectorial treatment of natural resource utilisation has resulted in the flagrant depletion and wasting of natural resources, and pollution and degradation of the environment in many regions. In most cases, the damage caused by industry to human health or the environment has had little or no effect on the assessment of their economic performance.

In treating the state of the environment as one of the principal indicators of the well-being of the Soviet people, the Central Committee of the CPSU and USSR Council of Ministers adopted a resolution in January 1988 entitled "Radical Perestroika [reconstruction] of Conservation Practices in the Country" in which the environmental conservation strategy was defined as a constituent element of perestroika in the political, economic and social spheres. According to this resolution, environmental conservation and sustainable use of resources are treated as priority issues by the government of the USSR.

Total expenditure on environmental projects exceeded over 100 billion roubles between 1976 and 1988, including 30 billion roubles of capital investment. This resulted in:

- a reduction of approximately 15 million tons in the volume of recycled and detoxified matter from waste gases and atmospheric pollutant emissions from stationary sources, through the construction of treatment facilities and plants;
- a substantial increase in physical plant capacity for waste water treatment and purification;
- an increase in the volume of recycled water circulation, with an annual saving of fresh water intake from natural sources exceeding 274km^3 today (greater than the mean annual flow of the Volga).

However, despite the evident growth of capital investments in environmental protection, there have been neither substantial improvements in the application of these methods nor significant recovery of the natural environment. Only about 53-60% of planned environmental projects have been implemented (e.g. for pollution control) and increasing consumption of materials and energy in manufacturing has given rise to large-scale mineral mining, processing and combustion, which has in turn produced substantial volumes of tailings and significant pollution of land, air and water. One of the main features of the recent programme for conservation and environmental protection in the USSR has been the restructuring of the economy. There is, therefore, increasing emphasis on low-pollution, energy-efficient industry and environmentally friendly technology.

3.2 Ecological Reformation of the Economy within Perestroika of the Socio-economic System

Remarkable changes have recently taken place in the national economy which may produce a more favourable climate for solving the USSR's ecological problems. The most important component of this process is fundamental economic reform. Elements of perestroika that will assist this process include:

- improvements in the planning process for new developments, including the consideration of designs for plants based on modern scientific knowledge and environmental protection objectives;
- orientation towards economic planning methods for development, including the introduction of incentives for natural resource management and alteration of the techniques and methods used in developing natural resource management policies to conform with the "Law on the State Enterprise Union";
- strengthening the territorial principle in environmental and rational natural resource use planning;
- decentralisation of planning functions and enhancement of the role of the local Soviets of People's Deputies in preparing natural resource management plans.

The introduction of financial incentives for the conservation of natural resources and control of pollutant emissions is playing an important role in the development of a new economic management system which takes account of conservation and environmental protection. Payments by state and cooperative enterprises and organisations for the exploitation of mineral reserves, land, water or biological systems will take three principal forms:

- as compensation for the restoration of equivalent types of natural resources included in the production costs of the user-enterprises;
- as rent payments for using relatively superior natural sources paid out from profits (cost accounting income) of the enterprises;
- as fines and sanctions for excessive use of natural resources and violations of conservation and environmental protection legislation, which are also to be paid out of the profits (cost accounting income) of the businesses.

Local government authorities must have a real economic leverage in order to manage conservation and environmental activities in their districts. One such takes the form of target funds for regional conservation and wise land use, which are mostly designated for use in financing interdivisional and regional conservation measures. The primary sources of these funds are the fees paid by enterprises for standardised pollutant emissions and waste storage and the fines imposed for exceeding these standards.

3.3 Improvement of Mechanisms for Restoration of Natural Environmental Quality

An improvement in the regulation of statutory controls will require the development of a comprehensive system of environmental standards, definitions of acceptable environmental effects, expert environmental impact assessment for construction projects, the expansion and modification of economic facilities and the development of legislation for defining the statutory and administrative responsibilities of natural resource users. The socio-political mechanism must be capable of solving the most severe ecological problems on a democratic basis. The focus of activity will be on increasing the level of ecological education and training, disseminating extensive information on the state of the environment to the populace, increasing the role of society and the mass media in environmental issues and obtaining the active support of the Soviets of Peoples' Deputies. The problems of rational natural resource use must be solved with specific application to the primary types of natural resources available. Calculations have demonstrated that the entire range of conservation measures outlined here will require approximately 130 billion roubles capital investment (nearly four times the present level of investment).

Plans are also in place for substantially altering the distribution of capital investment in conservation and environmental protection. Thus, capital investment on the rational use and conservation of water resources will be reduced to 40% (from 70% in the 12th Five-Year Plan), the proportion of capital investment on air quality conservation will be increased by a factor of 1.7, capital investment on mineral resource conservation increased by a factor of 11.5 and that on the conservation and rational use of land increased by 2.5.

These outlays will be targeted primarily for enterprises and cooperative organisations in accordance with the USSR Law "On the State Enterprise (Union)" and the USSR Law "On Cooperation in the USSR".

State centralised capital investment can be used to finance major interdivisional and regional conservation measures.

3.4 Legal and Administrative Conservation Measures

Environmental legislation and the system of standards require refinement. The Fundamental Land Use Legislation of the USSR and the union republics is currently under review and efforts are under way to develop draft legislation "On the conservation and use of vegetation", "On rents" and other statutes, as well as refinement of the standardisation process.

Nature conservation legislation was previously codified by developing statutes for each industry based on a particular resource: the Fundamental Principles of Land-Use, Water, Forest Legislation, etc. This legislation was implemented throughout the 1970s and 1980s, although the need for a comprehensive approach had already been recognised world-wide.

Under these conditions, it became obvious that once the conservation legislation had been framed within each economic division, a comprehensive act was needed. The draft legislation of the USSR Law "On Conservation" is presently under development and the adoption of this law will conclude the formation of conservation legislation in the USSR. The need to satisfy statutory environmental protection requirements highlights the need for updating the system of legal guarantees, improving organisational activities and enforcement and improving the effectiveness of legal liability for ecological enfringements.

3.5 The Natural Resource Conservation Management System

Certain difficulties are encountered in the reorganisation of the environmental management system. Ministries and departments previously responsible for state monitoring of the environment and conservation are impeding the transfer of the corresponding services to the new conservation committee. For example, the USSR State Committee for Forestry retains the right to monitor the lumber and wood processing industries' compliance with forest exploitation and reafforestation regulations. The problem of monitoring timber operations remains unresolved. The USSR Ministry of Fisheries retains the right to divide the remit of government control and monitoring over the use of fish stock; thus conservation organisations monitor the habitats of aquatic life and vegetation while the Ministry of Fisheries is responsible for conserving fish stocks and monitoring their status and exploitation.

It is currently of crucial importance to concentrate the complete responsibility for and control of environmental conditions and natural resource exploitation within one body.

The National Programme on Environmental Protection and Wise Use of Natural Resources (13th Five-Year Plan and programme until the year 2005) is intended to provide the fundamentals for the USSR State Committee for Environmental Protection Activities and establish the scientific, technical and legislative basis for the operation of the whole national economic mechanism. One of the central areas in the restructuring of conservation and environmental protection is the maintenance of public health, conservation of the biosphere and restoration of natural resource potential in the interests of the effective and stable socio-economic development of the USSR.

3.6 Priority Initiatives for the Wise Use of Natural Resources

Several objectives must be solved with specific application to the primary types of natural resources available.

3.6.1 Air protection

The rate of reduction of pollutant emissions to the atmosphere from stationary sources (up to 32.5 million tons) must be doubled and emissions from vehicles reduced by 40-45% in order to achieve health standards of atmospheric air in urban and industrial centres.

3.6.2 Water protection

The excessive use of pesticides in agriculture must be reduced and the application of biological methods for plant protection from pests and disease increased on an area of over 55 million ha. A programme aimed at the wise use of water resources requires the complete elimination of contaminated waste water discharge to natural water bodies. Special attention should be given to the provision of safe drinking water. To meet this demand it will be necessary to speed up the construction of the central drinking water supply systems in rural regions and reduce the use of good drinking water for industrial purposes. There are other opportunities to save water resources, for example, through the improvement, management and reduction of water consumption in agriculture. The volume of water used per hectare of irrigated land must be reduced by at least 25%.

3.6.3 Land and soil protection

It is necessary to conserve and enhance diminished natural soil fertility through the improvement of the physico-chemical properties of the soil and achieving a zero-deficiency humus balance. This requires intensive anti-erosion activities on 113 million ha of cultivated lands. Additionally, areas destroyed by mineral mining must be reclaimed. The complex reconstruction of drainage systems, construction of advanced water supplies and irrigation networks and modernisation of land improvement installations are also of vital importance. Over 10,000 million roubles of capital investment are needed to meet this objective.

3.6.4 Agriculture protection

The most important problems for sustainable agriculture and nature conservation in farmland are as follows:

- The creation of an optimal land use system, answering the needs of agriculture and laying the foundation for the optimisation of the interaction between man and nature.
- Improving the ecological aspects of agricultural technology, with due regard to scientific and social progress.
- A scientifically based restriction on the use of pesticides, through the extensive introduction of an integral system of plant protection (combining agrotechnical, mechanical, chemical and biological means of controlling the pest and weeds afflicting agricultural crops).
- The optimal use of nutrients in accordance with the needs of some agricultural crops. Development of stable mineral fertilizers.
- Minimisation and eventually completely eliminating pollution of surface and underground waters by agricultural and industrial waste products, through the introduction of low-waste or waste-free technologies.

- A reduction in irrigation water demand in the near future, through a policy of rigid economy, sub-soil and dripping irrigation methods.
- Implementing scientifically based nature conservation measures, with due regard for their influence on entire natural systems, including agriculture.
- Preventing the destruction of animals during cropping, hay-mowing and other harvesting activities.
- Improvement, in the near future, of technological processes in the interests of wildlife conservation.

Integration of the intensification of agricultural production with nature conservation measures requires global, interconnective consideration of the following main principles:

- an increase in agricultural productivity;
- maintaining water quality;
- the conservation and improvement of soil fertility;
- the preservation of fauna and flora as a gene fund;
- the preservation of natural ecosystems, as an integral component of the biosphere.

3.6.5 Mineral resource protection

The use of waste recycling at all levels must be incorporated throughout the national economy in order to increase the efficiency of natural resource utilisation. The utilisation of certain forms of waste is to be increased to 90-95%.

3.6.6 Natural resources protection

To conserve the forest heritage of the country and implement timber-saving technology it is necessary to reassign forest stocks to groups and categories according to their protection level. The area of first and second category forests (which mostly perform water conservation, protection, health and hygiene functions) and special purpose forests (those in areas of high population density and extensive transportation routes with either a protective or limited economic purpose) must be increased. There should be a 1.7 to 2-fold reduction in the forest area of the third group (multi-forested regions principally used for lumber production). Measures are to be taken to increase the efficiency of timber consumption up to 90-95%.

About 2-3 million hectares of forest are currently suffering from the harmful effects of pest and diseases, of which 56% requires active protective measures. Biological methods are most effective against this damage. The use of biological techniques and agents increases from year to year and these measures will soon account for 80% of the total range of forest conservation measures in the USSR.

3.6.7 Protected areas

The completion of the establishment of a scientifically validated network of natural protected envirouments, with the total volume of these areas up to 3% of the total area of the country (the ecological standard) is also among the primary objectives. During the period 1991-2005, 85 wildlife reserves and 51 National Parks are to be established.

3.7 Science and Technology in Ecological Problem Solving

General scientific research requirements have been identified for the optimisation of natural resource management and environmental protection, but priorities for fundamental and applied research are still being determined. Research priorities are provided in the sections on ecological problems in the Comprehensive Programme of Scientific and Technical Progress for 1991-2010: Natural Resources, Environmental Protection, Secondary Resources. State scientific and technical programmes are being developed and the implementation of these programmes will play an important role in optimising natural resource management. For example, the State Scientific and Technical Programme on Ecological Problems currently under development includes four sub-programmes:

- the economic and legal principles of rational natural resource utilisation;
- ecological standardisation;
- modernisation of the monitoring systems and techniques used to monitor conservation and natural resource utilisation;
- scientific and technical support in conservation and the wise use of natural resources.

The programme of Biosphere and Ecological Research of the USSR Academy of Sciences Through to the Year 2015 has been developed. This programme is intended to develop fundamental interdisciplinary problems through the joint efforts of natural technical and social sciences.

3.8 The Ecological Social Movement

The ecological social movement, in addition to previously established social organisations (republic conservation societies, societies of hunters and fishermen, conservation clubs, etc.), can be characterised by the widespread emergence of a very broad range of conservation organisations throughout the country. These bodies have different organisational principles (unions, clubs, cooperatives, societies, associations, funds and committees) and different areas of activity (ecology, socio-economics, ecological-cultural, etc.).

The emergence of new ecological social unions is the natural result of positive changes in the country, the rapidly increasing availability of information and the socio-political

activity of the Soviet people. Small unions predominate, but there has been a trend towards combining individual groups into All-Union organisations (for example, the Socio-ecological Union of the USSR and the All-Union Society for the Protection of Wildlife).

The public is increasingly aware of their personal responsibility for the environment and there is a clear trend towards direct participation in conservation measures. Public initiatives now appear to be influencing decision-making processes, for example, the Socio-ecological Union organised an All-Union Social Protest Day against the construction of the Volga-Don and the Volga-Chogray Canals as their first practical initiative.

Plate 1. Caspian tern colony in May at Krasnovodskiy Zapovednik (Turkmenskaya SSR)

CHAPTER 4: PRIORITY INITIATIVES

4.1 High Priority Initiatives

The following high priority initiatives have been identified in the State Programme on Environmental Protection and Wise Use of Natural Resources in the 13th Five-Year Plan and through to 2005:

(a) Reduction in atmospheric air and water pollution for the improvement of public health.

(b) Rapid implementation and application of resource conserving, waste-free or low waste technologies.

(c) Reduction of natural resource losses through all stages of industry, from mineral extraction to consumption.

(d) Reduction and utilisation of waste, particularly of potentially toxic chemicals on the World Register.

(e) The rational and ecologically validated distribution of new enterprises.

(f) Protection and rational use of natural systems and their components (land, forest, water, the gene-pool, etc.).

(g) Improvement of the economic mechanisms, regulating systems and standards, rules and norms for environmental monitoring.

(h) Improvement and further development of ecological legislation, education and training.

(i) Development of international cooperation in the field of environmental protection and ecology.

4.2 Regional Priorities for Environmental Improvements

(a) Cities with populations of over 100,000, where particularly toxic industries are located.

(b) Cities with a population of over 500,000 and a severely damaged environment.

(c) Cotton-planting areas of Central Asia, particularly the Aral Sea region.

(d) South Ukraine and the Crimea.

(e) Industrial areas: the Urals, Siberia and Kazakhstan.

(f) Transcaucasian Republics.

(g) Arctic basin.

(h) The Baltic Republics.

(i) The Asov and Black Sea areas.

(j) Moscow, Leningrad and Kiev.

The problems of environmental protection and rational use of natural resources are most complex in the Ukraine, the Republics of Central Asia and in the most loosely regulated cities. These are the top regional priorities.

4.3 Environmental Management Priorities

(a) Identification of firm ecological-economic parameters to be given to industries as direct planned targets.

(b) Development of a system using these parameters to reveal the actual, predicted or baseline state of the environment and natural resource stocks (at regional or sectorial level).

(c) Development and introduction to practical management of a system of assessment and forecasting for changes in environmental and natural resources.

(d) Development of a standard methodology for ecological assessments of major projects involving the use of natural resources.

(e) Development of a list of controlled parameters and identification methods.

(f) Development of recommendations for the improvement of production in the 13th Five-Year Plan and through to the year 2005.

4.4 Priorities for Fundamental Research

(a) Development of a theory for the stability of biological, ecological and geographical systems (involving the biosphere).

(b) Development of the theory of human ecology.

(c) Development of the theory of the space/time structure of the biosphere and its components.

(d) Investigation of energy and mass exchange in the biosphere.

(e) Investigation of geophysical processes in the biosphere.

(f) Development of a theory of evolution of the biosphere and its dynamics.

(g) Development of the ecological principles of industrial manufacturing, transportation and agricultural production.

(h) Development of research methodology and mathematical modelling for human-nature interaction, biosphere processes and its components (geo-ecological information science, etc.).

(i) Development of a scientifically validated system for environmental education, training and the development of legislation.

Plate 2. Little egret, a wetland species of southern USSR registered in the Red Data Books of Kazakstan and Georgia

CHAPTER 5: OPPORTUNITIES FOR REGIONAL AND INTERNATIONAL COOPERATION

The Soviet Union considers international cooperation as a factor which could help to provide global peace. The concept of "ecological security", was developed by socialist countries as an element of their comprehensive approach to international security and in response to the new political outlook, which gives priority to values common to all mankind. The natural environment is the most important and permanent of these values and one which is most vulnerable to damage.

The USSR has initiated many proposals for joint efforts from different countries in the field of environmental protection at international and regional levels. Such proposals for the further development and improvement of international cooperation have been made as follows:

- in Murmansk: Soviet-Northern countries cooperated to develop the concept of ecological security in the North and achieve this through complex environmental protection initiatives in this region;
- in Krasnoyarsk: the organisation of a Conference of experts on the problems of environmental cooperation in the Asian-Pacific Region;
- at a United Nations Session, the establishment of the Centre of Urgent Ecological Help has been proposed and the USSR has declared readiness to cooperate in the organisation of the World Space Laboratory;
- at the UN's 43rd Session, the establishment of an international instrument was proposed for the development of urgent decisions on primary global economic and ecological problems.

The Soviet Government has declared the following major environmental activities in the field of international cooperation:

- development of a world strategy on conservation and use of natural resources, taking into account all existing and predicted ecological problems;
- development of bilateral and multilateral cooperation, improvement of the international principles of natural resource use and the scientific and legal instruments necessary to solve international ecological problems;
- development and implementation of resource-and-energy conserving, waste-free and ecologically benign technology;
- proposals for the prevention and elimination of large industrial and traffic accidents and natural disasters;

- further cooperation in the conservation and rational use of the natural resources of the world oceans and shelf seas;
- development of measures for the prevention of the ecological and economic consequences of climatic changes;
- development of international controls over the environment with the use of space techniques.

Chapter 2.4 has outlined the current participation of the USSR in international activities. At present, the USSR is studying the possibility of joining the 1979 Bonn Convention on migrating animals, the amendment to the financial duties of Parties to the Convention on International Trade in Endangered Species of wild fauna and flora (CITES), the 1982 Protocol to the 1971 Ramsar Convention on Wetlands of International Importance Especially as Waterfowl Habitat, and the 1988 Convention to Monitor Cross-Border Transport of Dangerous Wastes and their Elimination.

Soviet specialists are participating in a new Convention being developed on the conservation of biodiversity and protection of the Black Sea.

Taking into account the importance of legally based comprehensive international cooperation, the USSR will commence a study of the possibility and expediency of joining international conventions and agreements of which it has not previously been a participant.

Bilateral agreements with Austria, Mongolia and Switzerland are currently under consideration. Other countries interested in bilateral cooperation with the USSR include Argentina, Brazil, Iran, China, Japan and the Netherlands.

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Plate 3. Population management work is continuing on the goitered gazelle, found in the deserts of Central Asia and areas beyond the Caucauses, and registered in the USSR Red Data Book

IUCN EAST EUROPEAN PROGRAMME

Environmental Status Report 1990

USSR

Part II

THE STATE OF THE NATURAL ENVIRONMENT AND NATURE PROTECTION ACTIVITIES IN THE USSR IN 1989

The USSR State Committee
for the Protection of Nature

(near-original translation from the Russian)

CONTENTS

INTRODUCTION

This is an abridged version of a report compiled by the USSR State Committee for the Protection of Nature with contributions from more than 20 Union Administrations and environment protection bodies representing all the Union Republics. The present report, in comparison with last year's, gives a wider coverage of regional environmental problems, factors affecting the natural environment, strategic aspects of environment protection and the rational utilisation of natural resources, issues concerning the ecological education of the public and the evolution of the public environmentalist movement. The report also includes a characterisation of the state of the natural environment in each of the Union Republics and its evolutionary trends in recent years.

Current qualitative and quantitative changes in the state of the natural environment of the USSR and its natural resources, affected by economic activities, basically depend on such factors as:

- the production of hydrocarbon fuels, mining of ores and inert materials, water diversion, wood felling, etc.;
- the implementation of geological prospecting, agricultural and construction work, and goods handling;
- the processing of mineral resources, production of heat and electric power, the implementation of other kinds of industrial work associated with environmental pollution by gaseous and/or liquid industrial wastes; and
- the disposal of solid and mixed industrial wastes, processing and utilisation of natural raw materials, as well as industrial and agricultural products.

In spite of the instability of the economy in 1989, which was caused by the transitory period of *perestroika*, the scale of these effects upon the USSR's natural environment remains very significant. In 1989, for example, approximately 1,300 million m^3 of sand, gravel, crushed stone and other natural inert materials were mined, almost 400 million m^3 of wood felled from an area exceeding 2 million ha, 358,000 million m^3 of fresh water diverted from all sources and 153,400 million m^3 of effluents discharged into water basins, more than 3 million tractors and 1.2 million harvesters of various kinds were used in agriculture, while industry and construction used more than one million units of heavy machines, such as tractors, bulldozers, scrapers, excavators, mobile cranes, etc.

Coal, natural gas and oil shale production amounted to 2,200 million tons of fuel equivalent. Almost 540,000 million tons of iron ore was mined.

Iron and steel production reached 114 million tons and 160 million tons, respectively; 4,900km of large-diameter pipelines and more than 20,000km of roads of various kinds were constructed.

Wastes produced by the mining industry alone (including the usable part) constituted 3,500 million m^3 of overburden and enclosing rocks, slurries and slag.

The instability of the functioning of the USSR's economy and other important factors, such as a decline in state and labour discipline, a greater labour turnover, and a change in the socio-psychological attitude of the public to certain kinds of industrial activities, could not but affect the progress of work aimed at preventing harmful influences upon the environment. In this connection it is interesting to note that, as additional safety measures were undertaken in running nuclear power stations and the Armenian Nuclear Power Station was brought out of operation, the electric power output of the USSR's nuclear power stations fell by more than 3,000 million kw per hour. At the same time, the year was marked by a low rainfall in Siberia, so that electric power output by hydraulic stations dropped by 6,700 million kw per hour. These losses were compensated by increasing power generation at thermal stations by 11,000 million kw per hour, which was accompanied by an increase in organic fuel consumption.

A slow-down in petroleum production, which started in the second half of 1988 when some high-output oil fields were exhausted and brought out of exploitation, made it imperative to start operations in 1989 at a significant number of low-efficiency oil fields, which could only be accompanied by a greater impact upon the landscape and other elements of the natural environment.

In 1989, plans for the commissioning of new waste treatment plants and the reconstruction of outdated ones remained unfulfilled. At the same time, the introduction of resource-saving technologies and products lagged notably behind schedule. Thus, the order for the production of heat-hardened rolled stock, high strength pump-and-compressor tubing and drill pipes, cold drawn steel sections and other kinds of metal products which could save about 2 million tons of metal for consumers, was not carried out.

The inadequate performance in 1989 of almost half the enterprises of the chemistry and forestry complex gave rise to a short supply of modern materials and products and adversely affected the progress in key branches of industry, such as machine building, which in turn, prevented the alleviation of the burden from metal-making and other industries producing traditional structural and natural raw materials. This situation is the reason for the significant negative impact on the natural environment by ore and coal mining, coke, iron and steel production.

Unused wastes from industrial and agricultural production processes and residential wastes are rejected as solids, liquids and gases and cause the pollution of air, surface, underground and sea water, and soil. The chemicalisation of agricultural areas, involving the use of significant amounts of fertilizers and plant protection compounds, is another important anthropogeneous factor also affecting natural environment pollution.

Pollutant emission into the atmosphere in 1989 amounted to 94 million tons, including 58.5 million tons from industrial enterprises and 35.5 million tons from motor vehicles. Note that these figures do not include emissions from railroad rolling stock, aviation, sea

and river vessels, agricultural and other off-road vehicles, from fuel and garbage burning by people, or from fires.

The USSR's waterways received 153,000 million m^3 of waste waters, of which 32,600 million m^3 (21%) was polluted. The waste waters brought more than 40 million tons of pollutants to watersheds and waterways. This is a minimum estimate, it does not include the pollution of surface waters by chemicals emitted with drainage effluents.

In 1989 agriculture used 255,000 tons of pesticides (in terms of the active compound) and more than 25 million tons of mineral fertilizers.

At present, the dumps of the mining industry contain more than 50,000 million tons of overburden and enclosing rocks and dressing wastes. In 1989 another 3,300 million m^3 of wastes were added. Only 1,300 million tons, or 39%, of these were used to satisfy the needs of the national economy. In 1986-90, the volume of mining industry wastes grew faster (19%) than their utilisation (17%). A major part (76%) of new wastes is amassed at coal and metal industry sites.

The mass of unused wastes collected in dumps and accumulators extensively pollutes soils, as well as surface and subterranian waters and the air basin. In 1989 wastes from metallurgy, including slags from iron, steel and ferro-alloy production, amounted to 79 million tons. Thermal power station dumps contained more than 22 million tons of ashes and slag wastes. During the same year, other industries produced 11.7 million tons of phosphogypsum, 3.8 million tons of pyrite cinders, 1.4 million tons of lignine, and 1.7 million tons of sulphite dyes. Seven million cubic metres of wood wastes were destroyed, burnt or dumped.

USSR cities and towns annually produce about 300 million m^3 of solid domestic garbage of the following composition: 23-37% foodstuffs, 20-40% paper, 3% wood, 4-6% textiles, 2-5% ferrous and non-ferrous metals, and 1-5% polymers. About 96.7% of domestic garbage is dumped, 2.2% incinerated, 1.3% recycled. The annual growth rate of the garbage mass is 0.5%. The existing trend is towards a lower content of foodstuffs and higher contents of cardboard, paper and polymer materials. Ferrous metal and glass contents are also increasing.

The largest quantity of solid domestic garbage in the USSR, 46% of the total volume of such garbage, has been accumulated on the territory of the Russian Federation (RSFSR). About 2 million tons of foodstuff garbage were collected from residents and, after recycling, used as animal feed. Industrial methods are currently used to recycle approximately 3% of garbage. All the remaining household wastes are dumped on or buried in special grounds.

Seven incinerators and two garbage treatment plants are operated currently in the RSFSR. The existing programme of measures planned for the period up to the year 2005 envisages the development and introduction of advanced methods of collection, transportation, purification and recycling of solid domestic garbage, as well as the organisation of 43 plants, 84 waste dumping sites and 35 garbage-handling stations, and

the improvement of production and technical facilities of enterprises. It will cost 700 million roubles to implement the programme, which will make it possible to raise the level of the industrial treatment of solid domestic garbage in RSFSR townships to 20% and to thereby receive 1.9 million tons of compost plus 130,000 tons of ferrous scrap and other components.

The construction of incinerator plants, started in the USSR in 1972, was based on imported equipment. Such plants are operated in Moscow, Vladivostok, Sochi, Sevastopol', Pyatigorsk, Kharkov, Kiev, Murmansk and Vladimir, others are under construction in Dnepropetrovsk, Kishinev and Saratov. In 1989, RSFSR plants treated 2% of the domestic waste produced, those of the Ukraine, 8.2%. The flow charts of these plants do not foresee the pre-sorting of garbage. Garbage incineration pollutes the atmosphere with noxious emissions, including such highly toxic substances as dioxin, hydrogen chloride, hydrogen fluoride, sulphur dioxide, toxic hydrocarbons and heavy metals.

In Byelorussia, garbage treatment plants in Minsk and Mogilev take up more than 600,000m^3 (7%) of garbage. In the process, approximately 3,000 tons of ferrous and more than 100,000 tons of nonferrous metals are retrieved. In the RSFSR, the Leningrad and Gorky garbage treatment plants utilised more than one million tons of solid domestic garbage. The garbage treatment plant in Baku, Azerbaijan, recycles 200,000m^3, though its design capacity is 300,000m^3 per annum. In Alma-Ata, Kazakhstan, and Tashkent, Uzbekistan, the plants take up 2.3% and 10% of solid domestic garbage, respectively.

In Georgia, 17% of domestic garbage is recycled by industrial methods, Estonia reclaims about 2% of garbage for re-use.

In Erevan, Armenia, a garbage treatment plant has been under construction since 1980; naturally, the plant design is outdated and requires reconsideration. Solid domestic garbage is not recycled in the Republic, nor is it in Turkmenia, Moldavia or Tajikistan.

Dumps and dumping grounds for the USSR's solid domestic garbage do not, for the major part, meet environmental and sanitary requirements. The dominating trend is to increase the specific load on the ground by compacting the garbage buried, covering individual layers with soil or other inert material, and increasing the depth of the burial. The establishment and operation of advanced dumping sites is hampered by a lack of machinery, such as heavy-duty bulldozers, rollers, scrapers, excavators, and dumping trucks.

CHAPTER 1: AIR

Pollutant emission into the atmosphere from stationary sources in cities and industrial centres within the territory of the USSR fell by more than 3 million tons in 1989 compared with 1988 and amounted to 58.5 million tons, including 13.7 million tons of solids and 44.8 million tons of gases and liquids.

The principal pollutants of atmospheric air are solids (particulates), sulphur dioxide, carbon monoxide, hydrocarbons and nitrogen oxides, which together constitute some 98% of all noxious emissions. As an analysis of the state of the atmosphere indicated, it was the emissions of these compounds that produced an elevated level of pollution in many cities. In many industrial centres environmental hazard is created by specific pollutants, such as ammonia, hydrogen sulphate, phenol, formaldehyde, chlorine, benz(a)pyrene, sulphuric acid, etc.

The total amount of pollutants emitted into the air from stationary sources fell by almost 10% in the last nine years. In the period from 1980 to 1989 this reduction was most pronounced for chlorine (by 57%), lead (by 53%), carbon sulphide (by 39%), and fluorides (by 28%). At the same time, the emission of nitrogen oxides into the atmosphere grew by 11% and sulphuric acid by 41%.

Half the emissions into the air come from the enterprises of two industries, namely power generation (24.8%) and metallurgy (26.2%). Significant contributions are attributed to enterprises subordinated to the USSR Ministry of Oil and Gas Industry (8.9%), the USSR Ministry of the Chemical and Oil Processing Industry (7.1%), the *Gazprom* Concern of the Gas Industry (4.5%), the *Stroymaterialy* State Association for Construction Materials (3.6%), and the USSR Ministry of Forestry (2.2%).

Out of 3,152,000 stationary sources of pollution covered by statistical control, 2,846,000 have organised emissions, but only 1,129,000 of them (40%) are equipped with gas cleaning and dust removal plants. The degree of emission cleaning is extremely low, amounting on average to 78% *(sic)*. Liquid and gaseous compounds are extracted very inadequately, at 30.9%, while the cleaning level is only 1.2% at enterprises of the USSR Ministry of the Power Industry, 5.1% at those of the USSR Ministry of Oil and Gas Industry, 4.8% at the *Gazprom* Concern, and 0.6% at the USSR Ministry of the Coal Industry. The enterprises of the USSR Ministry of Forestry neutralise 20% of noxious pollutants, *Stroymaterialy* State Association captures 17.7%, and the USSR Ministry of the Medical Industry, 24.1%.

An analysis of the distribution of pollutant emissions among the Republics reveals that the largest atmosphere polluters are the RSFSR (35.9 million tons per annum), the Ukraine (10.5 million tons) and Kazakhstan (5.2 million tons).

Table 1: Atmospheric pollution from stationary sources in the USSR in 1989

Compound	Million tons	Compound	10^3 tons
Total	**58.5**	Carbon sulphide	70.0
Solids	13.7	Fluorides	25.4
Sulphur dioxide	16.8	Sulphuric acid	58.1
Carbon monoxide	14.0	Chlorine	4.8
Nitrogen oxides	4.5	Lead	6.3
Hydrocarbons	8.4	Mercury	0.045
Hydrogen sulphate	0.09	Benz(a)pyrene	0.032

A conspectus of the data obtained by the State monitoring of pollutant emissions into the atmosphere demonstrated that in 190 USSR townships motor transport was the principal source of air basin pollution, responsible for more than 50% of emissions.

In 1989, the USSR's total emissions from motor transport amounted to 35.5 million tons (compared with 36 million tons in 1988). In spite of the measures taken, the volume of motor transport emissions has been falling very slowly from year to year. Moreover, the share these emissions occupy in the total volume of emissions has risen from 35% to 38% in ten years. To a large extent, this is due to the fact that stationary plants are always better equipped with gas cleaning and dust removal units, while no emission control systems are fitted on motor vehicles.

The low success rate of attempts to reduce motor vehicle emissions is mainly associated with the following reasons:

- the absence, in legislation, of provisions stimulating the industry to develop and introduce low-emission engines, unleaded petrols and other environmentally cleaner fuels and to improve driving standards;
- the slowness of the Soviet motor industry in the development and introduction of a complex of measures aimed at lowering pollution from motor vehicles; and
- the incompatibility of the existing infrastructure of motor vehicle operation with modern ecological requirements.

In the 1974-85 period, the motor industry introduced a complex of industry standards which specified test methods and maximum permissible rates of exhaust emissions from motor vehicles. These standards were basically founded on the Rules of the UN Economic Commission for Europe (appendix to the 1958 Geneva Agreement on Motor Vehicle Certification). At that early stage, the UN ECE Rules were directed at achieving an

environmental effect at the lowest possible outlay, so they were less strict than US standards, but by 1993-96 it is envisaged they will reach the same level. Considering the advanced nature of ECE Rules, the question of their direct application in the USSR, as has been done in most other countries participating in the Agreement, is under discussion.

Since the introduction of the first standard, the total amount of emissions from Soviet motor vehicles (in terms of the toxicological significance of exhaust components) has been halved, while emissions of carbon monoxide have been reduced by a factor of 4, and hydrocarbons by a factor of 2.5-3.

In 1988-89, draft standards were developed in the USSR to establish motor vehicle exhaust emission and smoke rates on the basis of the advanced Rules of the ECE. These standards require that emission control systems be installed; they also include requirements relating to gas-fuelled vehicles.

Emission control systems are an efficient means of reducing pollution from motor vehicles, but a prerequisite to their application is the complete elimination of leaded petrols.

However, Soviet legislation has not yet established a time schedule for motor fuel quality improvement (including a transition to unleaded petrols and sulphur content reduction), which hinders the introduction of efficient emission control systems.

No legislative measures have been taken to ensure that the industries concerned should make their respective contributions to motor vehicle emission control, usually their duties are regulated by directives issued by executive bodies. As a result, vehicle manufacturers, fleet operators and enforcement bodies fail to acquire not only large gas-analysing systems, but even elementary gas analysers and smoke meters. There are no economic incentives for industrial enterprises to produce "clean" vehicles.

The results of 6,650,000 individual measurements of pollutant concentrations, taken in 566 townships by the units of the All-Union State Service for Natural Environment Pollution Monitoring, the USSR State Committee for Hydrometeorology and Environmental Control, gave grounds for the estimation of the situation with atmospheric air pollution in 1989. Systematic observations were newly established in 1989 in the following towns and cities: Ali-Bayramly, Vinnitsa, Dzhalal-Abad, Zheleznogorsk-Ilimsky, Zarinsk, Kul'sary, Mokhsogollokh, Rybinsk, Spassk-Dal'ny, Urgench, Ust'-Kut, and others (a total of 33 communities).

The observation data indicate that the atmospheric pollution level in towns and cities remains high. Annual average data for all USSR towns and cities show that concentrations of particulates, ammonia, phenol, and nitrogen dioxide exceed the maximum permissible concentration (MPC), while for carbon bisulphide, formaldehyde and benz(a)pyrene they are over 2 MPC.

Maximum pollutant concentrations observed on individual days exceeded 10 MPC in 126 USSR townships, while in 54 localities benz(a)pyrene content was over 10 MPC on the month-average basis.

Analysis of air pollution variation for the last five years indicates that atmospheric dust content, averaged over the USSR's townships, decreased by 12%, while the average concentration of carbon monoxide underwent practically no changes. The average concentrations of nitrogen dioxide and nitrogen monoxide in the USSR's towns and cities rose by 12% and 8%, respectively.

Cities and towns with the highest level of atmospheric pollution in 1989 have been selected, proceeding from data analysis and synopsis of the state of atmosphere pollution in cities and towns within the territory of the USSR, based on the results of the total index of atmosphere pollution with five compounds that introduced the highest contributions in the air pollution of each specific locality, as well as on data on the highest singular concentrations of pollutants exceeding 10 MPC. Small differences in the level of pollution do not allow these townships to be arranged in any systematic order nor to be assigned definite positions in a "list of priorities". All these localities equally require urgent measures to be taken to reduce noxious compound emissions.

A conspectus of the data received in the last 10 years (1979-89) from the network of the units of the USSR State Committee for Hydrometeorology and Environmental Control, working according to the international programme of monitoring and the long-distance atmospheric transfer of pollutants in Europe (EMEP), permitted the following conclusions to be reached:

- a moderate acidification of atmospheric precipitation is observed in the western regions of the USSR;
- concentrations of sulphur oxides and nitrogen oxides in the atmosphere are well below the values that can cause negative consequences to land biota ($<20 g/m^3$);
- since 1980 no valid reduction in sulphur concentrations and deposition has been registered in spite of the fact that most European countries participate in the international agreement on the 30% reduction of sulphur emission;
- sulphur deposition frequently reaches the level of 2 tons/km^2 per year, nitrogen deposition is usually less than 1 ton/km^2 per year.

In the USSR's European territory, sulphur loads exceeding 2 tons/km^2 per year are observed in the following highly industrialised regions: Leningrad and northern Estonia; Vilnius-Kaunas; Novolukoml'-Polotsk; Moscow-Tula; Donbass (the Donets coal fields); Kiev; the Carpathians; Perm'; Ufa-Sterlitamak-Salavat; and the entire industrial zone of the Urals. In the Asian territory of the USSR they are registered in the regions of Ust'-Kamenogorsk, Noril'sk, Krasnoyarsk, and Abakan.

The high sulphur loads on all the above areas are principally caused by emissions from local fuel and power industry plants, nonferrous metallurgy, iron and steel production, and the petrochemical industry.

Fields with elevated sulphur loads (1-2 tons/km^2 per year) also appear near the western frontiers of the USSR and in the Primorsky Territory in the Far East, where they are associated with transfrontier transfer.

Nitrogen loads in excess of 1 ton/km² per year are recorded in the following regions of the European territory of the USSR: northern Estonia-Leningrad; the central industrial agglomeration (Moscow-Tula-Lipetsk); the Ukrainian industrial zone (Donbass-Krivoy Rog); in the Carpathians; throughout the Urals industrial zone. Levels twice as high as this figure are observed in the regions of Moscow, Dnepropetrovsk-Kiev, Donbass, Sverdlovsk, and Chelyabinsk. In the Asian territory of the country, this level is exceeded in Kuzbass (the Kuznetsk coal fields) and in the Lake Baikal area.

High sulphur and nitrogen loads cover areas ranging from a few hundred to several hundred thousand square kilometres. The areas of spread of these phenomena depend primarily on the regional background of the territories. In regions with a dense population of large industrial objects, high-load areas occupy tens and hundreds of thousands of square kilometres. These regions include Donbass, the Central, Leningrad, and Baltic economic regions, and the central and southern Urals. Areas as large as a few thousand square kilometres exist in the individual industrial zones of Byelorussia, western Ukraine, the Volga region, the foothills of the Urals, Kuzbass, and Kazakhstan. Separately located industrial centres create even smaller areas of significant load, such as a few hundred square kilometres. As a rule, the areas with high nitrogen loads are smaller than those with high sulphur loads.

Plate 1. Yuzhnoyamal'skiy (Southern Yamal) Zapovednik, established in 1988

Table 2: List of cities and towns in USSR which were in the worst sanitary-hygienic and ecological conditions in 1989 due to air basin pollution and where air protection measures aimed at the preservation of human health are of primary importance

	City/town	Compounds determining high level of air pollution	Industry responsible for high level of pollution
SECTION 1. Localities with a systematically high level of atmospheric air pollution for several years (air pollution index [API] exceeding 15 units every year in the 1985-89 period) (See note at the end of the table)			
1	Alma-Ata	BP, FD, dust	Power generation, road transport
2	Almalyk	BP, AM, dust	Mineral fertilizer industry, non-ferrous metallurgy
3	Bratsk	BP, MM, CS2	Non-ferrous metallurgy, pulp and paper industry, power generation
4	Chardzhou	BP, HF, dust	Mineral fertilizer industry, road transport, power generation
5	Chelyabinsk	BP, FD, SO2	Iron and steel production, power generation
6	Dneprodzerzhinsk	BP, FD, AM, dust, NO2	Mineral fertilizer industry, iron and steel production, construction
7	Donetsk	BP, NO2, dust, phenol	Iron and steel production, coal mining
8	Dushanbe	BP, FD, dust, NO2, NO	Construction, power generation, rail transport
9	Dzhambul	BP, dust, HF, AM	Mineral fertilizer industry, power generation
10	Erevan	BP, CP, NO2, O3	Chemical industry, power generation, road transport
11	Fergana	BP, FD, NO2, dust	Petrochemical industry, mineral fertilizer industry, power generation
12	Frunze	BP, FD, dust, NO	Power generation, road transport
13	Grozny	FD, BP, NO2, phenol	Petrochemical industry
14	Kemerovo	BP, FD, AM, NO2	Mineral fertilizer industry, chemical industry, iron and steel production
15	Kommunarsk	BP, NO2, dust	Iron and steel production
16	Komsomol'sk-on-Amur	BP, Pb, FD, dust	Electrotechnical industry, iron and steel production, power generation, petrochemical industry
17	Krasnoyarsk	BP, dust, NO, FD, CS2	Chemical industry, non-ferrous metallurgy, construction materials industry, road transport
18	Kuybyshev	FD, KF, BP	Petrochemical industry, electrotechnical industry
19	Magnitogorsk	BP, CS2, NO	Iron and steel production
20	Mariupol'	BP, FD, HF, AM	Iron and steel production
21	Nizhny Tagil	BP, FD, phenol, dust	Iron and steel production
22	Novokuznetsk	BP, FD, dust, HF	Iron and steel production, non-ferrous metallurgy, coal mining, power generation
23	Odessa	BP, FD, HF, phenol	Foundries, mineral fertilizer industry, road transport
24	Osh	BP, dust, NO2	Power generation, construction materials industry, boilers
25	Perm'	BP, FD, HF	Petrochemical industry
26	Rustavi	BP, dust, AM, phenol	Construction materials industry, iron and steel production, mineral fertilizer production
27	Ust'-Kamenogorsk	Pb, BP, FD, SO2	Nonferrous metallurgy, power generation
28	Zaporozh'e	BP, NO2, phenol, FD	Iron and steel production, non-ferrous metallurgy
29	Zestafoni	MnO2, BP	Iron and steel production
30	Zyryanovsk	BP, dust, NO2	Non-ferrous metallurgy

SECTION 2. Localities with a high level of atmospheric air pollution (air pollution index [API] exceeds 15 units in 1989)

31	Abakan	BP, dust, FD	Heavy engineering, boilers
32	Andizhan	BP, FD, AM	Biomedical industry, road transport
33	Angarsk	BP, FD, dust	Biomedical industry, petrochemical industry
34	Arkhangel'sk	MM, FD, methanol	Pulp and paper industry
35	Berezniki	CS2, SA, NO2, NO	Chemical industry, mineral fertilizer industry
36	Chimkent	BP, Pb, dust	Nonferrous metallurgy
37	Chita	PB, FD, NO2	Power generation, chemical machine building, boilers
38	Dnepropetrovsk	BP, dust, FD, AM	Iron and steel production, power generation
39	Gorlovka	Phenol, NO2, SA	Coke by-product industry, coal mining, chemical industry
40	Irkutsk	BP, FD, NO2	Power generation, heavy engineering
41	Kamensk-Ural'sky	BP, HF	Nonferrous metallurgy
42	Khabarovsk	FD, BP, AM	Power generation, construction materials industry, petrochemical industry, rail transport
43	Kokand	BP,FD, dust, NO2	Power generation, chemical industry, construction materials industry, petrochemical industry
44	Kramatorsk	BP, phenol, dust, NO2	Iron and steel production, construction materials industry, heavy engineering
45	Krasnodar	FD, BP, phenol	Petrochemical industry, medical industry, construction materials industry
46	Krivoy Rog	BP, FD, AM, dust	Iron and steel production, construction materials industry
47	Kurgan	BP, FD, dust	Automotive industry, chemical industry, power generation
48	Kutaisi	BP, dust, phenol, NO2	Petrochemical industry, automotive industry, chemical industry
49	Lipetsk	FD, phenol, dust	Iron and steel production, construction materials industry
50	Lisichansk	FD, phenol, BP, AM	Chemical industry, petrochemical industry
51	Makeeva	BP, dust, NO2	Iron and steel production, coal mining
52	Nikopol'	MnO2, HF, dust	Iron and steel production
53	Novocherkassk	FD, BP, dust, NO2	Metallurgy, petrochemical industry, power generation
54	Novosibirsk	BP, FD, NO2	Road transport, power generation, construction materials industry
55	Omsk	AA, BP, FD, AM	Petrochemical industry, chemical industry
56	Prokop'evsk	BP, FD, dust	Coal mining
57	Rostov-on-Don	BP, dust, FD, soot	Power generation, farm-machinery industry, construction materials industry, road transport
58	Ryazan'	CS2, phenol, BP	Chemical industry, petrochemical industry
59	Selenginsk	BP, FD, CS2	Pulp and paper industry
60	Severodonetsk	FD, phenol, AM, NO2	Power generation, mineral fertilizer industry, chemical industry
61	Shelekhov	BP, dust, NO2	Nonferrous metallurgy
62	Slavyansk	BP, phenol, NO2	Chemical industry, heavy engineering, construction materials industry
63	Sverdlovsk	BP,FD, NO NO2	Iron and steel production, rail transport, petrochemical industry
64	Tashkent	BP, NO2, phenol	Power generation, farm-machinery industry, construction materials industry

65	Tbilisi	BP, FD, phenol	Road transport, machine-tool industry, power generation
66	Temirtau	BP, phenol, dust	Iron and steel production
67	Togliatti	FD, AM, HF, benzene	Mineral fertilizer industry, automotive industry
68	Tyumen'	BP, FD, phenol	Pulp and paper industry, construction materials industry, power generation
69	Ulan-Ude	BP, phenol, dust	Power generation, construction materials industry, road transport
70	Usol'e-Sibirskoe	FD, BP, NO2, dust	Chemical industry, power generation
71	Volzhsky	FD, CS2, BP	Petrochemical industry, abrasives production
72	Voroshilovgrad	BP, HF, FD, NO	Construction materials industry, metallurgy, machine-tool industry
73	Yuzhno-Sakhalinsk	BP, soot, NO2	Power generation, road transport, boilers

SECTION 3. Localities suffering more than 5 times a year from 10-fold excess of maximum unitary MPC for specific pollutants or from maximum unitary concentrations in excess of 10 MPC in three or more compounds (API below 15)

74	Dzerzhinsk	Ethyl benzene, HCl	Chemical industry, mineral fertilizers industry
75	Krasnoperekopsk	NO2, dust, HF,	Petrochemical industry HCl
76	Mogilev	CS2, NO2, H2S, phenol	Chemical industry, iron and steel production
77	Noril'sk	SO2, Cl, NOx	Nonferrous metallurgy
78	Sterlitamak	NO2, BP, AM, H2S, AMS	Petrochemical industry, chemical industry
79	Volgograd	HCl	Chemical industry

SECTION 4. Localities with API below 15, but with high volumes of emissions of unidentified specific pollutants

80	Baku	Petrochemical industry, petroleum production
81	Novokuybyshevsk	Petrochemical industry
82	Salavat	Petrochemical industry, chemical industry
83	Sumgait	Petrochemical industry
84	Ufa	Petrochemical industry, chemical industry
85	Yaroslavl'	Chemical industry, petrochemical industry

Symbols and abbreviations for Table 2

AA	acetaldehyde	AM	ammonia	AMS	alpha-methyl styrene
BP	benz(a)pyrene	Cl	chlorine	CP	chloroprene
FD	formaldehyde	H2S	hydrogen sulphide	HCl	hydrogen chloride
HF	hydrogen fluoride	MM	methyl mercaptan	MnO2	manganese dioxide
NO	nitrogen oxide	NOx	nitrogen oxides	NO2	nitrogen dioxide
O3	ozone	Pb	lead	SA	sulphuric acid
SO2	sulphur dioxide				

API (atmospheric Air Pollution Index) is a dimensionless index calculated as a sum of annual average concentrations of five compounds (expressed in terms of MPC) having the highest level for the locality in question and reduced to the toxicity level of sulphurous gas.

CHAPTER 2: WATER

2.1 Introduction

Water resources consist of the surface and groundwater runoff and the underground storage of water. The USSR average surface water resources amount to 4,414km^3 per year. If the volumes arriving from the territories of neighbouring countries are added, this figure increases to 4,740km^3. Approximately 84% of river runoff is formed in Siberia and the Far East, i.e. in the least populated regions of the country. The river basins of Enisey, Lena, Ob' and Amur enclose 44% of the catchment area and the runoff volume formed within the USSR's territory.

Water shortages are experienced in southern Ukraine, Moldavia, the steppe part of the Crimea, the areas near the Azov Sea, the Trans-Volga region, the Near-Caspian lowland, the southern regions of the Western Siberia, and the Trans-Baikal area. The highest water deficit is experienced in the vast territories of deserts, semi-deserts, and adjacent dry steppes in Central Asia, Kazakhstan, Kalmyk ASSR, and the Astrakhan Region of the RSFSR.

In the basins of most USSR rivers some 50-90% of annual runoff occurs during the spring floods. There are more than 4,000 water reservoirs in the country. Their full storage capacity is 1,018km^3, the usable storage capacity is 451km^3, the aggregate surface area is 146,000km^3.

Most reservoirs are used in a complementary manner. This is true, above all, of large-size water reservoirs. Hydraulic power stations generate 200,000 million kw per hour of electric power, the water from reservoirs irrigates about 12 million hectares of land, 12,000km of navigable waterways pass through the water areas of the reservoirs, and approximately 80 million persons use the reservoirs for some kind of recreational purposes.

The development of a water reservoir system leads not only to positive, but also negative results. Thus, the reservoirs have inundated 7.4 million hectares of land, including 3.1 million hectares of agricultural land, out of which 0.8 million hectares was arable land. About 30% of the total length of water reservoir banks was transformed. The filling of the reservoirs caused the underflooding of about 1 million hectares of land.

The USSR has more than 800 diversion channels; more than 170km^3 of water per year (about 4% of the USSR's river runoff) is conveyed for irrigation. The aggregate length of canals use for agricultural irrigation today exceeds 700,000km (including those of the distribution networks).

Besides irrigation canals, the USSR also operates large navigation canals: the White Sea/Baltic Sea Canal (227km long), the Volga/Baltic Waterway (361km long) and the V.I. Lenin Volga/Don Navigation Canal (101km long), to name only the main ones.

An important role in the redistribution of the USSR's runoff belongs to canals which supply water to large industrial centres, such as the Moscow Canal, the Irtysh-Karaganda, the Dnieper-Donbass, the Dnieper-Krivoy Rog, and Seversky Donets-Donbass canals.

River runoff control and non-return water withdrawal introduce changes into the water management conditions. In most of the USSR's river basins, the standards governing the environmentally permissible level of water resource control are being violated. An especially complicated situation has formed: on the rivers of the Azov Sea basin, including the Don and the Kuban'; those of the Caspian Sea, including the Volga, the Ural, the Kura, the Terek and the Samur; those of the Black Sea, including the Danube, the Dniester, the Yuzhny Bug, and the rivers of the Crimean Peninsula; those of the Aral Sea, including the Syr-Dar'ya and the Amu-Dar'ya; those of the Lake Balkhash, including the Ili and the Karatal; and on tributaries of the Ob' river, including the Irtysh and the Tom'.

Groundwater resources constitute 926km^3 per year, or 21% of the river runoff. A high volume of groundwater flow (35-60%)is characteristic of Armenia, Kirghizia, Georgia, Azerbaijan, Byelorussia, Uzbekistan, while the lowest indices are observed in Turkmenia and Moldavia. The RSFSR and Kazakhstan possess the largest groundwater resources (228 and 44.4km^3/year, respectively). Potential usable groundwater resources are approximately 380km^3/year, while explored resources exceed 67.0km^3 per year.

Subsoil water resources are evaluated in terms of total evaporation in the warm season, i.e. in the vegetation period. They depend on the moisture content and the relief of the territory. The country's total resources of subsoil water are estimated at 5,800km^3 per year.

2.2 Water Utilisation and Waste Discharge

According to State monitoring data, 358km^3 of water were withdrawn from natural sources in 1989.

The volume of water consumption fell in Republics of Central Asia (-6.3km^3 in Uzbekistan and -1.2km^3 in Kirghizia) and in Kazakhstan (-2.9km^3). Water consumption increased in the Ukraine, Lithuania, and the RSFSR by +1.9, +0.7 and +0.7km^3, respectively. The USSR's total water loss in conveyance from the place of diversion to the place of use exceeded 48.4km^3 in 1989 (compared with 50.6km^3 in 1988). This aggregate figure includes 14.7km^3 as the share of the Uzbek SSR, 6.8km^3 as that of the Turkmen SSR, and 6.6km^3 lost by the Kazakh SSR. The problem of water loss in conveyance has acquired the highest acuteness in the Aral Sea basin where more than 30km^3 of water is lost for this reason, including 16.8km^3 loss in the Amu-Dar'ya basin and 9.6km^3 in the basin of Syr-Dar'ya.

In six Republics (the RSFSR, the Ukraine, Lithuania, Moldavia, Latvia and Estonia), the principal water consumer is industry, in other Republics it is agriculture.

Water consumption for irrigation purposes decreased in 1989 in comparison with 1988 in Kazakhstan and all the Republics of Central Asia (by a total of 7.9km^3, as a result of the low water level in rivers), while in the Azerbaijan and Armenian Republics irrigation water withdrawal remained on practically the same level.

Water supply from recycling and successive use systems amounted to 268km^3 (97%) in industry, 5.9km^3 (2%) in agriculture, and about 1% in municipal and other services. The country-total freshwater saving through recycling and successive use in industry was 72%, i.e. it remained practically on the 1988 level. Non-return water consumption with respect to natural water objects (including seas and drainless lakes) equalled 173km^3.

Some 153.4km^3 of waste water were discharged into surface water objects in 1989, including 32.7km^3 (21%) of contaminated water, 10.9km^3 (7%) of effluents cleaned to standard, and 109.9km^3 (72%) of standard-clean effluents (those requiring no cleaning). Water basins received 10.3km^3 of untreated contaminated waste water, i.e. 23% of the total amount of the waste water that required cleaning.

Waste treatment plants pass 33km^3 of water a year, but only 32% of it is cleaned to the established standard, i.e. it may be regarded as effluent cleaned to standard; 68% of waste water after passing the treatment plants does not meet the standard requirements and is considered undercleaned.

In 1989, 3.7km^3 of contaminated water were discharged by agricultural farms, 14.2km^3 by municipal services of urban and rural settlements, and 14.3km^3 by industrial enterprises. The heaviest water polluters were the wood, pulp and paper industry (2.66km^3), the petroleum processing and petrochemical industry (2.61km^3), the metal production industry (2.17km^3), the coal industry (0.85km^3), and the mineral fertilizer industry (1.0km^3).

In 1989, surface basins received more than 40 million tons of contaminants with waste water, including 21 million tons of sulphates, 19 million tons of chlorides, 2.2 million tons of suspended matter, 1.6 million tons of decomposable organic matter, 74,000 tons of oil products, 65,700 tons of phosphorus compounds, 240,000 tons of ammonia nitrogen, 15,700 tons of synthetic detergents, 37,000 tons of iron, 924 tons of phenol, 1,000 tons of copper, 2,367 tons of zinc, 915 tons of nickel, 967 tons of chromium, and 2 tons of mercury.

The highest anthropogenic load (related to the river water content) falls upon the basins of the Volga, the Dnieper, the Kuban', and the Neva rivers.

2.3 Surface Water Quality

Information on the contamination of the surface water of the USSR's continental waters has been collected by the All-Union State Service for Natural Environment Pollution Monitoring.

As of the end of 1989, the network set up for continental surface water pollution monitoring consisted of 3,245 stations, of which 2,743 were located on watercourses (rivers, springs, canals, channels, effluents) and 502 on reservoirs (lakes, ponds, drowned rivers). Observations covered 2,236 water objects, pollutant concentrations being measured in 4,494 cross-sections.

Water quality in most rivers, lakes and reservoirs remains unsatisfactory. In 1989 in many water objects the concentrations of organic matter, ammonia and nitrite nitrogen, phenols of petroleum products, metal-containing compounds, and specific compounds exceeded maximum permissible concentrations [MPC] by a few tens, and sometimes even hundreds of times. The trends towards surface water deterioration still remain. The number of water objects with a contamination level of 10 MPC increased in the last three years.

The waters of the major rivers of the Baltic hydrographic region (the Zapadny Bug, the Zapadnaya Dvina, the Niemen, and the Neva) remained moderately contaminated (principal contaminants were within 2-5 MPC). A high contamination level remained characteristic of small rivers, such as the Kul'pe and the Sidabra in Lithuania, the Purtse in Estonia, the Poltva in the L'vov Region, and the Pregolya in the Kaliningrad Region. A very high level of contamination is observed in the Neva influents, the rivers Karpovka, Slavyanka, and Okhta.

Many lakes and reservoirs of the Black Sea basin have been eutrophied and are subjected to blue-green algae bloom in summer-time. Water objects (rivers, lakes and water reservoirs) receive large amounts of organic matter, as well as nitrogen and phosphorus compounds that take their origins from industrial enterprises, animal breeding farms, poultry farms, urban sewer systems and over-fertilized farm fields. Eutrophication of water objects, water depletion of oxygen or, on the contrary, oversaturation with it, increase in the concentration of mineral nitrogen - all this brings down the organoleptic properties of water and may give rise to toxic metabolic products of algae.

In 1989, water quality in the Danube River deteriorated, and the content of petroleum products and nitrite nitrogen in it increased. The water of the Danube is significantly contaminated with pesticides. High concentrations of ammonia and nitrite nitrogen are observed in small rivers of Moldavia (Lunga, Balka, Tarakliya, Reut, Byk, and Botna).

Water contamination in the Dniester River on the territory of the Ukraine increased in 1989. The principal contaminants include phenols, petroleum products, ammonia and nitrile nitrogen, and, in certain cross-sections, also decomposable organic matter.

The annual average concentrations of principal contaminants in the water of the Dniester Reservoir were within the permissible standards.

The Yuzhny Bug River is highly contaminated near the towns Khmel'nitsky, Vinnitsa, and Pervomaysk. Deficit of water-borne oxygen was observed in a number of cases. Downstream of Khmel'nitsky the annual average concentration of ammonia and nitrite nitrogen exceeded 10 MPC, maximum levels reaching 73 MPC and 57 MPC, respectively.

High annual-average concentrations of ammonia nitrogen (4-4.5 MPC) and nitrite nitrogen (1-8 MPC) are characteristic of the water of the River Dnieper in the vicinity of the cities of Kiev, Novaya Kakhovka, and Kherson, as well as for the following rivers: Styr', Ust'e, Sluch', Teterev, Desna, Ros', Psel, Vorskla, Moskovka, and Ingulets.

Increased contents of ammonia and nitrite nitrogen (up to 3-4 MPC) and decomposable organic matter (up to 2 MPC) were observed in the Dnieper's reservoirs.

The rivers Don, Seversky Donets, Sal, Manych, Aksay, the Tsimlyanskoe reservoir and other water objects are strongly contaminated with organic and suspended matter, petroleum products, phenols, nitrogen and phosphorus compounds, heavy metals, as well as with chloro-organic pesticides. The heaviest contamination was recorded in the Seversky Donets River on the territory of the Rubezhnoe-Lisichansk industrial complex. Water quality near the town of Lisichansk deteriorated in 1989; cases of strong contamination with ammonia nitrogen and phenols were observed here more than once.

Small rivers of the Rostov Region are in a critical state. Many of these have become shallow and choked with vegetation (cane), great lengths of their channels have lost their conveyance and drainage capacities.

The level of water contamination with petroleum products in the River Kuban' near Cherkassk and Karachaevsk amounted to 2-10 MPC, the content on nitrite nitrogen near Kropotkin exceeding sanitary standards by a number of times. Chloro-organic pesticides were found in water over the entire length of the river. In several influents of the Kuban', a significant concentration of copper compounds in the water was recorded; during recent years, their maximum content exceeded MPC by a factor of 20-30.

The rivers Kal'mius, Kal'chik, Bulavin, and Krynka have a high level of contamination. The Kal'mius near Mariupol' is very strongly contaminated with petroleum products and nitrite nitrogen. These rivers are classified as highly defective in terms of the state of plankton and benthos associations.

In the water of the Severnaya Dvina River near Arkhangel maximum concentrations of ammonia nitrogen, formaldehyde, phenols, and methanol reached 2-5 MPC, the contents of ligno-sulphonates amounted to 11.6mg/l. In the period of freeze-over in the river delta the concentration of water-borne oxygen dropped to 2.78mg/l.

The most contaminated river in the basin of the Severnaya Dvina is the Pel'shma which accepts waste water from the *Sokolbumprom* Pulp-and-Paper Production Association. The annual average concentrations of ligno-sulphonates reached 360mg/l, those of decomposable organic matter, 59.0mg/l (about 20 MPC). Biocenoses in certain basins of the Kola Peninsula (the Lake Imandra, the rivers Kolos-Yoki, Nyuduay and Khauki-Lampi-Yoki) are in a very sorry state.

The Ob' River waters are subjected to anthropogeneous effects over the river's entire length, from source to delta. The annual average concentrations of major contaminants reached 5-10 MPC. An extremely high contamination of the river water with chloro-organic pesticides in the vicinity of Kolpashevo was associated with the use of these pesticides for forest treatment.

Near the towns of Surgut and Salekhard, the village of Belogor'e and the settlement of Oktyabr'skoe, a very strong deficit of water-borne oxygen was systematically observed in the winter period.

One of the largest influents of the Ob' River is the Tom', strongly contaminated near industrial centres, the cities Mezhdurechensk, Novokuznetsk, Kemerovo, and Tomsk. The highest level of contamination with phenols and petroleum products was recorded in the river section lying 20.5km downstream of the city of Kemerovo. As some enterprises of the city in certain years committed unit discharges of waste water, the annual average concentrations of petroleum products reached 8-10 MPC, those of phenols, 16-30 MPC. In addition to principal contaminants, waste water of Kemerovo enterprises supplied the river Tom' with compounds, such as aniline, caprolactam, formaldehyde, and methanol.

The situation with rivers of the Sverdlovsk and Chelyabinsk Regions remains very unfavourable. In addition to the widespread contaminants, the rivers Iset', Tagil, Salda, Pyshma, Neyva, and Tura bear a lot of heavy metals (copper, zinc, arsenic, etc.) from the wastes of industrial enterprises.

Water of the Yenisei River is strongly polluted near Krasnoyarsk where, besides principal water contaminants, there are also specific compounds, such as lignosulphonates, methanol, and volatile acids. The Kransoyarsk industrial centre exerts a strongly negative influence upon the state of hydrobiocensis of the Yenisei River.

The area of the Ust'-Ilim water reservoir near the bay of the Vikhoreva river remains highly contamimated, quite often cases of water-borne oxygen deficiency and extremely high water contamination with methyl mercaptan and hydrogen sulphide occur here. In this area, the water of the reservoir contains large quantities of formaldehyde and lignine.

Water in reservoirs of the Volga River deteriorated in quality. In 1989 the annual copper concentration average in the Ivan'kovskoe reservoir water reached 36 MPC, while maximum figures rose as high as 294 MPC. The most heavily polluted section of the Cherepovets reservoir occurs near the river Koshta bearing the waste waters of the Cherepovets industrial centre. Water quality in the Gorky reservoir became much worse as a result of an extremely high contamination with petroleum products which occurred in February near the town of Tutaev, where the concentration of petroleum products reached 1,320 MPC.

Petroleum products are uniformly distributed over the entire surface of the Cheboksary reservoir, their annual average concentration lying within 2-6 MPC; methanol and cyanides were occasionally detected near the city of Gorky and the village of Bezvodnoe, the maximum concentrations reaching 20 MPC.

Contaminants characteristic of the Kuybyshev and Saratov reservoirs are petroleum products, phenols, and copper compounds at concentrations not exceeding 1-6 MPC.

Water quality in the Oka River became much worse in 1989, after a number of failures and violations of the rules of operation of waste treatment plants in the city of Orel.

Annual average concentrations were 10 MPC for ammonia nitrogen, 4 MPC for nitrate nitrogen, and 14 MPC for copper compounds, while their maximum values reached 36, 18, and 30 MPC, respectively.

The highest level of water contamination in the Oka was observed near the town of Dzerzhinsk, downstream of the influx of the Volosyanikha canal, where the annual average concentration of ammonia nitrogen was 10 MPC, while the maximum value amounted to 67 MPC.

Contents of ammonia nitrogen and nitrite nitrogen in the water of the Moskva River remain high at 12-16 MPC and 6-10 MPC, respectively.

The level of water contamination in the Kama River reservoirs did not exceed 1-4 MPC for many compounds.

The Chusovaya River downstream of Pervoural'sk and the Ilek River, amounting to 25-30 MPC on the territory of the Omsk Region and 15-25 in Khanty-Mansiysky Autonomous Region.

The Amu-Dar'ya River on the territories of the Kara-Kalpak ASSR and the Surkhandar'ya Region, and the Syr-Dar'ya and the Zeravshan Rivers on the territories of the Samarkand and Bukhara Regions are characterised by a significant (up to 30mg/l) content of chloro-organic pesticides in water.

In the upstream and downstream of the Amur River, near the cities of Blagoveshchensk and Nikolaev-on-Amur, the water contamination level is relatively low.

The highest anthropogenic load upon the Amur falls near the cities of Khabarovsk, Amursk, and Komsomol'sk-on-Amur. The river water in the cross-sections of Komsomol'sk-on-Amur and Amursk is contaminated with metal compounds. The annual average concentrations of zinc and chromium(VI) compounds were at 1-6 MPC, copper compounds, at 4-15 MPC. Near Amursk, downstream of the waste water discharge of the pulp-and-cardboard mill, the water contained lignine in quantities up to 0.12mg/l.

Concentrations of most contaminants in the water of the Zeya River and the Zeya water reservoir were within 3 MPC. The reservoir water contained an elevated quantity of phenols (4-7 MPC).

Rivers of the northern part of Sakhalin are affected by the waste waters of the petroleum and gas producing industries. The level of water contamination is extremely high. In some years, the average concentration of petroleum products in the water of the Okhinka river rose as high as several thousand MPC, then it descended to a few hundred, and in 1989 it constituted 158 MPC with maximum concentrations reaching 848 MPC.

2.4 Sea Water Quality

Systematic monitoring of sea water quality is carried out by 1,202 stations on all the USSR bordering and inland seas.

The highest anthropogeneous load falls upon the Azov, Caspian, and Black Seas, significant portions of contaminants arriving there with discharges of "standard-clean" effluents from irrigation systems.

The Azov Sea

The state of water in the sea deteriorated in recent years under the effect of anthropogeneous loads. In 1989 the volume-weighted average content of petroleum hydro-carbons exceeded MPC by almost a factor of three.

In the last two years in areas remote from the effect of river runoff and Black Sea water, high temperatures in the summer period caused the depletion of water-borne oxygen. Formation of anaerobic conditions due to decomposition of sulphur-rich protein residues resulted in the appearance of significant concentrations of hydrogen sulphide in the central part of the Sea, as well as in the Berdyansk and Temryuk Gulfs.

Kerch' Gulf contamination with petroleum hydrocarbons remained on the previous level, i.e. within MPC, while contamination of the Kamysh-Burun Bay and the southern part of the Kerch' Strait somewhat increased. The content of chloro-organic pesticides in the water of the Kerch' Strait rose from 8ng/l to 20ng/l (maximum), DDE and DDT were also recorded.

In the last 3-4 years when petroleum hydrocarbon contents in the Taganrog Bay stabilised at the level of 2 MPC, there appeared a tendency towards the reduction of the synthetic detergent concentration, and the content of chloro-organic pesticides was the lowest for the last five years. In the Temryuk Bay and in the delta of the Kuban' the contents of petroleum hydrocarbons, DDT and DDE were practically undetectable.

Water protection measures taken at the Azovstal' Iron and Steel Plant resulted in an amelioration of water quality in the Berdyansk Bay.

The Caspian Sea

Petroleum products are the contaminants most widely encountered in the Caspian Sea. Their annual average content varies between 2 and 10 MPC. Sea water contamination with phenols stays at the level of 4-18 MPC, while mercury, is at the 4 MPC level. Its content of synthetic detergents, heavy metals and ammonia nitrogen does not exceed the maximum permissible rates; maximum concentrations of copper reached the MPC.

Increased water contamination was observed in the following regions of the central Caspian Sea: Chechen' Island-Mangyshlak Peninsula; Makhachkala-Cape Sagandyk; Makhachkala - a region of the Azerbaijan shore - Sumgait; regions of Eastern shore-Shevchenko; and Bekdash. The water pollution index in these water areas lies between 1.82 and 3.93, i.e. it varies between slightly contaminated and contaminated values.

The regions where in 1989 water pollution remained at the previous level include: Lopatin, coastal waters at the River Terek, Kaspiysk, the Makarov bank, Neftyanye

Kamni, Bil'gya, the Bulla island, coastal waters at the River Kura, the Krasnovodsk and the Turkmen Bays.

Some lowering of the contamination level was observed in the vicinity of Shikhovo-Sangachaly, the Cheleken Peninsula, and the Baku Bay; this is associated with the commissioning of the first stage of the municipal waste treatment plant.

The Black Sea

In the open part of the Sea, the average content of petroleum products in the top 100m deep layer of water was observed to stabilise at 2 MPC, synthetic detergents at below MPC. DDT and its metabolites were not detected in the open part of the Sea.

The oxygen content also remained at last year's [1988] level, water saturation with oxygen was close to 100% in a 50m layer, while at the depth of 200m there was practically no oxygen.

In the coastal regions, water pollution was above the background level. In 1989 contamination with petroleum products rose from 1 to 3 MPC in the delta of the Danube River, from 5 MPC to 6 MPC near Odessa, from 6 to 10 MPC in the region of the Yuzhny and Ochakov settlements, from 4 to 8 MPC in Karkinit Bay, from 6 to 8 MPC near Batumi; petroleum product content remained at the 1988 level in the Sukhoy Liman and in the region of Anapa (2 MPC), near Yalta (1 MPC), and near Poti (4 MPC). Water pollution fell from 11 to 4 MPC in the Bug Liman, from 7 to 3 MPC in the Dniester Liman, and from 2 to 1 MPC in the vicinity of Sochi and Tuapse.

The concentration of synthetic detergents has remained at last year's [1988] level, i.e. below 1 MPC in the coastal area and 2 MPC near Batumi and the Sukhoy Liman. It increased from 5 to 6 MPC in the area of Odessa and from 4 to 7 MPC near settlements Yuzhny and Ochakov.

Phenol content in the sea water went down from 17 to 14 MPC near Odessa and from 4 to 3 MPC in the coastal waters near the Danube and in the region of Poti. The presence of y-hexa-chlorocyclohexane and pesticides of the DDT group was recorded in the coastal waters of the Danube, in the Dnieper-Bug Liman, in the Sevastopol' Bay, and in the regions of Tuapse and Sochi.

The Baltic Sea

More than 3.6 million m^3 of contaminated waste water have been discharged from the territory of the USSR into the basin of the Sea carrying 58,000 tons of nitrogen, 352,000 tons of organic matter, 375 tons of zinc, 42 tons of lead, 167 tons of copper compounds, etc. Note that in 1989 the waste water of large cities, such as Leningrad, Riga, Klaipeda, and Tallinn, were not cleaned to the respective standards. In 1989 the pollution level of open regions of the Baltic Sea underwent practically no changes, concentrations of principal contaminants remained at the MPC level, except for petroleum products (2 MPC).

Out of the 24 coastal regions of the Sea that have been under observation, ten demonstrated a tendency to increasing pollution levels, four to decreasing levels, and ten remained at the 1988 level.

Waters in the mouth of the Pregol' River are still the most contaminated. In 1989 heavy metal content increased in the water of the Neva Bay, and phenol concentration rose in the mouths of the Lielupe and Daugava rivers and in the Kurshsky Gulf.

In the Gulf of Finland the most contaminated regions are the water area of the Leningrad port, the Northern and the Southern Resort Zones where the annual average concentrations of copper equalled 6, 13 and 7 MPC, respectively, and those of manganese 2, 3 and 2 MPC, respectively. In several regions of the Gulf of Finland the mercury content was at the MPC level, while in the deep area in the eastern part of the Gulf concentrations of lead and cadmium reached 3 and 5 MPC, respectively.

In the Gulf of Tallinn and the Gulf of Riga, near the Liepaya and Ventspils ports, in the south-eastern part of the Sea, in the Visla and Kurshsky Gulfs, the annual average concentrations of petroleum hydrocarbons amounted to 1-2 MPC, while phenols were at 3-7 MPC.

The White Sea

The average content of petroleum products in the water of individual regions of the White Sea was within 0.03-0.04mg/l, i.e. is below MPC. The concentration of synthetic detergents was uniformly within 1 MPC, chloro-organic pesticides were registered at the background level. An increased content of phenols (up to 3 MPC) was detected in the Kandalaksha, Onega, Dvina, and Mezen' Bays.

The Barents Sea

Waters of the open part of the Sea in the Pechenga, Teriberka, Pechora Bays and in the Motovsky Gulf are classified as being clean.

The waters of the Kola Gulf remain the most polluted (especially near the city of Severomorsk and the settlement of Roslyakovo). The annual average concentrations of petroleum hydrocarbons reached 1 MPC here, those of phenols, 6 MPC.

In the regions of petroleum and gas prospecting on the sea shelf, petroleum product concentration in the sea water reached 10 MPC.

The Arctic Seas

The open waters of the Kara, Laptev, East Siberian, and Chuckchee Seas are relatively clean. The worst situation exists in the Bulunkan Gulf (the Laptev Sea) and the Yenisei Gulf (the Kara Sea). The annual average contents of petroleum hydrocarbons in these gulfs reached 6 MPC, those of phenols, 10 MPC, elevated concentrations of synthetic detergents were registered.

The Bering Sea

The highest contamination of coastal waters of the Kamchatka Peninsula was observed in the Avacha Bay and in the Gulf of Kamchatka. Here, the annual average concentrations of phenols were at 4-6 MPC, those of petroleum products at 6-10 MPC, and those of synthetic detergents at about 1 MPC.

The principal sources of water pollution in the region of the Avacha Bay are municipal and industrial enterprises of Petropavlovsk-Kamchatsky, as well as naval, merchant, and fishing vessels.

The Sea of Okhotsk

The principal contaminants are petroleum products and phenols. In 1989 the annual average concentrations of petroleum hydrocarbons in the northern part of the Sea were close to 3 MPC. In the south-western part of the Sea the annual average concentrations of phenols varied from 3 MPC near the Salmon Bay to 22 MPC near the settlement of Starodubskoe. At the Kamchatka shore (near the settlement of Oktyabr'sky) the phenol content reached 4-6 MPC, while petroleum product concentration was up to 10 MPC.

The concentration of petroleum products in the sea remained at the 1988 level. Phenol content fell in the Aniva Gulf, but rose in the north-eastern shelf and in the Gulf of Endurance.

The coastal zones of the Sea near the towns of Poronaysk and Korsakov remain polluted. A high concentration of cadmium was detected in the waters of the Aniva Gulf, but the source of contamination has not been found.

The Sea of Japan

Sea water contamination with petroleum products increased in 1989. Water quality in the Zolotoy Rog Bay did not change, the waters are classified as polluted. Water deteriorated in the Gulf of Amur and in the vicinity of the ports of Nakhodka and Aleksandrovsk.

CHAPTER 3: SOILS

As of 1 November 1989, the area of agricultural lands equalled 602.8 million hectares (27% of the land reserve area of the USSR); this figure included 335.3 million hectares (15%) of pastures, 226.1 million hectares (10.1%) of tilled land, 35.8 million hectares (1.6%) of meadow, and 5.6 million hectares (0.2%) of other farm lands (4.9 million hectares of perennial fruiting plantations plus 0.7 million hectares of leas). The rest of the territory is occupied by forests (33.2%) and other lands (39.9%).

Due to extensive human activities, processes of land degradation and contamination continue to develop. In the last 15 years the eroded area of agricultural land increased by 54.7 million hectares. The total area of gullies exceeded 10 million hectares, their total length is over 1 million km.

The crop yield on eroded arable land is falling by 35%, on other farm land, by 47%. Annual loss to agriculture caused by erosion (neglecting the ecological and social losses) is estimated at 18,000-25,000 million roubles; this figure has doubled in the last 20 years.

Erosion is the principal mechanism of soil humus loss. Its content in tillable soils has fallen by 8-30% in the last 15-20 years (by 20% on average in the RSFSR and by 9% in the Ukrainian SSR). Out of 173 million hectares of arable lands inspected in the country as a whole, 35 million hectares (20%) contained less than 2% of humus.

Soil erosion, as a consequence of poorly planned soil management, results in intensification of droughts and desertification of territories. Every year 300-1,500 million tons of soil decomposition products, together with toxic compounds accumulated in them, as well as about 30% of pesticides and mineral fertilizers, are washed off into water objects.

Zonal complexes of organisational, economic, agronomic, forest reclamation, and hydrotechnical anti-erosion measures are being developed and introduced; efficient technologies, technical means and soil-protection systems have been created.

The Government allots about 200 million roubles per annum for soil protection against erosion, but this sum does not cover the requirements.

Intensive desertification of territories continues in a number of regions of the arid zone. Thus, the process of desertification in areas near the northern part of the Caspian Sea (in the Black Lands and the Kizlyar Pastures) proceeds at a rate of 50,000-60,000 hectares per annum.

In the tundra zone, where the plant cover is highly vulnerable, lack of special vehicles for prospecting, construction and mining work has resulted in a significant destruction of

soils and reindeer pastures. More than 40 million hectares of reindeer pastures were brought out of rotation in the last 20 years alone.

The ecological situation also remains complex because of poorly planned hydrotechnical reclamation of land, a low efficiency of reclamation systems, improper use of reclaimed lands, wasteful consumption of water resources, and the inadequate quality of reclamation construction. As a result, several millions of hectares of the USSR's agricultural land are subjected to inundation and substrate flooding, 1.5 million hectares have an unsatisfactory water regime, and 6 million hectares have been resalinated. Drainage systems require reconstruction and/or rehabilitation on an area of about 2 million hectares, including approximately 1 million hectares in the RSFSR. The performance level of irrigation systems must by improved on an area exceeding 8 million hectares, including 4 million hectares in the republics of Central Asia.

Lands, including those with fertile and valuable soils, continue to be allotted, not always justifiably, for non-agricultural needs. Allocation of arable land alone for these purposes proceeds at an average of 60,000 hectares per annum.

Table 3: Scale of soil and plant contamination with pesticides in 1989

Union Republics	Number of samples analysed		Percentage of pesticide containing samples		Percentage of samples exceeding the norm	
	Soil	*Plants*	*Soil*	*Plants*	*Soil*	*Plants*
USSR	**42300**	**43800**	**33.4**	**25.0**	**4.6**	**3.9**
Azerbaijan	700	700	58.4	42.4	29.2	0.0
Byelorussia	600	900	37.2	10.0	24.8	3.4
Georgia	1100	5400	63.8	55.1	24.4	11.7
Kazakhstan	18400	16400	17.8	9.8	1.4	3.5
Kirghizia	1300	1900	2.8	1.0	4.9	0.6
Lithuania	300	1000	1.6	16.0	5.6	4.1
Moldavia	9100	800	30.2	8.8	11.7	6.9
RSFSR	3500	5400	25.8	17.1	1.4	5.1
Tadzikistan	600	1700	66.6	34.8	3.9	0.0
Turkmenia	400	2000	33.6	60.9	0.0	0.0
Ukraine	2500	4600	54.5	29.6	0.7	0.5
Uzbekistan	5000	3900	65.3	53.4	4.7	2.9

* Armenian, Latvian, and Estonian Republics have been omitted because insufficient data were available.

Agrochemical soil inspection has indicated that prevalent in the USSR are soils with a low to medium content of labile phosphorous (149 million hectares, or 68.1%) and a high content of exchange potassium (154.4 million hectares, or 70.6%). Acid soils occupy 50.3 million hectares (23%), of which 6.2 million hectares (2.8%) belong to the strongly acid class.

In the last 18 years, the area of the USSR's lands with a low content of labile phosphorous fell by 21%, those high in exchange potassium by 7.5%, and the acid soil area was reduced by 5.7%.

Saturation of soils with nutrient substances proceeded most actively in Byelorussia where areas with phosphorous-rich soils increased by 49% and potassium-rich ones by 45.3%. In the Ukraine this process developed at a slower rate, the growth amounting to 25.5% and 22.5%, respectively, in Latvia (15.9% and 17%), and in Lithuania (10.2% and 15.1%, respectively).

Unwarranted use and careless handling of pesticides and mineral fertilizers has serious consequences for people and natural objects, such as accumulation of nitrates and pesticides in quantities exceeding permissible levels.

Soil and plant inspection for concentration of residual quantities of pesticides and nitrates is carried out by the toxicological departments of 197 design and prospecting stations for agricultural chemicalisation and by 129 toxicological control laboratories of regional plant protection stations. In addition, agricultural products are inspected for nitrate content by 1,419 district complex technological laboratories for chemicalisation and plant protection, 10,000 express laboratories at farms, and 140 inter-farm laboratories.

A trend towards the lowering of pollution levels of objects under inspection has become evident. The level of contamination of agricultural lands has dropped by a factor of 5-6 and the crop products have become 4-5 times cleaner. However, high levels of pesticide content in agricultural objects are still observed in some regions. Inspection results show that definite regions are characterised by high levels of residual pesticides in soils. Unfavourable situations exist in the cotton-growing regions of Central Asia and Transcaucasia, Moldavia, a number of regions of the RSFSR, Byelorussia and the Ukraine.

Stable chloro-organic insecticides and sym-triazine herbicides remain the principal pollutants. Although the use of DDT has been forbidden, half the samples subjected to analysis contained traces of the preparation, while 14% exceeded the standard.

The crop products of most regions did not contain any residues of DDT, the only exception being cotton-growing regions. Thus, in Uzbekistan the maximum permissible level was exceeded in 12% of cotton samples and 1.3% of vegetable products analysed.

High contents of sym-triazine herbicides were detected in soil and plants in 1989. The highest contamination with simazine was observed in soils of the Mogilev and Grodno Regions of Byelorussia where 90% of samples taken contained residues exceeding the

standard. The soils of some regions of Moldavia showed a 60-fold excess of simazine and 20-fold excess of atrazine, although in 1989 a significant reduction of soil contamination with these preparations was observed in the Republic as a whole.

The highest level of crop contamination with sym-triazines was characteristic of Georgia where 100% of the inspected products contained residues of simazine and in 20% of harvested tea the standard was exceeded.

Note should be made of a significant increase in soil pollution with treflan in Moldavia and the Ukraine. Its average concentration in the soils of the Moldavian SSR amounted to 5 MPC, the maximum concentration, to 20 MPC.

Country-wide inspection of crop products for nitrate content indicated that in 1989, as in 1988, red beet was the most toxicologically "dangerous" crop in terms of nitrates.

In Moldavia and Estonia, 25% of crop produce was contaminated with nitrates, in Byelorussia, Kazakhstan, Lithuania, and the RSFSR the share amounted to 17%, in Azerbaijan, Armenia, Georgia and Kirghizia it equalled 12%; the cleanest produce (0.7-7%) was supplied by Latvia, Uzbekistan, Tadzikistan and the Ukraine. The quality of individual cultures improved in a number of Republics. Thus, open-ground potatoes and vegetables, as well as melons and forage crops became cleaner in Kazakhstan and Georgia. In Moldavia, on the other hand, nitrate content in these cultures increased, the highest nitrate contamination being observed in melons, marrows, and forages grown in the Republic.

Trend analysis of crop product nitrate contamination for the last four years shows that nitrate content continues to grow in such cultures as potatoes, cucumbers, cabbages, melons and some forages.

Land inspection within and around approximately 100 towns and cities of the USSR indicates that the heaviest anthropogeneous effects fall upon soils in the vicinities of Chimkent, Ust'-Kamenogorsk, Monchegorsk, Revda, Belovo, Rudnaya Pristan', Alaverdi, Verkh-Neyvinsk, Dal'negorsk, Svirsk, Glubokoe, Mednogorsk, Balkhash, Konstantinovka, and Khar'kov.

Soil contamination in excess of 10 MPC was detected around the townships of Alaverdi, Belovo, Konstantinovka, Ust'-Kamenogorsk, Glubokoe, Sverdlovsk, Nikolaev, Mednogorsk, and Khar'kov. Soil lead contents exceeding the MPC was observed in a total of 78 townships.

The highest mercury content was detected in soils of the Khaydarkan Integrated Mercury Works (Kirghizia) where maximum values were 10-100 times over MPC. Mercury contamination surpassing sanitary standards was also found in soils near Verkh-Neyvinsk, Usol'e-Sibirskoe, Konstantinovka, Nikitovka, Temirtau, Zima, Gorlovka, and Chauvay.

Soil contamination with benz(a)pyrene over the permissible level was registered around Dal'negorsk, Erevan, Rudnaya Pristan', Sumgait, Gorky, Makeevka, and Komsomol'sk-on-Amur.

In townships accommodating enterprises of the electro-technical industry, where capacitors and capacitor liquid are made (Ust'-Kamenogorsk, Dzerzhinsk, Serpukhov, and Leninakan), territories adjacent to the enterprises show high levels of polychlorinated biphenyls, and extremely toxic compounds produced in the USSR and three more countries. MPC for polychlorbiphenyls has not yet been established.

Thus, the scale and rate of soil degradation and contamination on the whole has not fallen, which creates an extremely dangerous ecological and socio-economic situation. In this connection, preservation of soils and raising their fertility constitute one of the principal directions of nature protection activities.

Plate 2. Vaygach Island, where yet another zapovednik will be created in the Arctic

CHAPTER 4: BIOLOGICAL RESOURCES

4.1 Introduction

The fauna and flora of the Soviet Union are rich both in species composition and in quantitative terms. Since the natural ecosystems suffer from significant anthropogeneous loads, the practical utilisation of biological resources is managed by a State system which also includes the protection of rare and vanishing species of plants and animals. Social and legal guarantees ensuring their preservation are specified in the Decision of the USSR Council of Ministers On *The USSR Red Data Book*. This Decision is a State document describing the entire system of measures aimed at the preservation of rare and vanishing species of plants and animals and containing data on their numbers, distribution, and biological features, as well as a list of recommended measures for their preservation.

4.2 Flora

The 1989 edition of *The USSR Red Data Book* includes 603 species of vascular plants, 32 species of mosses, 29 species of lichens, and 20 species of fungi. Almost half (49%) are endemic in definite regions of the USSR and another 23% are at the limits of their ranges. Prevalent among endemics are plants of Central Asia (29%), the Caucasus (24%), the European part of the USSR (16%), and the Far East (14%). More than half the vascular plants entered in *The USSR Red Data Book* are conserved in botanic gardens, 36% of species in reservations and preserves, but for 60% protection of their natural habitats has yet to be arranged.

A plant protection service has been created and is being developed. It controls all the measures taken to combat pests, weeds, and plant diseases. The service includes Republic, regional (territorial), interdistrict, and district plant protection stations, a total of 161 stations.

Natural plant resources are capable of fulfilling national requirements in raw materials for pharmaceutical, industrial and alimentary use. A significant number of pollen-bearing, oil-bearing, industrial, and other useful plants grow in the country. About 200 species of edible mushrooms may be found in forests; the potential aggregate biological yield of wild berries and fruits amounts to 12.5 million tons. The genetic pool of wild forage plants is very valuable.

Wild drug plants are of special importance. About 40% of pharmaceutical preparations are produced from plant products, and more than half of the latter is derived from natural conditions. Nearly 2,500 plants of the USSR's flora possess healing properties, but only a little more than 200 species have been sufficiently investigated.

Today, about 240 species are allowed to be cropped and used, of which 55 species are grown on specialised farms of the *Soyuzefirlekrasprom* All-Union Agro-Industrial Complex for Production of Essential Oil-Bearing and Drug Plant, ten species are bought from fishing and agricultural enterprises, while the rest is produced by enterprises of the USSR Ministry of Medical Industry, the USSR Health Ministry, the Central Council of Cooperatives, the USSR State Committee for Forestry, and the RSFSR Main Administration for Wildlife Management.

The demand for drug plant materials more than tripled in the last decade. The aggregate yield of cultivated drug plants for the period 1986- 89 equalled 62,000 tons, while the quantity required for 1990 alone amounted to 65,000 tons. Demand for certain kinds of produce is realised by only 10-30%. The reasons for this are over-picking of plants and the extensive economic development of plant habitats, such as the ploughing of virgin and lea lands, the construction of hydropower stations, or land reclamation. As a result, drastic changes have already occurred in many regions in the relation between the biological and usable reserves of sea buckthorn, wild rose, magnolia vine, ginseng, *Rhodiola rosea, Rhaponticum carthamoides*, perennial adonis, sandy everlasting, and many other plants.

Forests

The permissible felling level for 1989 (the scientifically established rate of forest utilisation) was established at 625.3 million m^3, including 392.6 million m^3 for conifer forests. Actual felling in the same year amounted to 331.2 million m^3 (53% of permitted felling), including 235.7 million m^3 (60%) of conifers.

The level of utilisation of forest resources varies widely in different regions of the country, quite often it does not depend on natural conditions, but on previously elaborated economic structures, such as transport accessibility and/or the availability of felling and processing facilities and labour resources. Imperfection of wood processing technology leads to a situation where the felling potentials of deciduous and larch forests is in practice permanently under-used, while permitted felling in coniferous woods is exceeded. In 1989 this over-felling constituted 12.4 million m^3 over the country as a whole.

Continuous fellings clear forest stands over an area of 2.0 million hectares, while forests are regenerated on an aggregate area of 2.2 million hectares. Their regeneration is accomplished by the seeding and planting of trees on approximately 1.0 million hectares and by promoting the natural regeneration of forests on the remainder of the territory. As a result of this reafforestation work, the area of forest-covered land is restored and is even increasing. However, because of the inadequate ecological and economic basis of logging and insufficient financial and material support of forest regeneration work, economically valuable conifers are being replaced, in a number of regions, by soft-wood deciduous species (birch, aspen, and the like).

This forest species replacement proceeds most extensively in the Archangel Region, Komi ASSR, East-Siberian area. Attempts to stop the deterioration of forest species composition in the European and Ural parts of the country have been unsuccessful.

Continuous felling continues to prevail in cedar woods with the accompanying elimination of underwood. Despite a decision made by the Government, cedars are cut in Siberia in the period of the most intensive fructification. All the highly productive cedar plantations in the lower parts of the mountains of southern Siberia and in the south of Western Siberia have mostly been cut down. The felled cedar wood is utilised irrationally. Suffice to say that pencil production uses no more than 20% of wood received for this purpose. The volume of pine nut stocking does not exceed 2-3% of the potential.

Fire protection of forests is ensured on a territory of 870 million hectares or 69% of the territory of the USSR's forest fund.

In 1989, 28,000 recorded fires enveloped 1.6 million hectares of forests; more than 80% of the area covered by the fire occurred in the territories of the Tyumen', Tomsk and Sakhalin Regions and the Khabarovsk Territory (39%, 23%, 11%, and 8%, respectively).

The total area of forests infected with pests and diseases equalled 2.8 million hectares; 53% of which accounts for leaf beetles, among which gypsy moth (728,000ha) and leaf roller (551,000ha) remain dominant; the most widespread of forest diseases being the pine fungus affecting conifer stands (413,000ha).

The heaviest damage to forests is registered in Armenian, Byelorussian, Moldavian, the Ukrainian SSR, in the Bashkir, Mari, and Tatar ASSR, in the Volgograd, Voronezh, Penza, Saratov, Tyumen', Ul'anovsk, and Chelyabinsk Regions, and in the Krasnodar Territory.

Forest protection measures using biological and chemical means covered 1,420,900ha in 1989. The share of biological forest protection measures amounted to 79% of the total volume of forest protection work.

The state of forests is appreciably affected by noxious emissions from industrial enterprises. Even at a significant distance from the source of air pollution, forests are notably suppressed and partly dying. The largest areas of forest vegetation affected by industrial contaminants lie in the neighbourhood of petroleum processing, chemical, non-ferrous metal making, pulp-and-paper, cement, and power generation industries.

Emissions from non-ferrous metallurgical enterprises affected 81,000ha of forests near the town of Bratsk, 130,000ha near Monchegorsk and Nikel', and 545,000ha near Noril'sk.

The effect of ammonia, sulphur dioxide and nitrogen oxide emissions from the *Azot* Production Association in the Lithuanian SSR is noticeable on an area of 7,000ha. Air pollution from a similar enterprise in Rovno, Ukrainian SSR, killed 500ha of forests, and the total area of forest degradation around the city of Novgorod amounted to 2,400ha.

Areas of forests damaged and/or weakened under the effect of emissions from mineral fertilizer plants have been detected in the vicinity of towns of Berezniki, Gomel', Dzerzhinsk, and Shchekino (Tula Region).

Woods around cement plants in Iskitim (Novosibirsk Region), Voskresensk (Moscow Region), Vol'sk (Saratov Region), Balakleya (Ukrainian SSR), and Akmyane (Lithuanian SSR) have been strongly affected and weakened.

A large area of dead forest exists around the *Magnezit* Integrated Works in the town of Satka, Chelyabinsk Region. The area of damage has stabilised at a level of 50,000ha, while a 10,400ha area of forest has died completely.

4.3 Fauna

The *USSR Red Data Book* includes 463 species and subspecies (or populations) of animals.

The general strategy of rare and vanishing species protection is aimed in two directions. A special importance is attached to genofond conservation in special genetic banks established on the basis of zoo nurseries where such animals are kept in open-air cages or with semi-free management. Creation of such zoo nurseries is practised throughout the world, but the Soviet Union was the first State to legally regulate their upkeep as a direct duty of State bodies responsible for the protection and management of animal life.

Hunting is the main form of wild animal utilisation, its official status is regulated by the USSR Law on Animal Kingdom Protection and Utilisation.

Wild animals and birds regarded as objects of hunting constitute the basis of the USSR's hunting resources. They include the principal species of hoofed and fur-bearing animals and a numerous group of upland and water-fowl. The total hunting area of the country approaches 2,000 million hectares, of which 1,560 million hectares have been allotted to hunters' organisations and enterprises.

As of 1 January 1990, the USSR registered a population of more than 5 million hoofed animals, 23.4 million principal hunting species of wildlife (including 3,302,200 deer, 1,340,200 saigas, 879,600 elks, 893,600 roe deer, 462,200 wild boars, 1,181,600 sables, 304,200 beavers, 760,400 red foxes, 280,500 martens, and 92,500 brown bears), and more than 58 million wildfowl: 16,875,000 game birds (wood and black grouses and partridges) and 41,465,000 water-fowl (geese and ducks).

Measures taken in the USSR to protect, reproduce and rationally utilise its fauna have led to the enlargement and stabilisation of numbers of quite a few valuable species of game animals, among them sable, river beaver, elk, roe deer, wild boar, deer, etc.

The protection, reproduction and utilisation of game reserves in the USSR is carried out by 5,400 hunters' organisations, of which approximately 500 are professional (these include State hunting enterprises, cooperative game hunting enterprises, sovkhozes and kolkhozes of the Extreme North), the rest (operated by the Government or by hunters' unions) are run by sports and amateur associations.

The continuing destruction of wild animal habitats by human activities results in the reduction of the hunting area in many regions of the USSR. In 1989 alone this area

decreased by 52.0 million hectares. Take just the example of the Kalmyk ASSR where the development of an irrigation system, poorly designed and not presented for approval by nature-protection bodies, with over-grazing of domestic animals, and the construction of the Volga-Chogray canal made the area used by saiga several times smaller over a ten year period, while the herd decreased from 400,000 in the 1980s to 150,000 by 1990. Commercial hunting for this antelope has been stopped, but it seems impossible to reproduce a commercial herd of these animals without taking extraordinary measures.

Aquatic animals

The legal concept of fish reserves includes fish and other aquatic animals and plants. The country produces 11 million tons of fish and seafoods. Many of the USSR's rivers, seas and lakes have lost their aquicultural importance due to significant anthropogeneous effects.

For example, as a result of over-fishing and growing water pollution, the Barents Sea's yield of capelin dropped from 600,000-800,000 tons per year to practically zero. Water quality deterioration has been noticed in a number of regions of the White Sea. The Aral Sea has completely lost its aquicultural significance. The Caspian basin still retains its importance as a source of fish. This is the world's only reservoir inhabited by unique species of sturgeon (90% of world reserves). In recent times, this basin yielded more than 600,000 tons of this most valuable game fish per year. However, man-induced changes in the state of the Caspian Sea ecosystem have produced a negative effect on the reproduction of traditional catch objects (sturgeons, bream, Caspian roach, sander, etc.) and caused a notable change in the catch structure and a reduction of the total yield. The last 30 years saw a 24-fold reduction in the sander catch, 16-fold in herring, 8-fold in Caspian roach, and 4.5-fold in bream. The increase in the Volga runoff and a rise in the Caspian Sea level in the last four years has somewhat improved the situation and led to the formation of generations of fluvial anadromous fishes and to an increase in their numbers. The commercial stock of the Caspian roach increased from 35,000 tons in 1986 to 65,000 tons in 1989, that of bream, from 30,000 to 54,000 tons, and that of sander from 3,000 to 4,500 tons. The total catch amounts to 330,000-380,000 tons.

The stocks of Russian and starred sturgeons are currently in an unsatisfactory state and tend towards overall reduction. The mass of the spawning population of Russian sturgeon decreased from 40,000 tons in 1974 to 15,000 tons in 1987, that of starred sturgeon from 16,000 to 12,000 tons. This reduction in numbers results from a sharp drop in the scale of the natural reproduction of populations in the rivers of the basin (mainly in the Volga). The industrial rearing of Russian and starred sturgeon is not yet capable of compensating for the loss of natural spawning grounds.

The Azov Sea is the second largest aquicultural reservoir of the USSR. In favourable years it yielded up to 160,000 tons of valuable fishes. In 1989, the catch amounted to 50,000 tons. Sea water contamination and salinity increase resulted in the halving of the productivity of the Azov Sea ecosystem. The reduction of the fish population was also accelerated by a gigantic population growth of Atlantic ctenophore (up to 32 million tons) which exterminated the plankton and fry of commercial fish species.

The yield of the Baltic Sea dropped to 220,000-250,000 tons. Plans have been made for future off-shore petroleum production between the Gulf of Gdansk and the southern end of the Saarema Island, i.e. in the area where all the stock of local populations of herring (up to 30% of the total herring catch in the USSR) is spawned. The pollution of the Kurshsky Gulf of the Baltic Sea is a cause for much anxiety, inhabited as it is with almost 50 species of fish, 34 of which are game fishes. In 1977-85 a record number of fish poisoning and suffocation cases (89 in total) were registered in this Gulf.

The Ob' basin concentrates major reserves of *Coregoni*, unique in numbers and species composition (*C. peled, C. muksun, C. nasus, C. pyzhyan, C. sardinella, C. autumnalis* and *C. tugun*). In favourable years, up to 12,000-13,000 tons of white fish were caught here; today the catch has dropped to 6,000-8,000 tons. The basin also yields about 44,000 tons of sturgeon (sterlet and Siberian sturgeon) and salmon (Siberian white salmon). The principal cause of the productivity decrease of the Ob' basin is petroleum contamination.

A relatively favourable situation exists in the seas of the Far East. During the last five years the fish catch here grew from 3,619,000 to 4,874,000 tons. About 90% of this total falls upon seven species, namely Alaska pollack, ivasi, cod, dab, *Cololabis saira,* salmon, and herring. The stocks of all these fishes are in a satisfactory condition.

Extensive amelioration work is carried out every year in the USSR's aquicultural water reservoirs with a view to improving the state of natural spawning grounds and migration routes for producers and young fish and to raising the efficiency of natural reproduction. The USSR Ministry for Fish Economy operates 88 aquicultural enterprises and nine acclimatisation stations which, in 1989, released 3,927,112,000 specimens of young fish into natural and man-made reservoirs and released 35 species of fish and 13 of invertebrates into 250 water reservoirs.

However, all the fish reclamation measures cannot counteract the growing influence of exploitation of the game fish reserves. If today's ecological situation of internal water reservoirs persists, the fish catch in the USSR in 1995 will not exceed 1 million tons, the bulk of the catch still being formed by small-size common fishes, such as sprat, anchovy, or sardelle.

The inland and bordering seas of the USSR (the Sea of Okhotsk, the Bering, Chuckchee, White Barents, and Caspian Seas) are inhabited by game species of sea mammals. In the Northern basin these are Greenland and ringed seals, sea hare, and white whale; in the Pacific basin these constitute sea hare, ringed, ribbon, harbour and fur seals, walrus, and grey and white whales; the Caspian Sea is inhabited by the Caspian seal; and Lake Baikal by the Baikal seal. Lately, the difficult ecological situation has resulted in a reduction in the numbers of these animals. In this connection the quota on hunt for Greenland seal, for example, has been reduced from 80,000 in 1989 to 30,000 in 1990. A difficult situation has developed with regard to the Caspian seal which now numbers only 400,000; consequently, the hunt quota has been reduced from 40,000 to 30,000 head.

Measures have been taken to protect all species of sea mammals. These include restrictions on the killing of certain sex and age groups, bans on hunting in certain areas

at certain times, the establishment of strict limits on the number of animals killed, and the prohibition of low-level aircraft flights over walrus and fur seal breeding grounds.

Some species of pinnipeds (grey seal of the Baltic Sea, Atlantic and Laptev walrusses, sea beavers of the Kuril and Komandorskie Islands and others) are entered into the USSR and the RSFSR *Red Data Books*, and hunting them is forbidden. In the Chuckchee National Area, traditional aboriginal hunting is permitted (but strictly limited of late) for Pacific walrus (3,000) and grey whale (about 260 a year).

4.4 Biological Pollution

Biological pollution includes: (1) the introduction of new biological agents or organisms to the environment, which were previously unusual to it, and (2) an increase in the numbers (biomass) of live organisms exceeding the normal organisms (average for many years and cyclic peaks) occurring in natural conditions.

4.4.1 Accidents in laboratories

The explosive development of biotechnology and genetic engineering creates another ecological hazard, that of the emergence from laboratories into the natural environment of organisms with new properties, such as new strains of pathogenic micro-organisms which may put down root in the natural environment and cause unpredictable consequences. Unlike the USA, the USSR has not yet adopted special legislative restrictions on strains of micro-organisms where inheritance has been changed by genetic engineering.

Accidents in medical and veterinary laboratories using highly virulent and contagious cultures of pathogenetic organisms release the organisms into the ambient environment, and may cause infection of workers in the laboratory and subsequent widespread sickness among local residents. However, the authorities are not interested in revealing information of this kind, and it is difficult to establish actual facts.

4.4.2 Liquid wastes from animal breeding farms and municipal sewages

The influx of human and animal metabolic products is a link in the natural biological cycle. However, large inflows of uncleaned wastes and sewages from large concentrations of people and/or animals (such as from cities or animal breeding complexes), when the potentials of self-cleaning are exceeded, leads to the biological contamination of water reservoirs and/or soils. Thus, in 1989 and 1990 the Oka River was polluted more than once as a result of the collapse of a settling basin in the town of Orel. Vladivostok, a city with a population of half a million, which even now does not have a waste treatment plant, continues to pollute the waters of the Amur Gulf with its sewage. As a result, a layer of almost lifeless sludge has formed on the bottom of the Gulf and it has become dangerous to bathe on the resort's beaches.

4.4.3 Animal and plant acclimatisation

Work on animal acclimatisation was well developed in the USSR in the 1930s to the 1950s. Muskrat, American beaver, American mink, musk-ox, and racoon were brought from America and acclimatised in the new conditions. Racoon dog and sika deer, taken from the Far East, were established in the European part of the USSR. In order to fight against the larvae of malaria mosquito, gambusia, a small fish, was settled in water basins in the south of the USSR. In numerous cases, game fishes were transplanted inside the country into water basins where they had never lived before. Credit should be given to many successful introductions where the incomers did not cause any notable damage to local biocenoses, but occupied empty ecological niches. However, in a number of cases the new species proved more competitive and started to expel local animals (American mink replacing its European cousin, and muskrat supplanting desman). In order to save the European mink, more were introduced, without proper ecological substantiation, in Kunashir Island where they began to destroy nests in bird colonies and kill local reptile and amphibian rarities. Racoon dog became a rabies virus carrier and activated the nidi of this sickness in the European part of the USSR. A similar part was played by muskrat in enlarging the nidi of tularemia in West Siberia. Moreover, having no resistance to the virus of Omsk haemorrhagic fever, which it had never before come across, the muskrat activated previously dormant nidi of this sickness and made them dangerous to humans.

Plants that have been introduced and are becoming widespread in natural communities, include *Elodea*, ash-leaved maple, *Echinocystis*, and Sosnovsky hogweed.

4.4.4 Casual introduction

The casual investment with, and subsequent settlement of, animals and plants usually brings about negative consequences. *Rapana*, a far-eastern gastropod which penetrated the Black Sea in 1930s *en masse*, resulted in the destruction of oyster banks.

In the 1980s, the ctenophore, a representative of coelenterates, penetrated the Black and Azov Seas *en masse*, an introduction that may have catastrophic consequences for the ecosystems of these Seas. Previously, this subtype had not been represented in the ecosystem of the Black and Azov Seas. According to VNIRO, All-Union Research Institute of Sea Aquiculture and Oceanography, the ctenophore *Mnemiopsis leidyl* is distributed along the Atlantic shore of North America and, probably, has penetrated the Black Sea with ballast waters of grain carriers. Detected in the Black Sea for the first time in 1982, it was found all over the Sea as early as 1987, while 1988 saw a massive escalation of its numbers, which continues until now. M.E. Vinogradov (Institute of Oceanology of the USSR Academy of Sciences and VNIRO) estimates the biomass of the Black Sea ctenophore at 800 million tons. The ctenophore destroys zooplankton, eggs and fry of fish, mussels and other sea invertebrates. As a result of its mass multiplication in the Azov Sea, in 1989 the ctenophore destroyed 78% of zooplankton, which resulted in a 7-fold reduction of the yield of anchovy, the principal game fish.

Other examples of unwelcome invaders are Colorado potato beetle and varroa mite, which parasitises honey bees.

Weed plants are among the most negative cases of non-deliberate introduction of plant species. They not only become widespread on fields, but also penetrate natural associations.

The USSR was infected with five species of gender *Ambrosia*, of which *A.artemisiifolia*, or common ragweed, is the most frequently encountered. This species was first detected near Stavropol' in 1919. Today it is widely represented in the steppe and forest-steppe zones of the European part of the USSR and in the Caucasus. In the 1960s ragweed was unintentionally brought to the Primor'e Territory (in the Far East). It tends to penetrate further north.

A rather wide distribution on the territory of the USSR has been gained by species of another American plant genus, clotbur (*Xanthium*). The USSR has been infected by 12 species of this genus. Their area extends from the USSR's western frontiers to the Far East, some species are even encountered in the territory of reservations.

Anthropogeneous activities are conducive to the mass introduction of new species and their rapid distribution. To take the Moscow Region as just one example: some 580 species of introduced plants have been registered already. Quite often, the incoming species prove more competitive and begin to suppress local fauna species.

4.4.5 Excessive reproduction and expansion of live organisms

The existence of unequipped waste dumping grounds and the ill-timed removal of refuse and communal wastes from townships create favourable conditions for the multiplication of synanthropous animals and birds, such as rats, crows, and pigeons. In the Astrakhan' and Kzyl-Achag Reservations, numerous hooded crows and magpies destroy large numbers of water-fowl nests. In the densely populated European part of the USSR, the ecological niche of the wolf has been occupied by new beasts of prey, hybrids of the wolf and dog, whose population and distribution are on the increase. The extensive construction of residential apartments aided the tropical form of the mosquito *Culex pipiens molestus* to enlarge its range by breeding in the basements of urban buildings. Larvae of this sub-species can develop in small volumes of water, even heavily contaminated. By the mid-1970s, mosquito swarms spread throughout Moscow and Leningrad and in the 1980s they reached Murmansk. At the present time, they are a serious irritant for dwellers, even in multi-storey buildings, during the summer.

Epizootics of infectious diseases among wild animals started to cover significant areas, to involve previously safe species of animals into the circulation of pathogenetic organisms, and to cause serious damage to wild fauna. In Kazakhstan in 1981-88 pasteurellosis killed about 600,000 saigas, and botulism was the cause of death of around 1 million waterfowl in the Caspian Sea in 1982. Approximately 3,000 wild boars fell victim to swine fever in 1974-76 in the European part of the country, while in the Primor'e Territory in 1984-86 their numbers fell by a factor of five for the same reason. Hundreds of seals died in 1987-88 in Lake Baikal because of predator fever. Outbreaks of wild animal infectious diseases create a threat to the health of humans. In the Baltic Republics, the successful fulfilment of environment protection measures resulted in a numerical

growth of hoofed animals, and, as a consequence, ticks multiplied there, circulation of the virus of tick-borne encephalitis became more active, and recently this has caused a sharp rise in the sickness in man.

The anthropogeneous effects on water basins in the form of industrial and sewage discharge leads to their eutrophication and sewage waste discharge leads to their eutrophication and the mass-multiplication of the blue-green algae. This is observed in water reservoirs around Moscow, to cite just one example.

4.4.6 Enterprises of biosynthesis

The effect on the natural environment by pollution, i.e. by emissions and discharges from biological synthesis enterprises which produce antibiotics, enzymes, vaccinés, serums, feed protein, vitamined protein concentrated feed, feed lysine, microbial plant protection preparations, etc. has been the subject of grave concern. Such enterprises are operated by the USSR Ministry of Medical Industry (120 factories), the agro-industrial complex (28 biological factories), and the USSR Health Ministry (eight manufacturing institutes producing vaccines and serums). Some of these enterprises use pathogenetic materials. It should be stressed that an extensive enlargement of the production facilities of this industry's enterprises is taking place with practically no measures having been taken to ensure ecological safety. Discharges and emissions of enterprises of the biosynthesis industry, especially those making the vitamined protein concentrated feed, contain biologically active substances, among them allergens which cause mass allergies among humans, especially children. The long-term effects of other bioactive substances on the human organism have not been studied either.

CHAPTER 5: REGIONAL ECOLOGICAL PROBLEMS

5.1 Introduction

In 1989 the general ecological situation in the territories of the USSR continued to remain a complex one. In spite of measures taken to bring down harmful production facilities, to improve the filtering of industrial emissions, to close certain enterprises under public pressure, to discontinue the construction of new ones (such as the Crimean nuclear power station), and to reduce recreational carrying capacity (in the Crimea and on the Baltic beaches), the degree of acuteness of the ecological situation in general remains at the previous level.

The 1/8,000,000 map of the most acute ecological situations in the USSR prepared by the USSR Academy of Sciences' Institute of Geography, indicates the regions of highest ecological stress as observed in the late 1980s. When compiling the map, the state of the natural environment was evaluated according to the following factors:

- air pollution;
- depletion and contamination of continental waters;
- contamination of seas;
- deforestation (over-felling of forests);
- degradation of forests;
- degradation of natural pastures;
- depletion of fish resources;
- accelerated soil erosion;
- soil deflation;
- resalination of soils;
- contamination of soils;
- extensive gullying;
- disturbance of permafrost regime of soil-grounds;
- all-round disturbance of lands by mining work;
- loss of productive lands;
- deterioration and destruction of natural recreational properties of the landscape;
- infringement of the regime of specially protected natural territories.

A total of 290 areas with acute ecological conditions have been detected in the territory of the USSR. They cover an area of 3.7 million km^2, or 16% of the country's area. If degraded reindeer pastures and arid grazing lands are taken into account, this value

increases to 20%, which is 15-20 times larger than the area of specially protected natural territories. A total of 20% of the entire population and 39% of the urban population live in unfavourable ecological conditions.

It is first of all evident that the lands subjected to the most intensive technological effects (ploughed soils, suburban areas, lands allotted for transport and urban development) are concentrated in the central, southern and western regions of the European part of the USSR. These regions correspond to the native zones of mixed and broad-leaved forests, as well as to the forest-steppe and steppe zones, i.e. to those territories which present the most favourable conditions for human life, including the best lands for grain crop cultivation, that is, zones which have been inhabited and assimilated for a long time. Ploughing as the prevalent type of territory utilisation, combined with a high population density (up to 25-100 persons per km^2) and rapidly growing urban, including industrial, centres and their suburban zones, give rise to at least three highly critical and interconnected problems:

- loss of significant areas of productive lands, including those that are unique in terms of fertility (chernozem ploughland), due to land allotment for non-agricultural needs;
- soil degradation (loss of humus, soil wash-off, deflation and erosion, etc.) due to neglect of agronomic and ecological requirements; and
- the industrial and agricultural contamination of the natural environment (waters, air and soils) which becomes most hazardous in densely populated areas (Donbass, Kuzbass, etc.).

The most acute ecological zones of the USSR are defined as areas in catastrophic, perilous, and critical ecological situations.

Catastrophic situations are characterised by profound and non-convertible changes of the natural environment, loss of natural resources and a drastic deterioration of human living conditions caused mainly by a heavy overload of landscapes in the region with anthropogeneous effects. This situation is evidenced by the notable deterioration of human health, especially in densely populated areas, as well as by loss of genofond and unique natural objects.

A perilous situation is close to catastrophic, and can turn into one in a comparatively short period of time, unless urgent and cardinal measures are taken.

In a critical (acute) situation, significant and poorly compensated landscape changes appear, along with the rapidly growing threat posed by the depletion or loss of natural resources (including genofond) and unique natural objects, and the notable worsening of human living conditions. Anthropogeneous burdens, as a rule, exceed the established norms and environmental requirements. If the anthropogeneous burdens are removed or reduced and nature protection measures are taken, the ecological situation can be normalised, the human living conditions improved along with the quality of individual natural resources, and landscapes partially reconstructed.

Catastrophic or near-catastrophic (perilous) situations are typical of such regions of the USSR as the Aral Sea and territories adjacent to it, the zone affected by the Chernobyl' nuclear power station accident, Donbass, the Dnepropetrovsk-Krivoy Rog industrial region, Moldavia, natural recreation territories at the Black and Azov Seas, lands near the northern Caspian Sea, Kalmykia, areas along the central part of the Volga River, the Kola Peninsula, the industrial zone of the Urals, Kuzbass, and the region of Noril'sk.

These regions are characterised by a very complicated set of environmental problems arising mostly from the polluting influence of their industrial centres, as well as from extensive utilisation of natural resources (mining and agriculture), whose unfavourable effects are aggravated by a high population density.

In the regions discussed, priority must be given to the contamination of the natural environment, which presents a threat to human health. Next, comes the problem of the degradation and destruction of natural complexes (erosion, soil disturbance, etc.).

High production and population concentration in the ecological disaster areas has led to the drastic deterioration of the ecological situation; the environmental capacity of natural complexes is either exhausted or approaching exhaustion. The potentials of ecological self-regulation are mostly limited here, while the natural resource potential is on the verge of exhaustion. In areas surrounding cities not only atmosphere, but also waters, both surface and subterranean, and soils are heavily contaminated, soils are disturbed, and forests are degraded.

Most of these regions now experience a shortage of water resources which limits the development of productive forces. The growing water intake, increase of non-returnable water consumption, and hydraulic engineering construction, on the one hand, and discharge of contaminated waste waters into rivers and water basins, inflow of fertilizers and toxic chemicals from agricultural fields and contaminated waters from urban areas have, on the other hand, resulted in a significant deterioration of the state of the Volga, Dnieper, Kama, Oka, and other rivers and basins. The ecosystems of these rivers have lost most of their potential for self-purification, autoregulation and self-recovery.

A very unstable land resource balance has been recognised in some regions of the USSR. A high level of land occupation for dwelling and industrial purposes, agricultural assimilation level up to 90% and an arable land ratio of up to 70-80% have been observed in such regions as the Donbass, the lands along the Dnieper and the middle part of the Volga, the Urals, and Kuzbass, where the afforestation level sometimes does not exceed 3-5%. The potential fertility of these soils tends to decline. The scale of this decline is estimated in terms of humus content in the soils which decreases at an annual rate of 1-2% of its total reserves, so that the total loss over the last 25-30 years amounts to 25-30%.

The acute ecological situation in the Kola Peninsula industrial zone has developed because the landscape has a low resistance to technological effects, contaminants migrate relatively slowly, and human activities create a heavy burden. Note that the area of ecological disaster is permanently increasing. The main problems on the Kola Peninsula are environment pollution, soil disturbance and biota degradation.

In the area surrounding the Aral Sea, as well as in Moldavia and Kalmykia, the depletion or loss of natural (water, land, and biological) resources occupies first place. A situation endangering human health has also arisen due to water supply shortages and the deterioration of food composition quality.

In Moldavia, a high level of agricultural production intensification involving heavy use of pesticides and mineral fertilizers and the neglect of environmental requirements has led to a drastic complication of the ecological situation. Water, soil and plant contamination with toxic chemicals, fertilizers, and liquid wastes from animal breeding farms has resulted in deterioration of the quality of human life.

In the Kalmykia landscape, characterised by a low resistance to anthropogeneous effects (salinization of soils, their light mechanical composition, etc.), the principal ecological problem is pasture degradation due to unrestricted and poorly organised grazing. This has activated wind and water erosion and the general aridity (desertification) of the territory.

The acuteness of the ecological and sanitary situations in the territory adjacent to the northern part of the Caspian Sea is connected with the construction of the Astrakhan' Gas Concentrate Plant. The major reason is the low performance and poor organisation of production at the first stage of the plant. This has led to such problems as air and water contamination, the change of the natural regime of the Volga-Akhtuba flood lands, and the depletion of fish reserves. As a result of all these phenomena, the incidence of illness, especially in children, has been increasing. In other regions near the northern part of the Caspian Sea, the acute ecological situation occurring there is associated with oil and gas prospecting and production.

A high concentration of industrial production, a significant input of the mining and heavy industries, and intensive agriculture in Donbass, Kuzbass, and the industrial zone of the Urals have brought about the deterioration of the ecological situation which has taken on the forms of environmental pollution, soil disturbance, and biota degradation. Acute environmental problems are accompanied here with the impairment of human health.

In the Aral Sea region, the ecological situation is characterised by the profound and mostly inconvertible changes apparent in the region's nature, by the loss of land and water resources, and by a drastic deterioration of human living conditions caused by burdens placed upon the region's landscapes, vastly exceeding the permissible norms. The acute sanitary situation in the Aral region is associated with the absence of normal water provision for population, as well as with incompetent, and sometimes unjustified, irrigation and a liberal application of toxic chemicals. Another seat of environmental disaster is the Aral Sea.

The natural recreational territories located on the southern shore of the Crimea and along the shores of the Black and Azov Seas have long attracted vast numbers of holiday-makers by their unique and salubrious attractions. At present this is a zone with very hazardous ecological conditions formed by the industrial and agricultural contamination of the sea shores, an acute shortage of drinking water, an increasing contamination of the

atmosphere by road transport exhausts and of the sea by water transport. The ecological regime has been violated and the resource potential has mostly been lost in the Black Sea and even more so, in the Aral Sea.

5.2 Regional Summaries

The following section outlines in brief the characteristics of certain regions plagued by acute ecological conditions.

The Donets-Dnieper Region

The chronic state of the ecological situation in this region is mainly due to the extensive approach to the utilisation of natural resources, the contamination of the natural environment, and a high population density.

The region occupies second place in the USSR in terms of the quantity of noxious exhausts into the air. About 8 million tons of pollutants are emitted into the region's air basin every year. The atmospheric pollution level here exceeds sanitary standards in all the towns where the All-Union Service conducts its monitoring. More than 90% of contaminants are produced by enterprises of the following four Ministries: the USSR Ministry of Metallurgy, the USSR Ministry of Power Engineering, the USSR Ministry of the Coal Industry, and the USSR Ministry of the Chemical and Petroleum Processing Industry.

The land resources of the Donets-Dnieper region have been assimilated to a high level. More than 40% of tillable lands is damaged by water and wind erosion, as well as by mining and geological exploration work.

The region represents one of the worst areas in the USSR in terms of water resource availability from surface runoff per person. Available water resources are close to exhaustion. Significant damage to water basins is caused by the discharge of contaminated wastes. Thus, 2,261 million m^3 of contaminated waters, including 392 million m^3 of untreated waters, were discharged into surface waters in 1989.

The level of contamination of the river Seversky Donets from chemical enterprises remains high. In addition, the large number of filtering retention and settling basins operated by enterprises of the metallurgical, coal mining and chemical industries have caused the contamination of subterranean waters, especially in the Lisichansk-Rubezhnoe industrial area. A significant part of the subterranean waters of the region is unfit for supply to humans, and the scale of contamination continues to grow.

In the latter half of 1989, the ecological and social situation in the towns of Gorlovka and Enakievo was aggravated because of a significant toxic compound contamination of underground water and mine workings of the *Aleksandr-Zapad* mine due to leaks from workshops and stores of inflammable fluids of the Gorlovka Chemical Plant. Three persons died and many miners and rescuers were poisoned with chlorobenzene and

toluene. In addition to these substances, the presence of methanol, benzene, formaldehyde, and styrene is detected in the mines at present. The underground space is now permanently contaminated.

To normalise the environmental situation in this region will require the commissioning, before the year 2005, of waste treatment equipment of an aggregate capacity of about 7 million m^3 per day, recycling water supply systems for about 70 million m^3 per day, and gas cleaning and dust removal plants with a capacity of 71 million m^3 per hour.

Non-recoverable losses of local mineral resources during their production, processing and handling are of great importance for this region. The share of such losses in mining alone amounts to 13% of iron ore and 15% of the coal yield. Only 30% of overburden rocks, dressing wastes and slags are rationally utilised.

Kuzbass

The Kuznetsk Ore and Coal Basin is today a complex of different, but technologically closely interconnected enterprises, including coal mining for power generation and coking, iron ore mining, iron and steel production, cokeries, metal-intensive machine building, heat power generation, and the chemical industry.

Kuzbass produces almost 20% of the USSR's total coal, almost half of phenol-formaldehyde resins and plastics, and about one-third of caprolactam.

The use of predominantly extensive technologies and the neglect of natural environment protection have made Kuzbass one of the most ecologically hazardous regions of the USSR which, in turn, has aggravated already complicated social and economic problems.

In spite of the fact that in the 1985-89 period the gross annual emissions of the region's industrial enterprises fell by 21.2% (and in the city of Kemerovo by 36%, from 167,000 to 112,200 tons), the ecological situation in the region has not improved.

The Kemerovo Region territory accommodates almost 26,000 stationary sources of air pollution, but only 46% of these are equipped with gas cleaning and dust removal plants. Moreover, in 1989 in the city of Kemerovo 43% of the cleaning equipment was out of order or was functioning inefficiently (the respective figure was 12.3% in Belovo, 13% in Novokuznetsk, and 16.9% in Prokop'evsk). The heaviest atmosphere polluters were the towns of Kemerovo, Myski, Novokuznetsk, Belovo, and Prokop'evsk.

The level of atmospheric pollution in the cities and towns of the region significantly exceeds sanitary standards, the cities of Kemerovo, Novokuznetsk, and Prokop'evsk have been entered into the list of townships with the heaviest atmospheric pollution.

In 1989 the discharge of waste water in the Kemerovo Region was equal to 2,500 million m^3, of which 900 million m^3 were dumped without treatment; recycling systems fulfil only 70% of water needs. The principal water source, the river Tom', is in a very unsatisfactory state.

The Dniester Region

The zone adjacent to the Dniester river is affected by the industrial enterprises and agricultural operations of the seven regions of the Ukraine and Moldavia. The burden on the natural environment from economic activities grows rapidly in this region, in Moldavia the economically active territory already occupies 95% of the area.

A serious threat to the ecological well-being of this region comes from the excessive application of pesticides, herbicides and fertilizers, as well as from discharges of contaminants into the atmosphere and water, soil degradation, the significant pollution of subterranean waters used for drinking water supply, and the nitrate contamination of agricultural products, especially melons.

The economic activities in the riverside zone on the territory of the Ukraine and Moldavia are often carried out neglecting water protection requirements, there are no sanitary conservation zones, the vegetation of the river banks has been destroyed, and sand and gravel are recovered in river channels.

The volume of contaminated (untreated) water discharge into the Dniester basin increased from 13 million m^3 in 1986 to 21 million m^3 in 1989 when 610 tons of petroleum products and 19,000 tons of organic compounds were delivered into water basins.

The low quality of water in the river Dniester threatens the water supply of the cities of Kishinev, Odessa and other settlements. The problem facing the water supply of the resort city of Odessa is especially acute.

Bashkiria

Industry, developed in the Bashkir Autonomous Republic in the post-war years, continues to employ mainly extensive technologies, involving the heavy utilisation of natural resources and neglect the requirements of environment protection. Production is concentrated in the towns of Ufa, Sterlitamak, Salavat, Meleuz, and Blagoveshchensk located in the middle course of the river Belaya, the main waterway of the Republic. Human living conditions have become extremely tough here. Ufa, Sterlitamak and Salavat are among the townships with the heaviest air pollution. In 1989, the contaminant emission into the atmosphere from the stationary sources of the Republic's 411 industrial enterprises amounted to 1,060,000 tons, of which 42.2% were produced by the enterprises of the USSR Ministry of Chemical and Petroleum Processing Industry, 26.0% by those of the USSR Ministry of Petroleum and Gas Industry, and 17.2% by those of the USSR Ministry of Power Engineering.

The offices of the Bashkir ASSR State Committee for Environmental Control disclosed 13 cases of emergency and unit discharges of contaminants. Thus, the *Kaustik* Production Association discharged chlorine and hydrogen chloride, the *Soda* Production Association emitted incomplete combustion gases, and the *Avangard* Factory discarded nitrogen oxides. Fifty-one out of 269 enterprises inspected in 1989 exceeded the established standards.

The situation with water resources is also tense in the Republic. The river Belaya, its influents, small rivers, lakes and water reservoirs are heavily stressed.

Effluent discharge into water basins exceeded 900 million m^3 in 1989, of which 468 million m^3 were contaminated. The largest amounts of contaminated waters were discharged by Ufa (160.2 million m^3), Sterlitamak (149 million m^3) and Salavat (60 million m^3).

The major polluters of water resources are the enterprises of the USSR Ministry of Petroleum and Gas Industry, the USSR Ministry of Metallurgy, the RSFSR Ministry of Public Utilities, the Bashkir Republic Agro-Industrial Association, and other Ministries and Administrations.

Emergency and regular discharges of contaminants into water basins were made. The pollution of the Belaya river was recorded in 28 cases (the perpetrators being the Beloretsk Integrated Metallurgy Plant, the Beloretsk Tractor Spring Factory, the Beloretsk Interregional Water Supply and Sewerage Association, the *Khimprom* Chemical Production Association, the Nofo-Ufimsky Petroleum Processing Factory, the Sterlitamak *Avangard* Factory, and the Ufa Water Supply and Sewerage Enterprise). Discharges were also registered into the Ishtiryak river (from the Ilishevsky Oil Factory), and the Ol'khovka river (from the Sterlitamak Machine-Building Factory), and others.

In 1989 the Belaya river was permanently contaminated with petroleum products, phenols, ammonia nitrogen, nitrate nitrogen, and copper and zinc ions, the pollution level being especially high between the town of Meleuz and the settlement of Pribel'sky.

The large lakes of Asly-kul', Beloe, and Kandry-Kul' are being contaminated. Subterranean waters in petroleum production regions are in an unsatisfactory sanitary condition. Some 40 settlements and villages are partially or completely devoid of drinking water, as water is polluted even in springs and wells.

Toxic and large-volume industrial waste disposal sites are being constructed with great care in the Republic. As of 1 January, 1990, 4.8 million tons of noxious industrial wastes were accumulated, of which more than 130 million tons belonged to the 1st and 2nd hazard classes.

The noxious wastes accumulated include about 35,000 tons of electroplating rejects containing heavy metals. These are not reclaimed, while their burial has been organised only by the Belebey *Avtonormal'* Factory.

The city of Ufa is facing the most hazardous conditions of all with toxic waste reclamation and/or dumping. The city has accumulated more than 6,000 tons of highly toxic wastes, more than 320,000 tons of moderately hazardous wastes and over 1 million tons of those presenting slight danger. However, the city does not have a dumping site, so that toxic wastes are mostly delivered to the city dumping ground, which is not equipped to accept them.

The improvement of the ecological situation in the Republic was the objective of the Decision of the USSR Council of Ministers, *On First-Priority Measures in Environment Protection in the towns of Sterlitamak and Salavat, Bashkir ASSR*, dated 14 July 1987.

The northern part of the Tyumen' region

This territory, lying within the borders of the Yamalo-Nenetsky Autonomous Area, is the seat of new petroleum and gas development. By the beginning of the development (some 25-30 years ago), the northern part of the Tyumen' Region was not only fully assimilated, but also heavily stressed, if account is taken of the weak resistance of its natural complexes to technological burdens, accompanied by the activization of cryogenic processes (heaving, thermal erosion, etc.). The USSR's second largest stock of reindeer grazed here and the region was a major supplier of valuable game fish and furs. During a 30-year period of development here the reindeer grazing area fell by 6 million hectares, or 12.5%, the fish yield halved, and fires destroyed about 1.3 million hectares of reindeer pastures and hunting areas. If the new petroleum producing enterprises only used the lands allotted to them, they would occupy a mere 0.4% of the total territory usable as pastures.

At one of the oil fields examined in the newly industrialised regions, there were 25 industrial exploiting objects and 12.3km of line structures (pipelines, roads, power transmission lines, etc.) per 1 km^2 of territory. The intensive influence of new industries on the natural environment leads to the appearance of conflicting ecological situations even during the early stages of development, e.g. during geological prospecting. For example, in three years of Bovanenko oil field development (Yamal Peninsula) the soil and the vegetation cover have been destroyed and cryogenic processes have affected 38,000 hectares, or one-quarter of the oil field's total area.

5.3 The After-effects of the Chernobyl' Nuclear Power Station Accident

In 1989, the radioactive matter concentration in the air of certain regions of the USSR remained, to a significant extent, conditioned by the after-effects of the Chernobyl' accident of 26 April 1986.

The level of radioactive contamination of the atmosphere's surface layer outside the 60km area around the Chernobyl' Nuclear Power Station and outside the territories near the junction of the Gomel', Mogilev and Bryansk Regions and some "patches" on the territories of the Bryansk, Tula and Orel Regions, southern Ukraine and Transcaucasia, were close to those before the accident.

The highest average annual concentration of cerium-144, equalling 107 10Bq/m^3, was observed in the town of Pripyat'. In Chernobyl', average annual concentrations of cerium-144 and rhutenium-106 amounted to 16.3 10 and 8.3 10Bq/m^3, respectively. Elsewhere on the European territory of the USSR, in areas remote from the accident zone, radionuclides cerium-144 and rhutenium-106 were observed in the surface layers of the atmosphere periodically, and then at concentrations below 0.37 10Bq/m^3.

Average annual concentrations of plutonium-239 and plutonium-240 in Chernobyl' and Pripyat' were at 0.10 10 and 0.40 10Bq/m^3, respectively.

The air concentrations of individual radionuclides indicated above are significantly (by 4-5 orders of magnitude) lower than the average annual values permitted by USSR standards for a limited part of the population.

The absolute value of radioactive fall-out on the territory of the USSR varied widely. In some points of the contaminated zone and around it, the caesium-137 and strontium-90 fall-out was one or two orders of magnitude higher than the USSR average.

Concentrations of cesium-137 and strontium-90 in the soil by the end of 1989 were practically at the level observed in the later part of 1986, with the country-average (excepting the contaminated zone) values approaching 70mCi/m² (2.6kBq/m²) for cesium-137 and 40mCi/m² (1.5kBq/m²) for strontium-90. Contents of caesium-144, rhutenium-106 and cesium-134 in the soils were negligibly small and did not exceed a few millicuries per square metre. In comparison with the global background, the contamination of the USSR with cesium-137 after the Chernobyl' accident is noticeably greater on the European territory of the country to the south of the latitude of Moscow and Sverdlovsk, in western Lithuania and in western Georgia. Elsewhere in the country cesium-137 content in the soil is at the global background level.

In 1989, rivers flowing through the contaminated area carried strontium-90 and cesium-137 in higher concentrations than before the accident. Thus, maximum concentrations of radionuclides in the water of the river Pripyat' (in the town of Chernobyl') constituted 1,500Bq/m³ in terms of strontium-90, while before the accident the strontium-90 concentration in rivers of the European part of the USSR was an average of 17.4Bq/m³.

In the course of the year [1989] strontium-90 concentration in the river Pripyat' ranged from 220Bq/m² to 1,480Bq/m³, while for cesium-137 this range was 190-1,380Bq/m².

The average annual concentration of strontium-90 in the water of the Dnieper where it enters the Kiev Water Reservoir was at 148Bq/m³, and that of cesium-137 at 370Bq/m³.

In the cascade of the Dnieper water reservoirs, the highest concentrations of strontium-90 and cesium-137 were observed in the northern part of the Kiev Reservoir (1,630Bq/m² and 1,070Bq/m³, respectively). In this Reservoir the concentrations of radionuclides diminished with the distance from the mouth of the river Pripyat'.

Near Kiev, concentrations of strontium-90 and cesium-137 in the Dnieper water in 1989 were below those of 1988, they equalled 266Bq/m² and 370Bq/m³, respectively. In the lower course of the Dnieper (the Kakhovka Water Reservoir), the strontium-90 concentration dropped by 20% against last year's [1989] figure and amounted to 252Bq/m³. In some large rivers flowing in the southern part of the country's European territory, but missing the contaminated area, the level of strontium-90 was higher than before the accident.

In the Yuzhny Bug river (at the city of Nikolaev, the concentration of strontium-90 (180Bq/m³) remained practically at the 1988 level, i.e. was seven times larger than in 1985. The concentration of strontium-90 in the mouths of the rivers Don (30Bq/m²), Dniester (20Bq/m²), Kura (16Bq/m²), and Rioni (11Bq/m²) fell in 1989 by 20-50% as compared with 1988. While the strontium-90 concentration in the rivers Don and Dniester was, respectively, triple and double pre-accident value, in the rivers Kura and Rioni it

diminished practically to the 1985 figures. However, the 1989 radionuclide concentration in the River Volga (near the town of Verkhnee-Lebyazh'e) grew by 25% compared with the preceding year.

The annual average concentrations of cesium-137 in the rivers Dnieper (at the town of Rechitsa), Pripyat' (Mozyr'), Sozh (Gomel'), Iput' (Dobrush), Besed' (Svetilovichi), Oka (Byelaev), Plava (Plavsk), Zhizdra (Kozel'sk), and Upa (Tula) lay in the range of 150-590 Bq/m^2. This is far below the permissible concentrations which are set at 4 10Ci/l (1.48 $10Bq/m^2$) for strontium-90 and at 1.5 10Ci/l (5.55 $10Bq/m^2$) for cesium-137.

The concentration of strontium-90 in the north-western part of the Black Sea in 1989 was $24Bq/m^2$. Cesium-137 concentration in the surface layers of the Black Sea in 1989 varied between 40 and $80Bq/m^2$. In 1989 the average concentration of cesium-137 in the central part of the Gulf of Finland equalled $90Bq/m^2$, while in the open part of the Baltic Sea it fluctuated from $92Bq/m^2$ to $174Bq/m^2$.

Thus, in 1989 high levels of radioactive contamination of natural objects on the territory of the USSR were observed in the Chernobyl' zone and adjacent regions.

Plate 3. Prioksko-Terrasnyy Zapovednik, entrance to the Bison Breeding Centre

CHAPTER 6: NATURE PROTECTION ACTIVITIES IN THE USSR

A long-term State programme of environment protection and the rational utilisation of natural resources of the USSR for the 13th Five-Year Plan (1991-95) and for the period up to the year 2005 has been developed by the USSR State Committee for Science and Technology, the USSR Academy of Sciences, the USSR State Planning Committee, the USSR State Committee for Hydrometeorology and Environmental Control, the USSR State Committee for Forestry, the USSR Ministry of Fish Industry, the USSR Ministry of Geology, and the All-Union Central Council of Trade Unions, as well as with Councils of Ministers for Union Republics and other Ministries and Administrations.

The programme determines the concept of the Soviet Government, strategical and tactical tasks which must be solved by the society as a whole and by its industrial, scientific, ecological and other Governmental and social bodies and organisations if the ecological crisis experienced by the USSR is to be overcome, if the after-effects of past accidents are to be eliminated and new environmental calamities prevented.

In the period of 1995-2005, the environmental situation must improve step by step, special programmes must be carried out to eliminate the damage inflicted on the natural environment and its individual complexes and to re-establish disturbed ecosystems.

Investments in the protection of the natural environment should total 46,000-55,000 million roubles in the 13th Five-Year Plan, 74,000-100,000 million roubles in the 14th, and 120,000-180,000 million roubles in the 15th (in comparable prices). Thereby, the total investment in environment protection and rational utilisation of natural resources in the period of 1991-2005 should be at least 240,000-335,000 million roubles.

The tense environmental situation in the USSR requires radical measures to be taken to raise the efficiency of supradepartmental inspection. In this connection it is necessary:

- to complete the transfer of all departmental environmental services and inspections (except for the Sanitary Supervision Service and the State Traffic Inspectorate, the USSR Ministry of Internal Affairs) to the subordination of the USSR State Committee for Nature Protection;
- to create environmental police bodies; and
- to promote the formation of public organisations for control over the state of the environment and observance of ecological legislation.

Beginning with 1991, production of principal kinds of raw materials, such as petroleum, gas, and ore mineral resources, should be stabilised at the 1990 level, while the

power provision programme must be directed at ensuring a rational utilisation of the available power resources; and the build-up of power resources should be stopped by 1995. To do so, a moratorium, beginning in 1991, on the construction of nuclear and thermal power stations and the development of petroleum and gas fields in the Yamal Peninsula, should be announced.

The total area of the USSR's reservations is planned to increase to at least 2% of its territory by 1995, to at least 4% by the year 2000, and to at least 6% by the year 2005.

According to the programme, a State environmental assistance service should be created under the auspices of the State Commission of the USSR Council of Ministers for Emergency Situations, and measures should be taken to raise the safety level of nuclear power stations and hazardous chemical enterprises.

In 1989 the USSR Supreme Soviet adopted a number of decisions on the organisation or completion of work in preparation of *Fundamental Legislation of the USSR and Union Republics on Land*, and passed the USSR laws *On Property in the USSR, On Differentiation of Authority Between the USSR and Subjects of the Federation, On General Bases of Local Self-Management and Local Economy in the USSR, On Fundamentals of Economic Relations of the USSR, Union and Autonomous Republics,* and a number of other legislative acts.

The USSR Council of Ministers has also adopted many decisions of great importance for environment protection; special note should be made of Decision No. 15 *On the Shut-Down of the Power Units of the Armenian Nuclear Power Station and Measures to Assure Power Supply to the Republics of Transcaucasia,* dated 6 January 1989; Decision No. 495 *On the Suspension of the Construction and Postponement of the Beginning of the Construction of a Number of Large-Size and Expensive Projects,* dated 21 June 1989; Decision No. 537 *On the State Commission of the USSR Council of Ministers for Emergency Situations*, dated 5 July 1989; and Decision No. 888 *On the Intensification of Control over Forest Preservation in the Moscow Region*, dated 25 October 1989.

Regulation of the USSR Supreme Soviet *On Urgent Measures for the Normalisation of the Ecological Situation in the Country*, adopted 27 November 1989, has become the most important legislative act effective in the Union as a whole. It is planned that draft laws on the conservation and rational utilisation of the flora and on specially protected natural territories should be prepared.

The USSR State Committee for Nature Protection adopted the decision and, jointly with other organisations, developed a draft law of the USSR on environment appraisal by experts.

A draft law of the USSR on the protection of nature has been developed and presented for consideration to the USSR Council of Ministers. The draft previews, among other things, the legal enforcement of fees for the utilisation of natural resources and fines for natural environment contamination by emissions or discharges of noxious matters and for other environmentally adverse activities. Provisions have also been made for the

compensation of damages inflicted as a result of established norms of natural resource utilisation being exceeded as well as for the contamination of the natural environment. Economic control methods governing environmental activities are also to be intensified.

A draft regulation on the USSR State Committee for Nature Protection and a draft law of the USSR *On Granting the Right to Bodies of the USSR State Committee for Nature Protection to Examine the Cases of Administrative Responsibility for Delinquencies in the Field of Protection of Nature and the Utilization of Natural Resources* have been prepared and sent for consideration to the USSR Council of Ministers. Furthermore, draft Regulations on the State Supervision over the Protection of Nature and Utilisation of Natural Resources have been developed. They were officially presented to the USSR Council of Ministers in early 1990.

As in 1989, an experiment was held in a number of Autonomous Republics, Territories, Regions, and cities with a view to advancing the economic mechanism of natural resources management, and on 22 June 1989 the USSR State Committee for Nature Protection, the USSR State Planning Committee, the USSR State Committee for Prices, and the USSR Ministry of Finance approved the *Procedure for the Estimation and Application of Rates of Payment for Emissions/Discharges of Pollutants into the Natural Environment*. Additionally, on 14 June 1989, the USSR State Committee for Nature Protection approved *Provisional Methodic Recommendations on the Estimation of Payments for Natural Environment Pollution*. Various subordinated regulatory acts were also issued by other administrative bodies charged with environment protection.

Over 500,000 administrative cases of non-compliance were registered in 1989, while in 1988 the number approached 544,000 cases. Administrative proceedings were instituted against 479,000 persons, of which 414,000 persons were fined. The average value of the fine amounted to 28 roubles (25 roubles in 1988). Cases of 4,000 poachers, whose actions fell under the category of criminal offences in breach of hunting and fishing rules, were submitted to investigating agencies.

The sum of fines exacted in 1989 totalled 11.4 million roubles, while the sum of damages paid by enterprises upon claims of the USSR State Committee for Nature Protection was about 100 million roubles. On the other hand, according to this Committee's estimates, in 1989 alone the damages from emergency and regular emissions and discharges of environment pollutants exceeded 200 million roubles.

In 1989, the work of almost 1,000 enterprises or individual departments with an aggregate annual output of 4,411,000 tons of products, was stopped for a total of 1,051 days for gross violations of environmental legislation. These included factories manufacturing scarcely available products, such as paper pulp, synthetic detergents, sulphuric and boric acids, and starch. For example, the failure of the Svetogorsk (Leningrad Region) Integrated Pulp-and-Paper Mill of the USSR Ministry of Forestry to achieve the rated performance of waste treatment plants was the reason for a 12-day shut-down of two digesters of a capacity of 33,000 tons in the woodpulp department. The inefficient functioning of air-protecting equipment resulted in a 77-day suspension of use of an air slaking area with an annual capacity of 890,000 tons in the town of Krasnoperekopsk.

The reasons for which the work of enterprises and individual departments was halted in 1989 also included the incomplete construction or untimely commissioning of waste treatment devices, the use of outdated equipment and processes, and emissions and/or discharges at levels exceeding maximum permissible rates for environmental pollutants.

As a result of the domination of the administrative-command method of management, the USSR has fallen into an environmental situation with an acuteness unparalleled in industrialised nations. The national economy continues to consume 2-2.5 times more resources per product than in economically developed countries. According to the estimates of the USSR Academy of Sciences, the economic losses of the USSR national economy as a whole resulting from environment pollution are approaching 50,000-70,000 million roubles per annum, or 10-11% of the national income produced in the USSR.

A realistic danger of the depletion of certain kinds of natural resources has arisen; the quality of water, air, soil and ecosystems has been undergoing significant changes; and the volume and variety of wastes has also increased. All this poses the threat of ecological risk to human health and the environment.

Fees for the right to utilise natural resources and fines levied for pollutant emissions into the natural environment do not appear in the enterprise's accounts. In this case the sum of taxes on profits paid to the budgets of Union and Autonomous Republics and to local budgets, the payment for labour resources, and the payment for natural resources (excepting rent payments and sums ascribed to the cost of the products, work or services) must not exceed 23% of taxable profit. Payments for contaminant emissions in excess of the established limits (i.e. fines) and for natural resources utilisation surpassing the prescribed rates (i.e. fees) are withdrawn from the profits left to the disposal of the enterprise.

At the same time a system of tax exemptions is introduced, which takes into account nature protection activities and includes the reduction of taxable profits when measures are taken to protect the environment and the granting of tax advantages to enterprises manufacturing environment-protection equipment, materials and agents, as well as instruments and equipment for environmental monitoring.

In 1990, by a decision of the State Commission of the USSR Council of Ministers for Economic Reform, an experiment aimed at advancing the economic mechanism of nature utilisation was set up in 49 regions of the USSR. The targets were to improve the state of the natural environment in regions with complicated ecological situations, to clarify the methodic approaches to estimating the values and order of exacting the fees for natural environment contamination, and to test, in practice, the methods of formation and directions of application of nature protection funds in the conditions of local self-management and self-financing. In a number of regions of the USSR, fees were introduced by sessions of Soviets of People's Deputies for contaminant emissions in the 1988-89 period.

In these cases, the fees were, as a rule, estimated as proceeding from the economic damage inflicted on the natural environment. However, the estimated damages proved

rather large, in some instances they exceeded the accountable profits of the enterprise in question. When such was the case, the fee was estimated as a portion of the damage.

However, it was not always possible to find an optimum solution when determining the sum to be paid. For example, the *Kostromaenegro* Production Association for Power Supply to City of Kostroma was to be fined a sum which, according to different estimates, varied between 10 million roubles and 108 million roubles. Taking into consideration that the Association was expected to receive an accountable profit of 42 million roubles in 1989, this sum was insufficient to cover the fee.

Local environment protection bodies have been formed in many townships. They receive fees for environment pollution, sums exacted by court sentences for violations of environmental legislation, fines, and other incomes.

In the city of Dnepropetrovsk, fees for contaminant emissions/discharges into the natural environment are entered into the special ledgers of the city fund for environment protection. If the fees are deferred, a penalty is taken for each day of the delay. The city Executive Committee and the city Committee for Protection of Nature approved the forms of agreements on granting interest-free credits and an advantageous rate of payment for environment pollution to enterprises carrying out capital-intensive environmental measures. Similar projects are being undertaken in Saratov, Tver' and other cities: the sum to be paid by an enterprise is reduced by the value of the environment-protective measures it takes.

Ecological funds can be raised from various sources, including depreciation charges on environment-protection structures and objects; credits and subsidies of territorial ecological funds (banks) for the reduction of harmful effects on the environment; income (depositor's interest) from keeping the money of the ecological fund in a bank; the portion of enterprise income allotted to ecological activity financing; and other sources.

The distribution of assets of territorial funds among local, Republic and Union funds is subject to agreement.

At the present time, Republic funds for environment protection have been instituted in the RSFSR, the Ukrainian SSR, the Azerbaijan SSR, the Estonian SSR, and some other Republics.

In order to finance unexpected operations aimed at ensuring natural environment conservation and quality improvement on the scale of the USSR, the USSR State Committee for Nature Protection has instituted an all-Union State fund for nature protection. The fund, formed by deposits of local funds for environment protection, operates account no. 140305 (opened on 4 September 1989) in the USSR Agricultural Bank Operations Department.

The creation of an economic mechanism of nature management in regions of the USSR has provided incentives for a number of enterprises to start taking ecological measures.

In order to solve practical tasks in the field of nature management, the Kostroma and Yaroslavl' Regional, Gorki, Dnepropetrovsk, and Saratov City Committees for the Conservation of Nature have established cost-accounting ecological centres which act as customers in nature protection projects, supervise the progress of the projects and the spending of money allotted for the purpose from the nature-protection funds, and render practical assistance to enterprises in the solution of ecological problems.

It is planned to use these centres as the basis for the establishment of laboratories, computer centres and production facilities (for the recovery of wastes, construction and operation of waste treatment plants, etc.).

At the same time, practical work of Republics, regions and cities in the conditions of the economic experiment has shown that a number of problems exist which limit the introduction of the new economic mechanism of nature management. The experiment is restrained by the lack of basic legal documents required to carry out environment protection activities and the absence of a Regulation on the USSR State Committee for Nature Protection and its local offices.

The USSR State Committee for Nature Protection has established a network of expert appraisal centres, which includes the Main State Ecological Expert Council of the USSR State Committee for Nature Protection, main administrations (administrations, departments) of State ecological expert appraisal of State Committees for Nature Protection in Union and Autonomous Republics, respective departments at Regional committees for environment protection and that of Moscow City. The formation of the system of expert appraisal bodies employing over 600 specialists was basically completed in 1989.

The USSR State Committee for Nature Protection has distributed its functions between expert appraisal bodies functioning at different levels. According to this distribution, the Main State Ecological Expert Council has been charged with the expert appraisal of all kinds of pre-planning and pre-design documentation:

- for the development and location of the USSR's productive forces and branches of its national economy;
- of the most complicated and largest economic objects and complexes;
- of nuclear power enterprises;
- of joint ventures;
- of projects of economic activities whose implementation may exert influence on the natural environment of two or more Union Republics.

Besides this, the Main State Ecological Expert Council carries out the ecological appraisal of new machinery, equipment, materials and compounds, as well as the evaluation of draft all-Union legal-regulatory, instructive-methodic and engineering-regulatory documentation bearing on economic activities.

All other pre-planning, pre-design and design documents, irrespective of the estimated cost of the project and the departmental subordination of its owners, are subjected to expert appraisal at Republic, Territorial, and Regional Committees.

The Main State Ecological Expert Council of the USSR State Committee for Nature Protection has carried out appraisals of the following documents:

- a draft of *Guidelines for the Economic and Social Development of the USSR for the 13th Five-Year Plan and for the Period Ending in 2005*;
- a plan for the development of the rail transport of the USSR for the period ending in 2005;
- a plan for the development and location of the industry of power and transport machine building for the period ending in 2005;
- a plan for the development and location of the machine-tool industry for the period ending in 2005;
- a plan for the development and location of enterprises of chemical and petroleum machine building for the period ending in 2005.

During the year [1989], a total of thirteen development plans of branches of the USSR's national economy were assessed. The expert evaluation of the *Guidelines* demonstrated that their developers did not take into consideration the ecological and resource-availability aspects and that attempts at implementing general economic targets alone may lead to an aggravation of the social and ecological situation of the USSR.

None of the plans of development and location of branches of national economy met the requirements set by the USSR State Committee for Nature Protection for this type of document, so that all of them were returned for revision.

Expert bodies belonging to the USSR State Committee for Nature Protection analysed over 35,000 documents, among them the following:

- the project design of the South-Urals Nuclear Power Station;
- the principal design solutions of the South-Ukrainian Power Complex and a feasibility study for the expansion of the South-Ukrainian Nuclear Power Station;
- the project design of the Bashkir (Ishtugan) Water Reservoir on the Belaya River;
- the feasibility study of the prototype of the Bovanenkovo and Kharasavey gas condensate fields in the Yamal Peninsula, taking into account the transportation of the gas and other goods;
- the project design of the second stage of the Astrakhan' Gas Processing Plant and gas condensate field for the pilot production period;
- the project design of a complex for the processing of imported (Syrian) phosphates at the Bryansk Phosphorite Plant;
- a feasibility study for the development of a new facility for the manufacture of soluble pulp at the Ust'-Ilim Forest Complex;
- a territorial complex system of environment protection in the basin of Lake Baikal;

- a project design for the prototype of the Karachaganak gas condensate field for an annual yield of 11,000 million m^3 with the use of the skyling process;
- a feasibility study for the construction of a facility for an annual production of 100,000 tons of polypropylene at the *Orgsintez* Production Association, Sumgait;
- a feasibility study for the construction of the Baryshevka Tannery in the Kiev Region;
- a feasibility study for the construction of a joint venture factory in Tobol'sk together with a consortium of US and Japanese companies; and
- project design materials for the construction and reconstruction of the Kirishi Plant for vitamined, protein concentrated feeds.

The overall results obtained by the State ecological expert appraisal system show that project design documentation is insufficiently developed.

Projects continue to be designed without preliminary analysis of the potential consequences of the installations that are to be built on the natural environment; and the state of environment in the region proposed for construction is not taken into account.

Biological education

In 1989, the USSR State Committee for Nature Protection, the USSR State Committee for Science and Technology, the USSR Academy of Sciences, the USSR Academy of Pedagogical Sciences and the All-Union "Znanie" [Knowledge] Society approved of a *Programme of Education in the Field of Ecology for the 13th Five-Year Plan and for the Period Ending in 2005*, which is expected to eliminate the drawbacks observed. The *Programme* is aimed at the development of a coordinated system of the mass ecological education of the urban and rural population, the universal and continuous education of pre-school and school children, and students and specialists in the national economy, cultivating in them the practical habits of rational nature utilisation.

The *Programme* consists of two parts, a theoretical side, comprising conceptual fundamentals, and a practical side, sub-divided into 8 sections. It has become the pivot of work of many State and public organisations. All the four levels of formal and informal ecological education and upbringing are regarded as a single complex whose elements supplement and enrich each other.

Appendix 1

Distribution and basic characteristics of strictly protected areas, hunting-management units and nature national parks

Strict nature reserve, protected hunting grounds, national parks	Location	Year of establish-ment	Area (in ha x10^3)	Numbers of protected species Mammals	Birds	Plants
	RESERVES (RSFSR)					
"Azas"	Tuvinskaya ASSR	1985	333.0	42	120	719
Altaiski	Gorno-Altaiskaya avtonomnaya oblast	1932	881.2	67	310	1,452
Astrakhanski	Astrakhanskaya oblast	1919	63.4	30	260	287
Baikalski	Buryatskaya ASSR	1969	165.7	49	271	812
Barguzinski	Buryatskaya ASSR	1916	263.2	39	257	777
Basegi	Permskaya oblast	1982	19.4	44	136	418
Baikalo-Lenski	Irkutskaya oblast	1986	660.0	50	236	800
Bashkirski	Bashkirskaya ASSR	1930	49.6	52	177	632
Bolshekhekhtsirski	Khabarovski kray	1963	45.1	48	200	898
"Bryanski les"	Bryanskaya oblast	1987	11.8	36	161	-
Bureinski	Khabarovski kray	1987	358.4	26	34	236
Verkhne-Tazovski	Tumenskaya oblast	1986	631.3	29	130	90
Visimski	Sverdlovskaya oblast	1971	13.5	40	121	407
Vitimski	Irkutskaya oblast	1982	585.0	35	177	627
Volzhsko-Kamski	Tatarskaya ASSR	1960	8.0	50	181	844
Voronezhski	Voronezhskaya, Lipetskaya oblasti	1927	31.1	57	185	987
"Galichya gora"	Lipetskaya oblast	1925	0.2	33	186	1,021
Dalnevostochni	Primorski kray	1978	64.3	6	309	984
Darvinski	Vologodskaya, Yaroslavskaya oblasti	1945	112.6	37	223	582
Dagestanski	Dagestanskaya ASSR	1987	18.7	12	70	400
Daurski	Chitinskaya oblast	1987	44.8	34	256	124
Zhigulevski	Kuibishevskaya oblast	1966	23.1	35	105	774
Zavidovski	Kalininskaya oblast	1929	125.4	48	204	-
Zeyski	Amurskaya oblast	1963	99.4	45	150	851
Ilmenski	Chelyabinskaya oblast	1920	30.4	52	163	831
Kabardino-Balkarski	Kabardino-Baikarskaya ASSR	1976	74.1	29	100	1,000
Kavkazski	Krasnodarski kray	1924	263.3	70	222	1,700
Kandalakshski	Murmanskaya oblast	1932	58.1	30	208	633
"Kedrovaya pad"	Primorski kray	1916	17.9	50	200	903
Kostomukshski	Karelskaya ASSR	1983	47.5	23	98	200
"Kivach"	Karelskaya ASSR	1931	10.6	42	202	570

Strict nature reserve, protected hunting grounds, national parks	Location	Year of establish-ment	Area (in ha x10^3)	Numbers of protected species Mammals	Birds	Plants
Komsomolski	Khabarovski kray	1963	63.9	49	216	650
Kronotski	Kamchatskaya oblast	1967	1,099.0	42	217	810
Kurilski	Kamchtskaya oblast	1984	65.4	24	229	800
Lazovski	Primorski kray	1957	120.0	56	302	1,402
Laplandski	Murmanskaya oblast	1930	278.4	31	180	820
"Les na Vorskle"	Belgorodskaya oblast	1979	1.0	50	170	550
Magadanski	Magadanskaya oblast	1982	883.8	46	135	300
"Malaya Sosva"	Tumenskaya oblast	1976	92.9	43	184	362
Mordovski	Mordovskaya ASSR	1935	32.1	61	207	827
Nizhne-Svirski	Leningradskyaya oblast	1980	41.4	40	254	571
Okski	Ryasanskaya oblast	1935	22.9	55	229	826
Olekminski	Yakutskaya ASSR	1984	847.1	40	180	221
"Ostrov Vrangelya"	Magadanskaya oblast	1976	795.7	15	151	438
Pechoro-Ilichski	Komi ASSR	1930	721.3	45	208	702
Pinezhski	Arkhangelskaya oblast	1974	41.2	35	126	485
Poronaiski	Sakhalinskaya oblast	1988	56.7	-	-	-
Prioksko-Terrasni	Moskovskaya oblast	1948	4.9	50	130	816
Putoranski	Krasnoyarski kray	1988	1,887.3	-	-	-
Sayano-Shushenski	Krasnoyarski kray	1976	390.4	47	250	915
Severo-Osetinski	Severo-Osetinskaya ASSR	1967	29.0	44	167	2,000
Sikhote-Alinski	Primorski kray	1935	347.1	63	375	1,100
Sikhondinski	Chitinskaya oblast	1973	211.0	59	170	613
"Stolbi"	Krasnoyarski kray	1925	47.2	50	156	660
Taimirski	Krasnoyarski kray	1979	1,348.7	16	85	654
Teberdinski	Stavropolski kray	1936	85,0	43	170	1,250
Ussuriyski	Primorski kray	1932	40.4	62	64	860
Ust'-Lenski	Yakutskaya ASSR	1986	1,433.0	29	95	723
Khinganski	Amurskaya oblast	1963	97.3	47	300	700
Khoperski	Voronezhskaya, Lipetskaya oblasti	1935	16.2	49	215	1,019
Tsentral'no-Les-noi	Kalininskaya oblast	1931	21.4	32	200	546
Tsentral'no-Sibirski	Krasnoyarski kray	1985	972.0	45	239	643
Tsentral'no-Chernozemni	Kurskasya, Belgorodskaya oblasti	1935	4.9	40	186	983
Shul'gan-Tash	Bashkirskaya ASSR	1986	22.5	46	162	735

Strict nature reserve, protected hunting grounds, national parks	Location	Year of establish-ment	Area (in ha x10^3)	Numbers of protected species Mammals	Birds	Plants
Uganski	Tyumenskaya oblast	1982	648.6	27	148	339
Yuzhno-Ural'ski	Bashkirskaya ASSR	1978	254.9	42	160	700
UKRAINIAN SSR						
"Askaniya-Nova"	Khersonskaya oblast	1921	33.3	57	213	1,729
"Dunaiskiye plavni"	Khersonskaya, Odesskaya oblasti	1981	14.9	22	212	563
Kanevski	Kievskaya oblast	1923	2.0	49	240	832
Karadagski	Krimskaya oblast	1979	2.9	42	200	1,100
Karpatski	Ivano-Frankovskaya, Zakapatskaya oblasti	1968	12.8	50	141	898
Luganski	Voroshilovgradskaya oblast	1968	1.6	43	151	1,037
"Mis Mart'yan"	Krimskaya oblast	1973	0.2	28	146	500
Polesski	Zhitomirskaya oblast	1968	20.1	39	174	604
Rostochye	L'vovskaya oblast	1984	2.1	33	117	793
Ukrainski Stepnoi	Donetskaya, Voroshilovgradskaya, Sumskaya oblasti	1961	2.8	30	129	926
Chernomorski	Khersonskaya oblast	1927	57.0	44	300	624
Yaltinski	Krimskaya oblast	1973	14.5	33	91	1,363
BYELORUSSIAN SSR						
Berezinski	Vitebskaya oblast	1925	90.6	53	203	767
Pripyatski	Gomel'skaya oblast	1969	63.5	49	256	826
UZBEK SSR						
"Baday-Tugay"	Karakalpakskaya ASSR	1971	5.9	21	96	167
Gissarski	Kashkadaryinskaya oblast	1983	87.5	30	116	870
Zaaminski	Sirdaryinskaya	1959	15.6	30	140	700
Zeravshanski	Samarkandskaya oblast	1975	2.4	16	180	300
Kitabski	Kashkadaryinskaya oblast	1979	5.4	32	121	400
Kizilkumski	Khorezmskaya oblast	1971	10.1	37	197	102
Nuratinski	Sirdaryinskaya oblast	1975	22.1	18	135	504
Surkhanski	Surkhandaryinskaya oblast	1986	28.0	41	193	728
Chatkalski	Tashkentskaya oblast	1947	35.7	32	172	1,026

Strict nature reserve, protected hunting grounds, national parks	Location	Year of establish-ment	Area (in ha x10^3)	Numbers of protected species Mammals	Birds	Plants
KAZAKH SSR						
"Aksu-Dzhabagli"	Chimkentskaya oblast	1927	75.1	47	239	1,404
Alma-Atinski	Alma-Atinskaya oblast	1961	73.3	38	200	961
Barsakel'messki	Kizil-Ordinskaya oblast	1939	18.3	6	203	256
Kurgal'dzhinski	Tselinogradskaya oblast	1968	237.1	38	296	331
Markakol'ski	Vostochno-Khazakhstanskaya oblast	1976	75.0	58	251	800
Naurzumski	Kustanayskaya oblast	1934	87.7	32	233	687
Ustyurtski	Guryevskaya oblast	1984	223.3	27	81	261
GEORGIAN SSR						
Adzhmetski	-	1957	4.8	23	105	710
Algetski	-	1965	6.8	27	66	1,009
Akhmetski	-	1980	16.3	38	120	1,500
Borgeomski	-	1959	17.9	23	48	743
Vashlovanski	-	1935	8.0	30	57	660
Kazbegski	-	1976	8.7	22	120	1,347
Kintrishski	Adzharskaya ASSR	1959	13.9	22	60	1,043
Kolkhidski	-	1935	0.5	16	120	260
Lagodekhski	-	1921	17.9	40	124	1,316
Liakhvski	Yugo-Osetinskaya A oblast	1977	6.4	26	100	600
Mariamdzhvarski	-	1939	1.0	18	130	670
Pitsunda-Myusserski	Abkhazskaya ASSR	1966	3.6	17	115	723
Pskhu-Gumistinski	Abkhazskaya ASSR	1976	40.8	40	142	1,300
Ritsinski	Abkhazskaya ASSR	1957	16.3	27	53	800
Saguramski	-	1946	5.2	24	95	675
Satapliyski	-	1935	0.4	18	60	611
AZERBAIJAN SSR						
Ag-Gel'ski	-	1978	4.4	10	140	40
Basutchaiski	-	1974	0.1	6	10	18
Gei-Gel'ski	-	1965	7.1	8	5	416
Girkanski	-	1969	2.9	15	11	400
Zakatal'ski	-	1929	23.8	32	103	866

Strict nature reserve, protected hunting grounds, national parks	Location	Year of establish-ment	Area (in ha x10^3)	Numbers of protected species Mammals	Birds	Plants
Ilisuinski	-	1987	9.3	35	89	800
Ismailinski	-	1981	5.8	18	104	38
Karayazski	-	1978	4.9	9	40	642
Kizil-Agachski	-	1929	88.4	23	278	360
Pirkulinski	-	1968	1.5	30	193	520
Tirianchaiski	-	1958	12.6	11	95	415
Shirvanski	-	1969	17.7	12	65	71
LITHUANIAN SSR						
"Zhuvintas"	-	1946	5.5	36	258	590
"Kamanos"	-	1979	3.7	36	120	526
"Chapkyalyai"	-	1975	8.5	33	158	659
MOLDAVIAN SSR						
"Kodri"	-	1971	5.2	43	146	985
"Yagorlik"	-	1988	1.0	-	-	-
LATVIAN SSR						
"Grini"	-	1936	1.5	6	73	460
"Krustkalni"	-	1977	2.9	34	117	727
"Morotssala"	-	1912	0.8	8	90	470
Slitere	-	1921	15.4	37	130	800
"Teichi"	-	1982	19.0	34	177	552
KIRGHIZ SSR						
Besh-Aral'ski	Oshskaya oblast	1979	116.7	32	98	700
Issik-Kul'ski	Issik-Kul'skaya oblast	1948	19.0	24	232	297
Sari-Chelekski	Oshskaya oblast	1959	23.9	34	165	1,071
Narinski	Issik-Kulskaya oblast	1983	24.2	21	60	182
TAJIK SSR						
"Dashti-Dzhum"	Khatlonskaya oblast	1983	19.7	-	35	-
"Ramit"	-	1959	16.2	31	150	1,000
"Tigrovaya balka"	-	1938	49.7	28	214	480
ARMENIAN SSR						
Dilizhanski	-	1958	24.2	35	120	1,200
Khosrovski	-	1958	29.7	37	123	1,700
Shikaokhski	-	1975	10.0	13	31	-

Strict nature reserve, protected hunting grounds, national parks	Location	Year of establish-ment	Area (in ha x10^3)	Numbers of protected species Mammals	Birds	Plants
Erebuniyski	-	1981	0.1	-	-	1
TURKMEN SSR						
Amudaryinski	Chardzhouskaya oblast	1982	50.5	41	123	195
Badkhizski	Mariyskaya oblast	1941	87.7	42	258	800
Kaplankirski	Tashauzskaya oblast	1979	570.0	26	147	145
Kopetdaghski	Ashkhabad, pos. Berzenghi	1976	49.8	70	250	1,000
Krasnovoski	-	1968	262,0	18	317	486
Kughitanski	Chardzhouskaya oblast	1986	27.1	22	75	-
Repetekski	Chardzhouskaya oblast	1928	34.6	20	25	134
Syunt-Khasardaghski	-	1978	29.7	37	217	799
ESTONIAN SSR						
Viydumyaeski	-	1957	1.2	16	60	662
Vil'sandiyski	-	1971	10.7	10	246	495
Matsaluski	-	1957	39.7	48	261	702
Nighulaski	-	1957	2.8	36	144	328
	PROTECTED HUNTING GROUNDS					
UKRAINIAN SSR						
Azovo-Sivashskoe	Khersonskaya oblast	1957	30.1	6	230	240
Dneprovsko-Teterevskoye	Kievskaya oblast	1967	30.5	16	15	11
Zalesskoye	Kievskaya oblast	1957	15.0	15	17	160
Krimskoye	Krimskaya oblast	1923	43.0	37	250	1,180
BYELORUSSIAN SSR						
"Byelovezhskaya pushcha"	Brestskaya, Ghrodnenskaya oblasti	1940	98.5	54	226	836
MOLDAVIAN SSR						
"Redenski les"	-	1976	5.7	18	30	40

Strict nature reserve, protected hunting grounds, national parks	Location	Year of establish-ment	Area (in ha x10^3)	Numbers of protected species Mammals	Birds	Plants
NATURE NATIONAL PARKS						
RSFSR						
Bashkirski	Bashkirskaya ASSR	1986	98.1	22	120	-
Zabaykal'ski	Byuryatskaya ASSR	1986	269.1	22	291	1,500
"Kurshskaya kosa"	Kalininghradskaya oblast	1987	6.1	14	150	210
"Losiniy ostrov"	Moscow	1983	10.1	53	122	470
"Maryi Chodra"	Maryiskaya ASSR	1985	36.6	58	94	957
Pribaykal'ski	Irkutskaya oblast	1986	412.7	22	40	120
Priel'brusski	Kabardino-Balkharskaya ASSR	1986	101.0	13	10	25
"Samarskaya Luka"	Kuybishevskaya oblast	1984	128.0	71	212	1,044
Sochinski	Krasnodarski kray	1983	188.6	-	-	-
UKRAINIAN SSR						
Karpatski	Ivano-Frankovskaya oblast	1980	50.3	50	110	1,100
Shatski	Volinskaya oblast	1983	32.8	30	219	825
USBEK SSR						
Narodni Park	Sirdaryinskaya oblast	1978	31.5	33	145	750
KAZAKH SSR						
Bayanoul'ski	Pavlodarskaya oblast	1985	45.5	40	64	270
GEORGIAN SSR						
Tbilisski	-	1973	20.1	22	86	67
LITHUANIAN SSR						
National Park	-	1974	30.0	35	190	877
LATVIAN SSR						
"Ghauya"	-	1973	83.8	48	156	850
KIRGHIZ SSR						
"Ala-Archa"	-	1976	19.4	16	120	628
ARMENIAN SSR						
"Sevan"	-	1978	150.0	30	164	1,600
ESTONIAN SSR						
Lakhemaaski	-	1971	64.9	38	180	838

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East European Programme

IUCN's long history of activity in Eastern Europe provided the foundations for an integrated East European Programme, established in 1987. The aims of the Programme are to promote environmentally sound planning in accordance with the aims of the World Conservation Strategy and the Report of the World Commission on Environment and Development, participate in international conservation affairs and to promote and support the application of restoration ecology. The Programme has built up an unparallelled store of information on conservation issues in eastern, central and south-eastern Europe. Dissemination of this information is being carried forward through the EEP Report and Research Series.

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