World Conservation Union

East European Programme

Environmental Status Reports: 1988/1989

Volume One:

Czechoslovakia
Hungary
Poland

IUCN EAST EUROPEAN PROGRAMME

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Cover Photograph: the River Danube with riverine forest at the Czechoslovak/Austrian border (P. D. Goriup).

FOREWORD

It is not only the political map of Europe that will change in the 1990s. The transformation of East-West relations that is on the horizon will be accompanied by a fresh approach to the continental scale of environmental issues: pollution of air, water and soil, loss of wildlife habitats and prime agricultural land for industrial and urban development, despoliation of the countryside by waste, and the search for energy consumption patterns that do not contribute to global warming. In all of these areas, the contribution to be made from the countries of East Europe is considerable.

IUCN's long history of activity in Eastern Europe provided the foundations for an integrated East European Programme, established in October 1987 with financial support from the Rockefeller Brothers' Fund. 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 promote and support the application of restoration ecology. The National Environmental Status Reports, of which this is the first volume, are result of wide consultation amongst IUCN's members in Eastern Europe under the guidance of the national coordinators serving in the East European Task Force. The reports will form the springboard for planning and implementing local, national and international projects in defence of the environment.

The work leading up to the production of this volume was largely completed before the reformations of government policies and institutions in Eastern Europe during the latter part of 1989. Readers should therefore be aware that some of the information given here, especially concerning legal and administrative arrangements, is more than usually dated in a work of this kind. On the other hand, the reformations will not have lessened the environmental problems of East Europe - indeed, the full scale of these problems, described in the pages of these three National Environmental Status Reports, is only now beginning to emerge and gain the wide recognition needed to address them. Serendipitously, this volume actually marks a watershed in the environmental affairs of East Europe and provides a remarkably timely baseline against which to measure the progress of a new environmental era, not just in Eastern Europe, but across the whole continent.

Founded in 1948, IUCN - the World Conservation Union - is a membership organisation comprising governments, non-governmental organisations (NGOs), research institutions and conservation agencies in 120 countries. The Union's objective is to promote and encourage the protection and sustainable utilisation of living resources.

Several thousand scientists and experts from all continents form part of a network supporting the work of IUCN's six Commissions: threatened species, protected areas, ecology, sustainable development, environmental law, and environmental education and training. The Union's thematic programmes include tropical forests, wetlands, marine ecosystems, plants, the Sahel, Antarctica, population and sustainable development, and women in conservation. These activities enable IUCN and its members to develop sound policies and programmes for the conservation of biological diversity and sustainable development of natural resources.

THE NATIONAL ENVIRONMENTAL STATUS REPORTS

ACKNOWLEDGEMENTS

The compilation of a body of information such as that appearing in this volume requires the skilled coordination of a large number of individuals. The compilers of the three National Environmental Status Reports have benefited from a network of experts, scientists, researchers, translators, editors and typists, and others who remain anonymous but without whom this work would have been impossible.

The initial format and guidance for the preparation of the National Status Reports was devised by the members of the IUCN East European Task Force and the East European Programme (EEP) Secretariat. Initial drafts were discussed at the meeting of the IUCN EEP Task Force in Poland in autumn 1988 and proofs were presented in spring 1989 to Dr M. Holdgate, Director General of IUCN.

The final preparation and scientific editing is the work of P. D. Goriup. Others involved at the early stages of text preparation, typing and translation included R. Abudulai, J Gray, A. Suter, N. Phillips and B. J. Karpowicz.

IUCN EAST EUROPEAN PROGRAMME

Environmental Status Report 1988/1989

CZECHOSLOVAKIA

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CONTENTS

Note: In this Environmental Status Report, CSR refers to the Czech Socialist Republic; SSR refers to the Slovak Socialist Republic; and Czechoslovakia means the federal state.

Page

Tables

Figures

Plates

CHAPTER 1: INVENTORY OF NATURAL RESOURCES

1.1 Air Protection

The problems of air pollution are no longer of just national concern, but have clearly become an international affair. On a national scale research is oriented at the development of emission control; internationally the long-distance transport of pollutants and the regional as well as global level of air pollution are being monitored. The extent and intensity of air pollution depend on economic structures, use of technology, solution of big stationary sources as well as of vehicles. The change in air quality is reflected in changes in forest and water management, and also has a negative impact on the health of the population as a whole.

Domestic pollution sources not only affect the territory of Czechoslovakia, but also the territories of other countries. On the other hand the source of a considerable amount of pollutants is from abroad. In 1985 Czechoslovakia produced approximately 7.6 million tons of gas and solid emissions including 3.37 million tons of sulphur dioxide. The yearly deposits of sulphur dioxide received from foreign sources amount to 1.73 million tons; 2.1 million tons are transmitted abroad from domestic sources.

The distribution of emissions and their sources in Czechoslovakia is very uneven, being mainly concentrated in industrial areas with coal mines and power stations (Figure 1). The heaviest pollution occurs in North Bohemia, around Prague, Central Bohemia and in North Moravia (Ostrava and surroundings in particular). A classification of sources and pollutants is given in Table 1.

The rate of pollution by solid emissions reached its peak in the 1960s. There has been a decrease of 252,000 tons of ash reported from the period between 1980 and 1985. Nitrogen oxides have been monitored since 1980; a slight increase in connection with the growth of car traffic is reported. The main pollutant is sulphur dioxide with the last distinct emission increase in 1983. More than 90% of all emissions result from combustion processes. Approximately 90% of solid emissions are caught by cleaning processes.

The excessive air pollution by sulphur dioxide, solid emissions, nitrogen oxides and other pollutants is caused by the high energy requirements of Czechoslovak industry. The consumption of primary energy resources (based on measures of national income) is approximately 30% above the world average.

In Czechoslovakia the following substances are monitored as they are the most serious air pollutants: carbon monoxide, sulphur dioxide, airborne dust, ammonia, nitrogen oxides, chlorine, formaldehyde, sulphurated carbon and hydrogen, fluorine, phenol, sulphuric acid, nitric acid, arsenic and lead.

site on the world list of endangered protected areas, 62% of forest growth has been damaged: 48% from domestic pollutants, and 52% from foreign sources.)

1.2 Water Protection

The geographical situation of Czechoslovakia is very disadvantageous with regard to the occurrence and volume of both surface and underground water resources (Figure 2). Atmospheric precipitation is practically the only source of water. Key areas for water resource management are those mountains with a specific outflow exceeding 20 $l/s/km^2$, a dense network of torrents, extensive forests and a well preserved natural water balance and water quality. Natural lakes in Czechoslovakia are an exceptional natural feature; surface water bodies are represented mainly by ponds and reservoirs.

Czechoslovakia does not, however, suffer aridity even though the total volume of precipitation is not high. Water management problems do not result from any extraordinary lack of water resources but rather from their uneven distribution in time and space and from a relatively high intensity of their use. Increasingly, the water balance is being disturbed by forest damage or by urban development, multiplied by increasing population demands and waste and pollution problems.

The most serious contemporary problem is the threats to drinking water resources caused by pollution, particularly from agriculture with its heavy use of fertilizers and pesticides. If a radical change in pollution control is not achieved during the coming ten years, a very substantial proportion of the water resources will not be available for their present or foreseen use. In the mountain watersheds the water balance is being destroyed by the decay of forests caused by air pollution.

Table 2 and Figure 3 indicate the quality of surface running waters in the most important Czechoslovak rivers. To ensure necessary improvements in water resource management in the future it is imperative to strengthen pollution control.

1.3 Soil Protection

For many centuries, Czechoslovakia has been inhabitated and therefore cultivated by man, thus resulting in a changed landscape. This has particularly occurred in altitudes of up to 600 m, which supports 98% of the population. Each inhabitant in the CSR is alloted 0.42 ha of agricultural and 0.25 ha of forest land; in the SSR the allotments are 0.50 ha and 0.38 ha respectively. The development and changes since 1936 are given in Table 3. The total coverage of agricultural land is decreasing as a result of growing living standards, industrial development and population decrease in frontier areas during the past decades. Land unsuitable for industrial agriculture has generally been afforestated or neglected. During the period 1948-1980 Czechoslovakia lost 700,000 ha of agricultural land (370,000 ha in the CSR, 330,000 ha in the SSR) and gained 206,000 ha of new forest (43,000 ha in CSR, 163,000 ha in Slovakia).

Table 1: Classification of pollution sources and pollutants in Czechoslovakia (emissions in %).

Type of source	Solid	SO_2	NO_x	CO	C_xH_y	Other Gases	Total
Industry (incl. energy production)	22	27	10	3	3	3	68
Central and local heating	3	4	1	6	1	0	15
Traffic	3	2	3	6	2	1	17
TOTAL	28	33	14	15	6	4	100

Air pollution causes decreased soil fertility over a vast hectarage of arable land, inhibits forest growth and poses a threat to water catchments in many areas. Due to the negative impact of sulphur dioxide on agriculture, the economy of the CSR loses 3 billion crowns a year. The crops worst affected are lucerne, cereals, and lettuce, and potato production can be as much as 60% lower than normal. The most serious damage is to forest growth, with conifers such as fir, spruce, and even pine, being the most susceptible. The weakened trees are further attacked by pests, particularly insects.

In Czechoslovakia, the highest officially permissible daily concentration of sulphur dioxide is 0.15 mg/m^3. The prerequisites for successfull pollution control are changes in the composition of primary energy resources, more rational use of energy and the implementation of a desulphurization programme. The most economically feasible measure to achieve the agreed 30% sulphur dioxide emission decrease, is to install desulphurating systems in the largest pollution sources. For the second stage (period 1993 - 2000) besides further structural changes and development of a nuclear programme, the control of smaller pollution sources in big settlements is foreseen.

In spite of the above mentioned programme the prospects for the montane forests in Krkonose (Giant Mountains), Orlické hory, Jeseniky, Beskydy are not good, as a continuing increase of air pollutants concentration can be expected from sources in the German Democratic Republic, and particularly from Poland. (In the Krkonose National park, a

site on the world list of endangered protected areas, 62% of forest growth has been damaged: 48% from domestic pollutants, and 52% from foreign sources.)

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Plate 1: The upper reaches of a small clean watercourse: the Strela in West Bohemia *(Photo: M. Hain)*.

Plate 2: There are only a few natural lakes in Czechoslovakia, but artificial ponds are common: Maly Tisy State Nature Reserve in South Bohemia within Trebonsko Protected Landscape Area and Biosphere Reserve *(Photo: V. Obereigner)*.

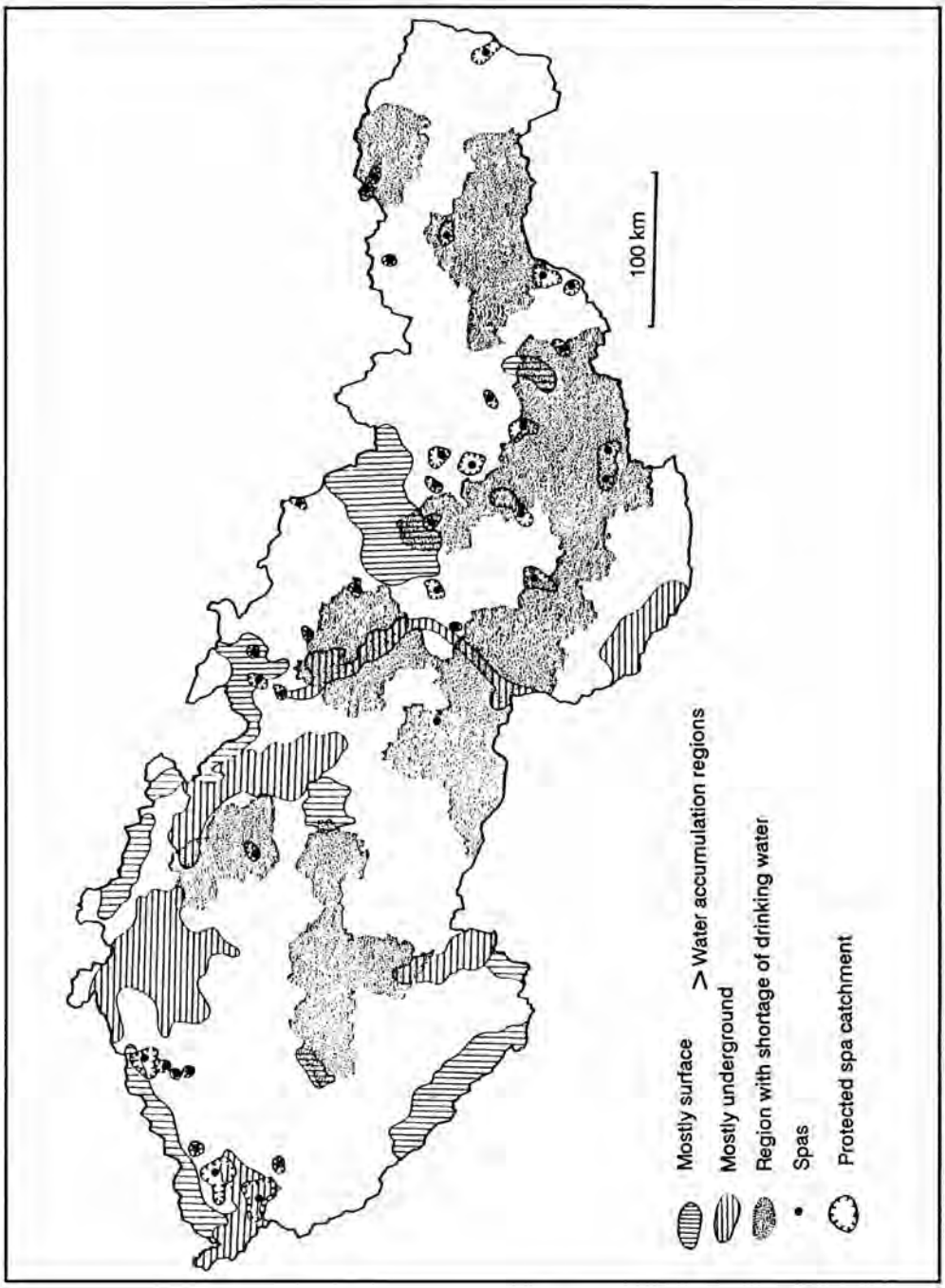

Figure 2: Water resources in Czechoslovakia.

(Source: Population Atlas of the CSSR, vol. 2. Geographical Institution, Czechoslovak Academy of Sciences, 1987.)

Table 2: The quality of surface running water in the most important rivers of the Czech Socialist Republic.

Period	Water quality category							
	I		II		III		IV	
	km	%	km	%	km	%	km	%
1966-1970	1360	18	2731	35	1917	25	1691	22
1971-1975	2387	18	2114	28	2330	30	1868	24
1976-1980	1275	17	1892	24	2976	39	1561	20
1980-1985	1320	17	2084	27	2584	34	1711	22

Note: Category I is for pure natural surface water; other categories indicate successively higher degrees of polluted water.

Table 3: Changes in per capita size of agricultural and arable land in Czechoslovakia 1936-1985 (ha).

Year	1936	1950	1960	1970	1980	1985
Agricultural land	0.562	0.648	0.535	0.4893	0.4483	0.4378
Arable land	0.408	0.467	0.375	0.3447	0.3147	0.3084

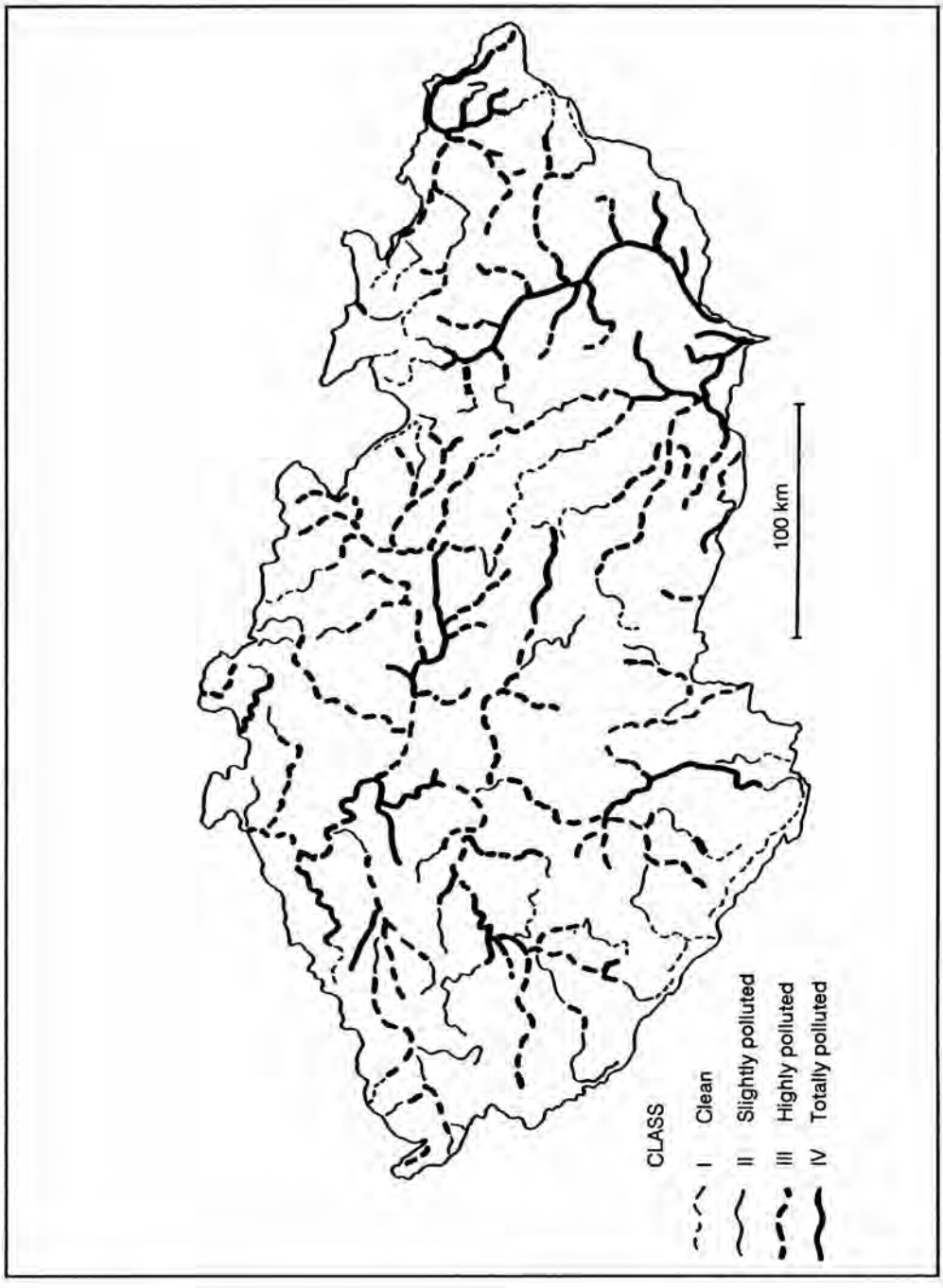

Figure 3: Water quality in principal watercourses of the CSR (1985).
(Source: State Institute for Physical Planning (TERPLAN), Praha)

Today, 55.2% of Czechoslovakia's territory is agricultural and 34.9% forested, the rest being occupied by surface water, industry, urban settlements and other features (Table 4). In Czechoslovakia, 49.1% of arable land is situated on slopes steeper than 3°, 13.4% above 7°, and 1.7% even on inclines above 12°. This means that more than one half of arable land is, to a varying extent, endangered by water erosion (Figure 4). Another 10.4% of arable land is estimated to be threatened by wind erosion, particularly in the lowlands of South Moravia and in the warm and dry Bohemian lowland basin of the Labe (Elbe) river. A considerable degree of soil deterioration also occurs in coal mining areas.

A further serious problem arises from the fact that much of the agricultural land is still being taken for other purposes. At present this concerns approximately 12,000 ha of agricultural (approximately 10,000 ha arable) land in a year.

Table 4: Land use in Czechoslovakia in 1988

Land use form	Total area (ha)	%
Arable land	4,966,528	38.8
Hop-gardens	9,939	0.1
Vineyards	38,447	0.3
Gardens	217,130	1.7
Orchards	78,876	0.6
Meadows	945,984	7.4
Pastures	803,441	6.3
Agricultural land in total	7,060,345	55.2
Forests	4,465,635	34.9
Ponds	53,526	0.4
Other water bodies	172,891	1.4
Urban land	215,935	1.7
Others	819,303	6.4
Other than agricultural land in total	5,727,290	44.8
TOTAL for Republics	12,787,635	100.0
Czech Socialist Republic	7,886,300	61.7

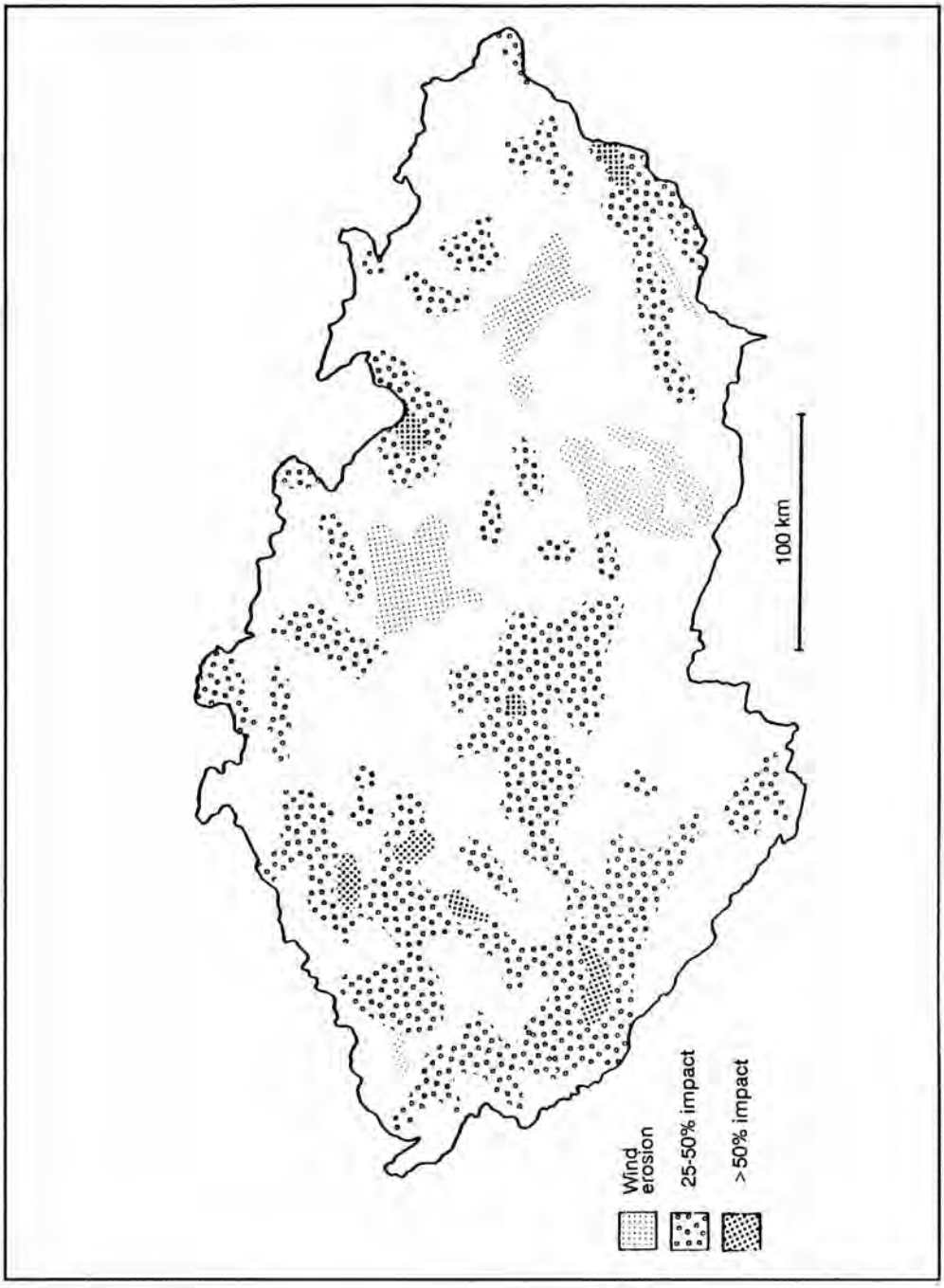

Figure 4: Soil deterioration in the CSR
(Source: State Institute for Physical Planning (TERPLAN), Praha).

The factor most strongly impacting the landscape, its design and its ecological stability and diversity, is primary agricultural production. The agrotechnology now applied has formed large fields ranging from 20 to 100 ha each, according to the type of the landscape. Besides that, the water balance in agricultural landscapes has been strongly disturbed by extensive drainage and other so called "improvements".

1.4 Mineral Resources Protection

Czechoslovakia is an important producer of coal, graphite, kaolin, magnesite, pig iron and steel (Table 5). The highly industrialized economy requires imports of many raw materials. Domestic petroleum and gas resources are very limited, but fairly extensive uranium deposits in North Bohemia are exploited at several sites (Figure 5). Although domestic coal provides about 60% and nuclear power nearly 15% of the country's fuel and energy needs, imports of fuels still account for over one quarter of the total. In 1984, mining and quarrying accounted for 3.8% of the total industrial output of Czechoslovakia; coal production made up 2.9% of this amount, crude oil 0.1%, metallic ores 0.4%, other mining 0.4%.

Of the total industrial output, 3.4% comprises refined petroleum products, although national crude oil production remains at an insignificant level (2,000 barrels per day). The reserves are situated in small fields holding an estimated total of 20 million barrels. The iron and steel industry contributes a further 9.1% of total industrial output. Domestic exploitation of iron ores from the small deposits available by rather low technological methods currently provides only about 2 million tons per year which represents only 5- 6% of the demand.

The most important fossil fuel base for Czechoslovak industry and energy production is high-grade lignite (brown coal). The reserves, situated mainly in North Bohemia, are estimated to be about 2.7 billion tons.

Table 5: Production of some important mineral commodities (in metric tons) in Czechoslovakia in 1985

Aluminium	85,000
Copper	10,300
Iron ore	1,900
Industrial minerals (stone, sodium ..)	32,500
Sulphur	80
Coal-bituminous	26,323
Brown coal (and lignite)	100,387

Plate 3: A large field strip on a rather steep slope heavily impacted by soil erosion *(Photo: SUPPOP Photolibrary).*

Plate 4: Open-cast lignite mining in North Bohemia *(Credit J. Mrazek).*

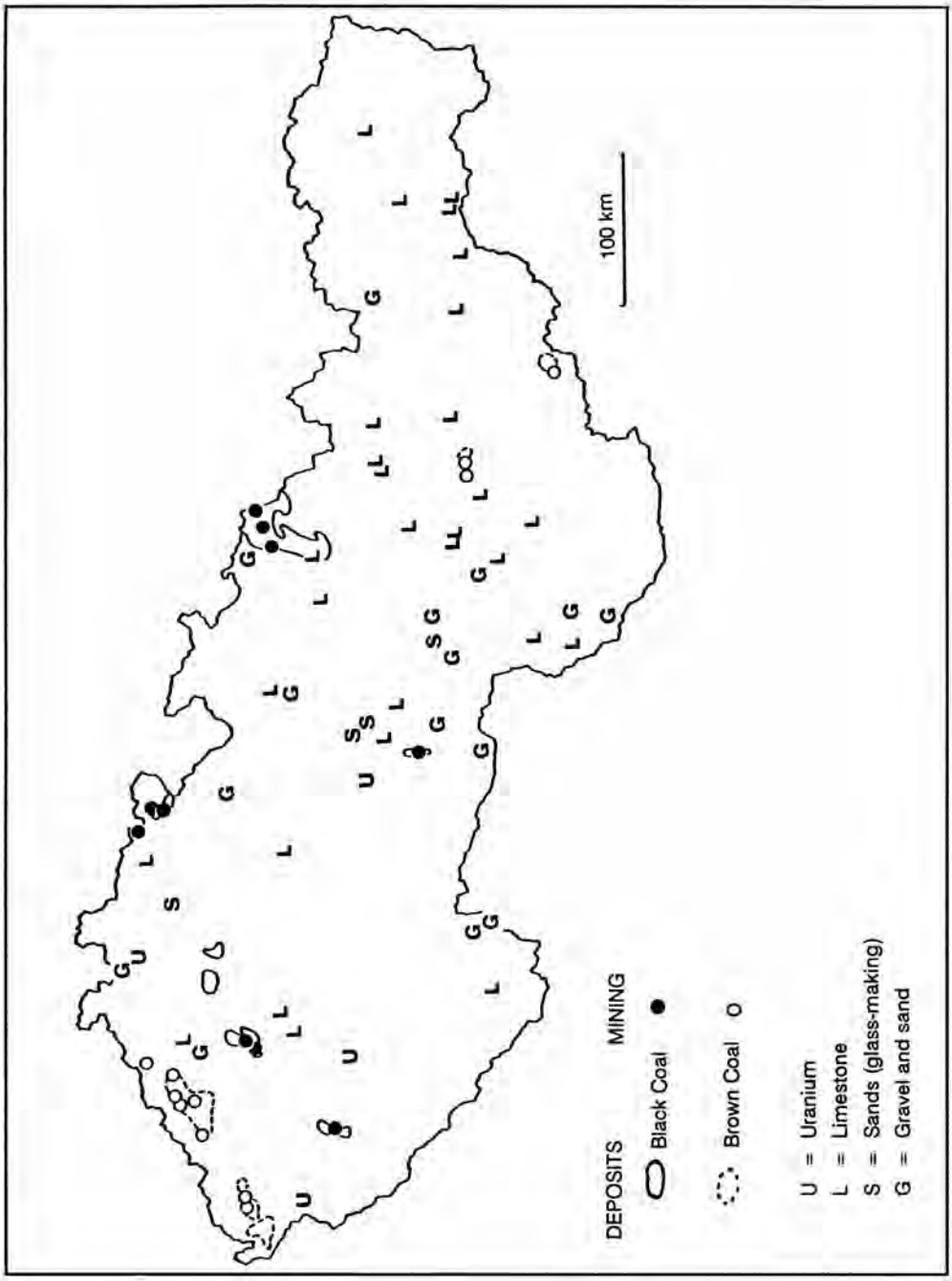

Figure 5: Environmentally important mineral resources.

(Source: Atlas of the CSSR, p.23.
Geographical Institution, Czechoslovak Academy of Sciences, 1984.)

Czechoslovak natural gas reserves were estimated at 9.8 billion m^3 from which nearly 700 million m^3 were produced in one single year (1985). Gas is imported from USSR through transit lines: the fourth and last of them is to be completed in 1989. The total capacity of the transit gas system will be 67.2 million m^3 per year. In exchange for Czechoslovak agreement to participate in the construction of a new gas pipeline linking the vast Soviet reserves in Siberia with East and West Europe, Czechoslovakia will receive from 1990 4.9 million m^3 of natural gas per year.

In West Bohemia there are clay (bentonite) reserves estimated at 63 million tons (consumption in 1985 was 150,000 tons). China clay deposits provide reserves for 100 years, and kaolin for as much as 200 years at the current levels of domestic and export demand.

A quantity of stone is exploited in Czechoslovakia. The most environmentally important stone quarrying and processing is of limestone. As limestone habitats host a rich biological diversity, there are frequent conflicts and compromises between limestone exploitation and nature conservation.

1.5 Biological Resources Protection

The varied geological substratum as well as diverse landscape relief endows the country with a rich biological diversity. Practically all Middle European ecosystems occur in the territory of Czechoslovakia, except those typical of the coast and highest altitudes. Because of a complicated and dynamic natural history during the glacial, interglacial and postglacial eras, the Czechoslovak flora and fauna include a wide range of biogeographical elements, with many of the native species being important relicts or even endemics.

There are 3,441 species of vascular plants listed in the synopsis of the Czechoslovak flora (Dostal 1982): this number includes introduced, adventive and commonly cultivated taxa, but more than two thirds of the total are certainly autochthonous species. The total size of the Czechoslovak fauna is estimated to be 50,000 to 60,000 species.

This biological diversity, however, is seriously threatened. A lot of species have disappeared from their habitats mainly because of habitat degradation and destruction. The threat to biological diversity does not only concern individual species (and their populations), but involves whole biological communities and ecosystems (biotopes). Among the most threatened, those that are actually disappearing, are wetlands and floristically rich meadows. Global and local pollution even reduce the biological diversity in those habitats which still remain without any direct human impact (streams, ponds and their shores; copses and edges of larger woodlands; roadsides and ditches; etc.). Tables 6 and 7 trace the decline of species as documented by the Czechoslovak red data lists compiled during the last decade.

Laws exist to protect rare and threatened species (see Chapter 2). Moreover, the establishment of protected areas (see section 1.6) has been strongly motivated by the need for preservation of biological diversity: the occurrence of critically threatened species has been recognized as one of the main criteria for the development of a representative

Table 6: Threatened vascular plants in Czechoslovakia according to the Red Data Lists (Holub-Prochazka-Cerovsky 1979, Maglocky 1983)

Republic	Threat category						Total
	AI	AII	CI	CII	CIII	CIV	
CSR	37	39	267	240	239	330	1,152
	ca 2%	ca 2%	14%	13%	13%	17%	61%
SSR	9	29	327	261	305	378	1,309
	0.4%	1.2%	13%	10%	12%	15%	52%

Key to categories

AI - extinct
AII - missing
CI - critically threatened
CII - strongly threatened
CIII - threatened
CIV - not common, requiring further study

protected areas network. Also some new, non-traditional, active methods of species protection are being developed and applied: habitat management, transfers, *ex situ* cultivation and captive breeding. Research and monitoring are now strongly oriented at the protection and rational use of the biological and genetic diversity during the last few years.

From the environmental conservation point of view, the most important vegetation is forest. Forest area is adequate (see Table 4), but its distribution is not widespread enough, and presently it is exposed to strong deterioriating impacts such as air pollution and excessively high numbers of game animals. Approximately 80% of the woodland in Czechoslovakia (Figure 6) has been converted to coniferous monocultures (mainly spruce and pine) of low ecological value. Most woodland occurs in the mountains and highlands, chiefly on steep slopes of deep valleys, while the watersheds are used for agriculture. In lowlands and river basins the woodland is in retreat in spite of its environmental, climatic, water-management and recreational functions. There is too little woodland near to towns: more than one third of settlements above 2,000 inhabitants lack forest in their vicinity.

The most serious forest deterioration and destruction is caused by air pollution, so-called "acid rain". In the CSR, some 420,000 ha of woodland (mainly in North Bohemia) have been affected by industrial emissions; in the SSR, almost 30,000 ha have been devastated, two-thirds of this in the heavily toxified area around Ziar nad Hronom.

Table 7: Threatened vertebrates in CSR and all Czechoslovakia (Trpak in Cerovsky, Petricek, Trpak, Damohorsky 1988)

Class:	Cyclo-stomata	Fish	Amphi-bia	Repti-les	Birds	Mam-mals	Total
Threat category							
Extinct	2	7	-	-	6	3	18
Endangered	-	4	7	4	12	14	43
Vulnerable	-	2	6	5	30	9	52
Rare	-	8	2	1	21	9	41
Indeterminate	-	7	3	-	44	14	68
Total for the CSR	4	28	18	10	113	49	222
No. of threatened species in all of Czechoslovakia	6	32	13	10	134	51	246

The restoration of woodland destroyed by acid rain is the most difficult and biggest task for contemporary forest management in Czechoslovakia. There is no longer a priority objective of timber production: the maintenance of environmental balance and stability have become the most important goals. In addition, there is a growing interest in the non-productive functions of woodlands, such as recreation. About one-third of the total coverage has been declared as "forests of special determination" with an emphasis on their environmental and social benefits.

1.6 Protected Areas

Czechoslovakia has a well-established national parks and protected areas system the origin of which reaches back into the early 19th century. This system covers 1,930,099 ha which represents some 15% of the country. Table 8 lays out the Czechoslovak protected area categories, as assigned by the State Nature Conservancy Acts, their numbers and extent.

Protected areas are divided principally into large-size and small-size sites (Figure 8). National Parks (corresponding to the UN List Category II in SSR, while the only "National

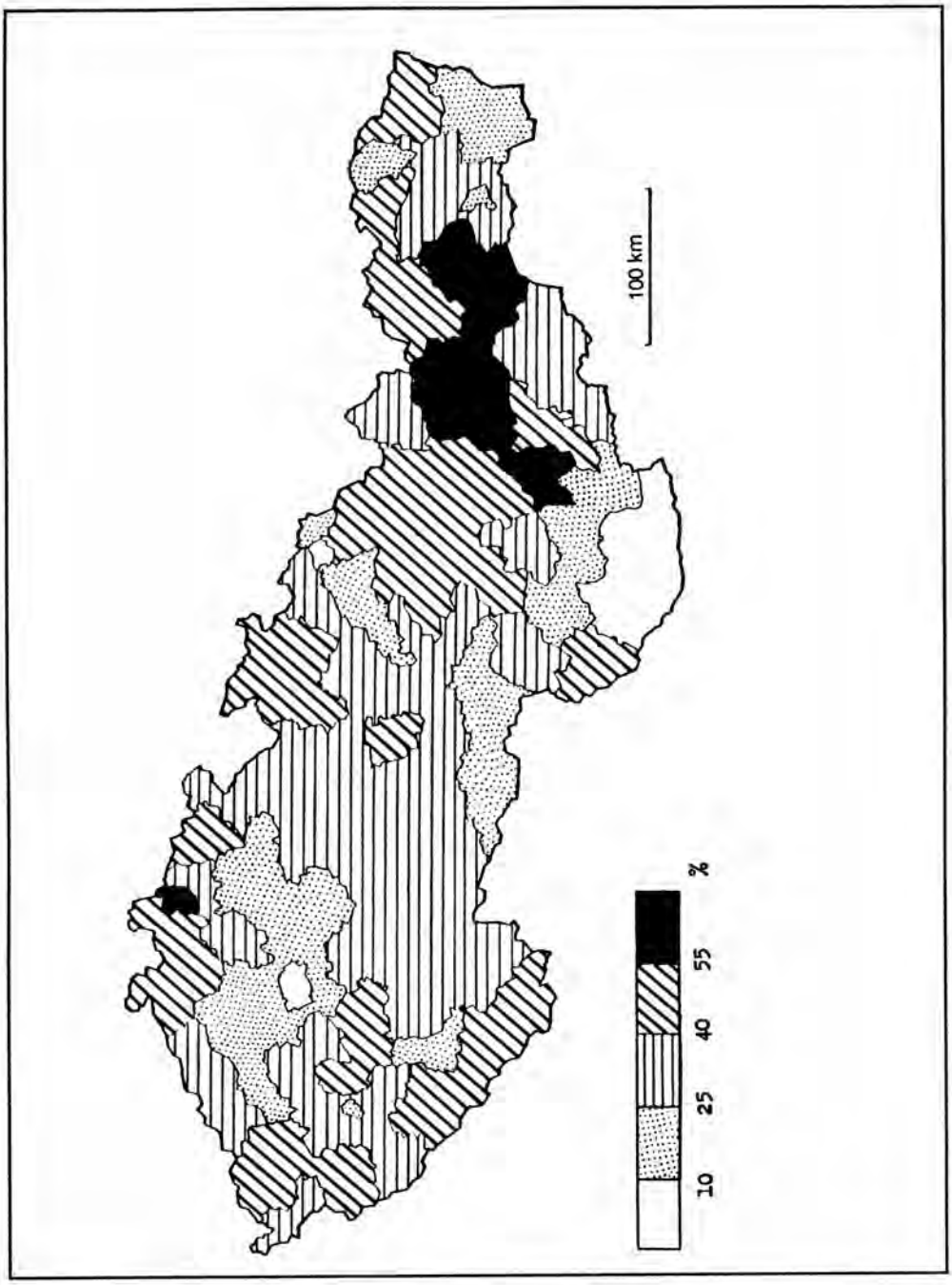

Figure 6: Forest cover of Czechoslovakia.
(Source: Population Atlas of the CSSR, vol. 1. Geographical Institution, Czechoslovak Academy of Sciences, 1987.)

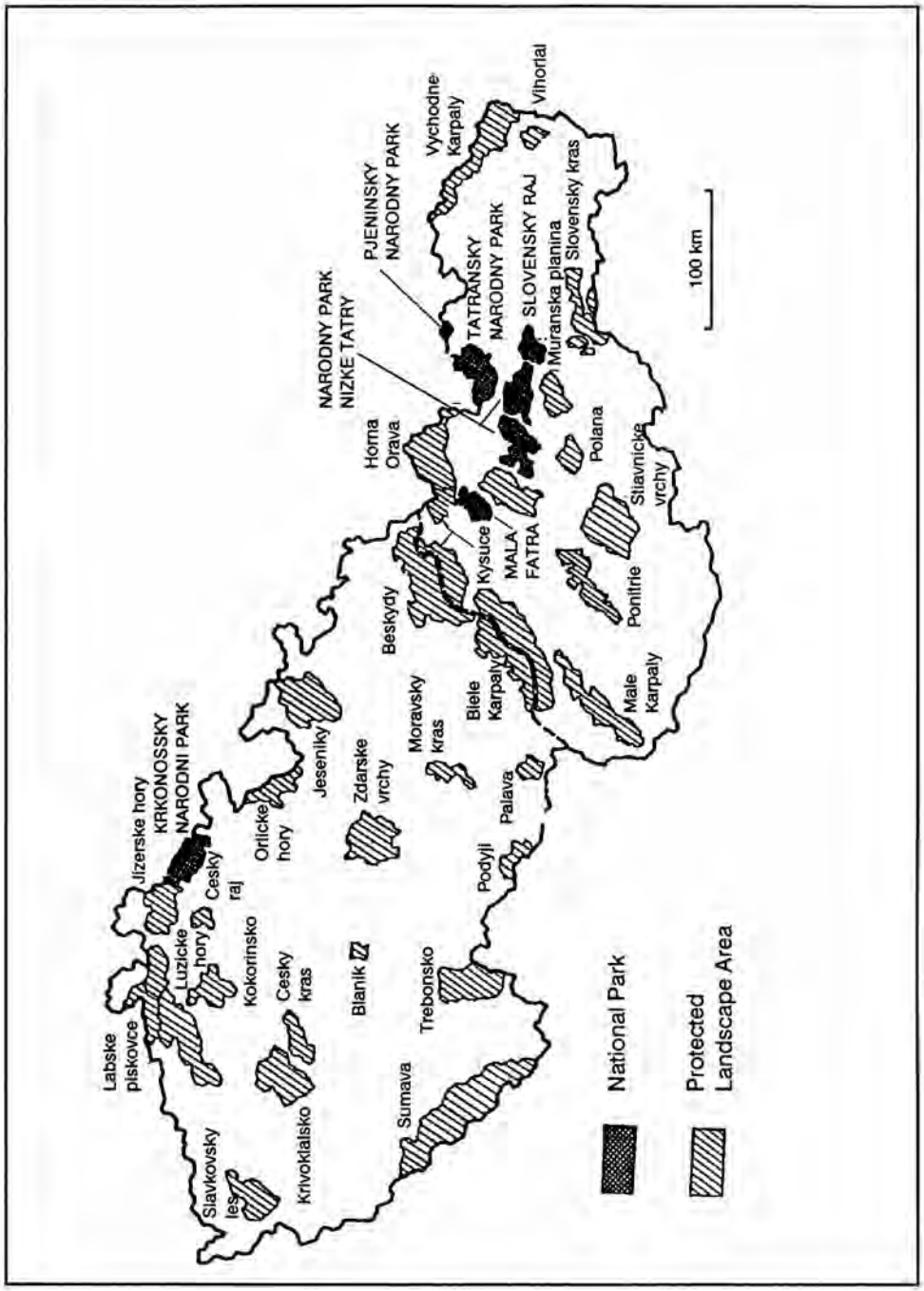

Figure 7: Large-size protected areas system of Czechoslovakia.
(Source: State Institute for Protection of Monuments and Nature Conservation (SUPPOP), Praha 1988.)

Park" in the CSR (Krkonose) is only in Category V) and Protected Landscape Areas (PLAs - UN List Category V) belong in the first group. They cover tens of thousands of hectares (Sumava PLA (Bohemian Forest), at 160,000 ha, is the largest). All have their own professional administrations (complementing the local government) within the State Nature Conservancy structure. Newly devised and designated, PLAs are intended to be pilot areas for testing sustainable development policies. Their management is executed according to physical planning documents specially produced for the purpose. Some of the best preserved and most valuable PLAs are being transformed into National Parks. Four PLAs (Krivoklatsko, Palava, Slovensky kras, and Trebonsko) have been declared Biosphere Reserves (UN List Category IX), and other areas are being considered for nomination to UNESCO.

The second, small-size, group comprises a large number of sites from several hectares to several hundred hectares in size; only a few reserves extend over 1,000 ha (Table 8). They may occur scattered within the wider (unprotected) countryside or they may be situated within the large-size protected areas, usually as core zones. The most important small-size areas are the State Nature Reserves which preserve a broad range of both original (natural) and modified (semi-natural) ecosystems. They correspond mostly to the UN List Category IV, with some corresponding to Category I. They have no special administrations; their management is based on an inventory survey and is undertaken according to a conservation plan.

Some other "areas of special designation", not actually belonging to the conservation areas network, and therefore also not included in Table 8, do have environmental value. They include, for instance "Quiet Areas" for recreational purposes, protected water resources zones, and recreational forests in and near big cities and towns. Large military zones, moreover, are also beneficial for the protection of the countryside, natural resources and biological diversity.

Table 8: National park and protected area system in Czechoslovakia (Situation on 1 January 1988).

Category	Definition	CSR		SSR		Czechoslovakia	
		Number	Area (ha)	Number	Area (ha)	Number	Area (ha)
NATIONAL PARK (Narodni park)	Vast area, nature not or little altered by man; scientific, climatic, water management, recreational and educational importance	1	38,500	3	159,983	4	198,483
PROTECTED LANDSCAPE AREA (Chranena krajinna oblast)	Typical complex of countryside with scattered outstanding natural features	20	1,003,200	14	623,357	34	1,626,557
Large-size protected territories TOTAL		21	1,041,700	17	783,340	38	1,825,040
STATE NATURE RESERVE (Statni prirodni rezervace)	Smaller area, nature not or little altered by man, research-scientific importance	538	41,289	293	54,997	831	96,286
PROTECTED HABITAT (Chranené naleziste)	Small territory with occurrence of rare plants, animals or other natural rarities	45	204	78	1,249	123	1,453

Category	Definition	CSR		SSR		Czechoslovakia	
		Number	Area (ha)	Number	Area (ha)	Number	Area (ha)
PROTECTED PARK OR GARDEN (Chraneny park, zahrada)	Park or garden of scientific, historical or artistic importance	3	70	4	28	7	98
PROTECTED STUDY AREA (Chranena studijni plocha)	A plot for a temporary study of human impact	4	43	15	1,503	19	1,546
PROTECTED NATURAL FEATURE (CREATION) (Chraneny prirodni vytvor)	Natural feature such as karst phenomenon, rock formation, also outstanding tree or a group of trees	441*	5,994	204*	1,300	645*	7,244
PROTECTED NATURAL MONUMENT (Chranena prirodni pamatka)	Natural creation (feature) also documenting social development	11	356	20	6,772	31	7,128
Small-size protected territories TOTAL		1,042	47,906	614	65,849	1,656	113,755

* Single trees not included

Note: some of the smaller protected territories are situated inside the larger ones

Plate 5: The preservation of birds of prey is among the urgent tasks of Czechoslovak nature conservation: *Falco tinnunculus* is protected and fortunately still common *(Photo: M. Hain).*

Plate 6: The first and the most important national park in Czechoslovakia: Tatransky in the High Tatra Mountains *(Photo: M. Hain).*

Plate 7: Varied Czechoslovak landscape with a large coverage of woodland: the Protected Landscape Area of West Bohemia supplies mineral water for the most prominent Czech spas *(Photo:V. Obereigner).*

Plate 8: Forest decay in the North Bohemian border mountains *(Photo: M. Hain).*

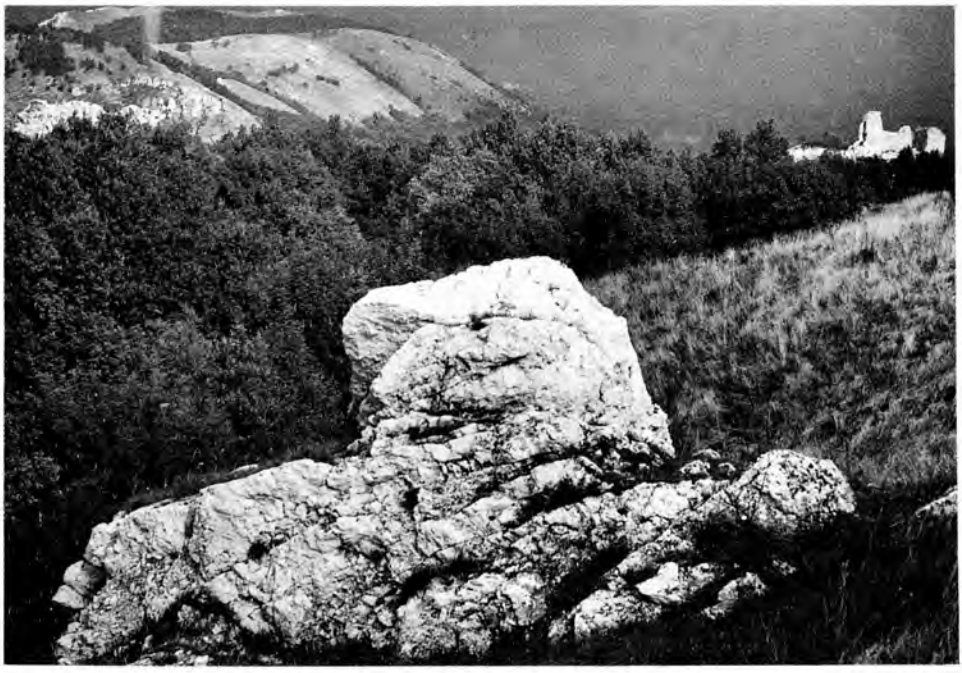

Plate 9: Palava Protected Landscape Area and Biosphere Reserve (South Moravia) *(Photo: M. Hain).*

Plate 10: A group of holiday cottages in a small valley in Central Bohemia, within easy reach of the capital *(Photo: H. Seifertova).*

CHAPTER 2: INSTITUTIONAL STRUCTURE AND LEGISLATIVE FRAMEWORK

2.1 Federal Responsibilities

Czechoslovakia is a socialist federal state with administrative and executive powers divided between the authorities of the federation and the authorities of the two national republics: the Czech Socialist Republic (CSR: the western part) and the Slovak Socialist Republic (SSR: the eastern part). This division of responsibilities is illustrated in Figure 8, while Table 9 gives a short account of the long history of environmental conservation in the country as a whole.

At the federal level, the authority competent in environmental matters is department for environment of the State Commission for Scientific, Technical and Investment Development (Statni komise pro vedecky, technicky a investicni rozvoj). Matters concerning international cooperation in important environmental matters (intergovernmental agreements, accession to international conventions and treaties, participation in the work of UN system, etc.) are dealt with by the Federal Ministry of Foreign Affairs.

2.2 Responsibilities of the Republics

At the level of the Republics, in 1988 a new Ministry of Interior and Environment was established in both Republics on the base of the former Ministry of Interior. This is the central authority for the state management of the environment, executing, coordinating and controlling functions for the Czech and the Slovak Governments. The Ministry is charged with coordinating the activities of other ministries and other central authorities in matters concerning the environment and conservation.

At the same time some other departments (ministries) remain competent in certain aspects of environmental and natural resource management. The Ministry of Forest and Water Management and Timber Industry is responsible for water and air quality (mainly pollution control) and in forest management and conservation. The Ministry of Agriculture and Food is responsible for agricultural land and soil conservation. The Ministry of Health Service and Social Matters takes care of people's environmental health. The Ministry of Industry has been entrusted with the elaboration of a bill on waste recycling. The Czech Geological Office (and the Slovak Geological Office in the SSR) control mineral raw materials, including the problems of their conservation and rational use. In addition to the Ministry of Interior and Environment in the SSR, there is a governmental Council for Environment which acts as a national advisory body.

Nature conservation with respect to wildlife, which is a Constitutional duty of the State and of all citizens under Law No. 100/1960 (Article 15), falls under the authority of the

Ministry of Culture. However, nature conservation in Czechoslovak legislation is expressed from a rather partial point of view: statements of a complex character are too general, and the protection of specially selected natural features is elaborate (including designated areas, species, natural monuments, fossils and minerals).

There are six National Parks in Czechoslovakia (one in the CSR, five in the SSR), two of them (High Tatra and Pieniny) under the authority of the Slovak Ministry of Forest and Water Management and Timber Industry and 34 Protected Landscape Areas (20 in the CSR and 14 in the SSR). All of them have their own administrations with professional staff. They cover nearly 15% of the state territory, being called "large-size protected areas". There are over 1,000 small-size areas in the country mainly in the State Nature Reserve category. Ministries of Culture have small professional conservation departments, technically and scientifically advised by special bodies: the State Institute for Protection of Monuments and Nature Conservation (SUPPOP - Statni Ustav Pamatkové Péce a Ochrany Prirody), Conservation Section, Prague; the Central Board for Nature Conservation (USOP - Ustredie Statnej Ochrany Prirody) in Liptovsky Mikulas for Slovakia; both are IUCN members. There are also Regional Centres operating for the Protection of Monuments and Nature Conservation with their own conservation departments.

There is a third level in the institutional structure of environmental conservation in Czechoslovakia - that of National Committees. The Regional, District and Town National Committees (i.e. executive bodies of regional, district and local government) have a commission or a council for environment. The departments for culture of the Regional and District National Committees, assisted by active volunteers and voluntary groups, support the State Nature Conservancy activities in regions and districts of the country.

2.3 Environmental Legislation

Czechoslovak environmental legislation is not contained in one comprehensive legal instrument. At present there are two State Nature Conservancy Acts in force: Law No. 1/1955) for the SSR, and Law No. 40/1960 for the CSR. Both, however, are now out-of-date in relation to current conservation practice and new bills are being prepared. There are several other more modern acts regulating the management and conservation of some natural resources. Certain of these acts have been complemented by a series of prescriptions of lower legal power such as government ordinances and ministry decrees.

Special decrees protect rare and threatened plants and animals, as well as trees and shrubs growing outside forests. In 1986, new acts were passed by National Councils in both CSR and SSR, introducing (since 1987) fines for offences (by both individuals and organizations) against the State Nature Conservancy Acts and decrees. Individual offenders can be fined up to 5,000 Crowns, and organizations up to 100,000 Crowns respectively.

2.4 Research Infrastructure

The principal institution in Czechoslovakia ensuring the development of research and science is the Czechoslovak Academy of Sciences, with its companion Slovak Academy of

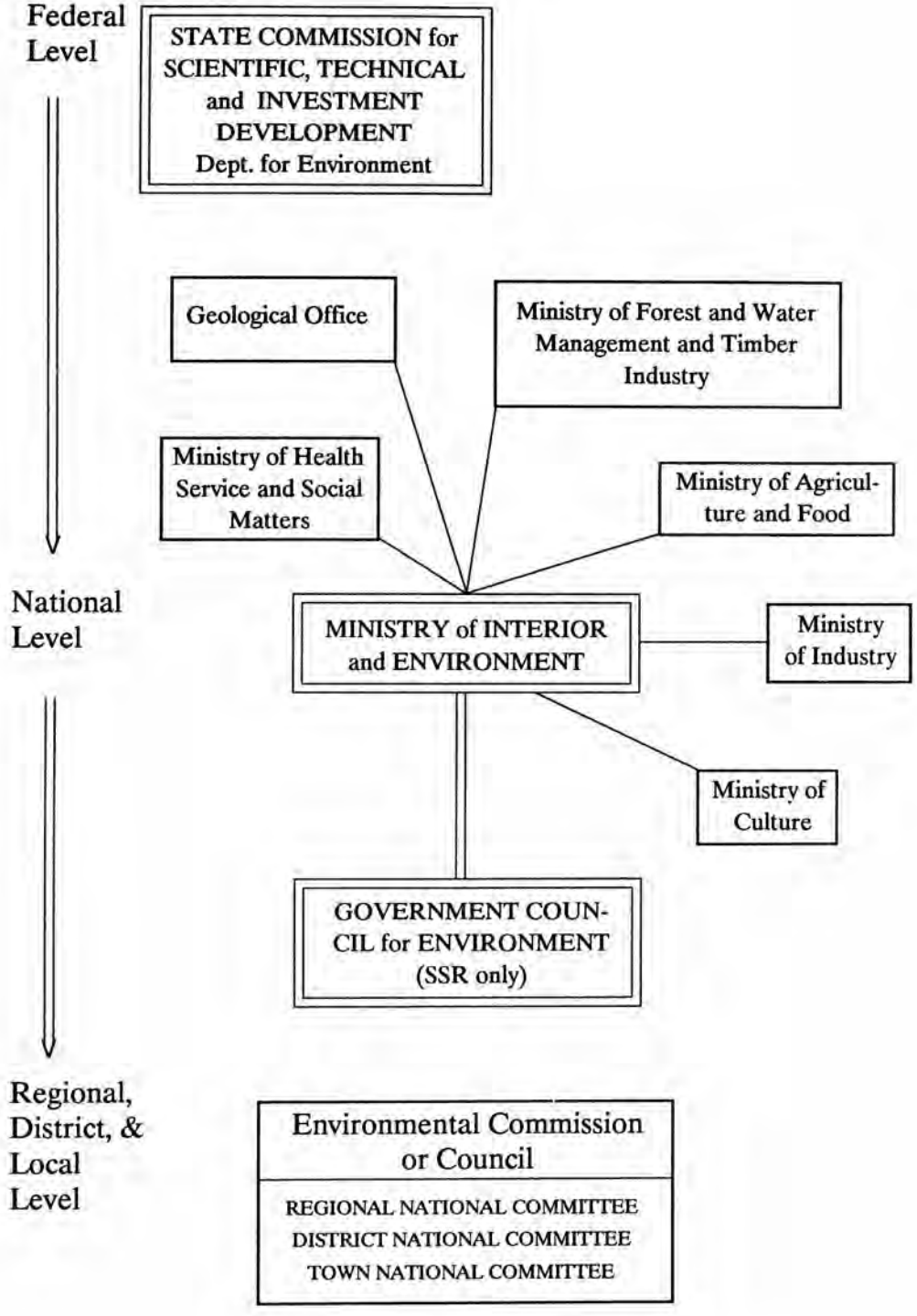

Figure 8: Institutional Structure of Environmental Conservation in Czechoslovakia.

Sciences. The amount of environmental research work conducted by these academies in the environmental field has increased considerably in recent years, with substantial work being carried out on landscape ecology and biological diversity. The most important bodies involved in this work are the Institute of Landscape Ecology in Ceské Budejovice, the Botanical Institute at Pruhonice near Prague, the Biological Centre in Brno, and the Institute of Experimental Biology in Bratislava. The State Nature Conservancy also has small scientific research groups concerned mainly with biological diversity, ecosystems management and also remote sensing and monitoring. A large project being carried out jointly by the State Nature Conservancy (Ministries of Culture) and the Czechoslovak Academy of Sciences, is the preparation of a 5-volume Czechoslovak Red Data Book. The first volume (Birds) was recently and the others (II - other Vertebrates, III - Vascular Plants, IV - Invertebrates, V - Low Plants) will follow at yearly intervals.

Other research institutes also pay attention to environmental conservation problems. Many of them are attached to the federal authorities. The State Commission for Scientific, Technical and Investment Development has recently established the Institute for the Protection of the Environment and Rational Use of Natural Resources, based in Usti nad Labem and with offices in Prague and Bratislava. Some environmental problems are being investigated by the Czechoslovak Academy of Agricultural Sciences and several universities (including Prague, Brno, Olomouc, Bratislava, Nitra, Zvolen and Kosice). To train both specialists and generalists, special environmental chairs and departments have been established in many universities and other tertiary level establishments. The science faculties of universities in Prague and Bratislava run special courses and award degrees in the "Protection of the Natural Environment".

2.5 Conservation Awareness

There is growing public interest and involvement in nature conservation and environmental matters generally. The voluntary "Brontosaurus Movement" in the CSR and "Tree of Life" project in the SSR were organised by the Socialist Union of Youth (see 3.6). Voluntary conservation unions work both in SSR and CSR, recently becoming constituents of the "National Front" organization.

There is increasing interest in environmental matters among top party and government bodies and among political leaders, as demonstrated recently through the CMEA appeal on ecological security, issued at the 1988 CMEA meeting in Warsaw, on the initiative of the Czechoslovak delegation.

Plate 11: The firm attitude of conservation authorities, public pressure and citizen action saved the Krivoklatsko Protected Landscape Area and Biosphere Reserve from being turned into a huge reservoir: the first "big" conservation victory in Czechoslovakia *(Photo: H. Seifertova).*

Plate12: The Czechoslovak mountains are ecologically stable and diverse, like these foothills of Krkonose (Giant Mountains) National Park *(Photo: V. Obereigner).*

Table 9: A short history of nature conservation in Czechoslovakia

1838	First two nature reserves (primeval forests) declared in South Bohemia
1858	The Boubin virgin forest in Sumava (Bohemian forest) Mountains, South Bohemia, declared as a nature reserve
1870	Legal protection of birds "useful in agriculture" enacted by law in Bohemia
1990	An ordinance concerning protection of natural monuments valid in Slovakia
1904	The Trust for Enhancement and Protection of Native Country founded in Prague
1920	State Nature Conservancy started within the Ministry of Education
1933	State Nature Conservancy issued a list of 147 nature reserves established up-to-now in Czechoslovakia
1948	Establishment of the first National Park in Czechoslovakia (Tatransky narodny park - High Tatra)
1955	Establishment of the first Protected Landscape Area in Czechoslovakia (Cesky raj - the Bohemian Paradise)
1955/56	First State Nature Conservancy Acts enacted in Czechoslovakia
1960	The new Constitution of the Czechoslovak Socialist Republic with Article No. 15 on nature conservation
1977	UNESCO approved the establishment of the first three Czechoslovak Biosphere Reserves
1985	The state conception of the Creation and Protection of the Environment approved as Federal Government Decree No. 226/85.
1986	Laws passed concerning sanctions (fines) for offenders in the field of nature conservation.
1987	Elaboration of environmental conservation programmes 1987-1990 for both Republics.
1988	Conceptual goals and objectives for environmental conservation until the year 2000 determined.

CHAPTER 3: ENVIRONMENTAL TRENDS

The environmental situation in Czechoslovakia is serious, particularly in North Bohemia where the situation is verging on ecological catastrophe. The most important trends can be grouped under ten headings, briefly described below.

3.1 Impact of Mining, Industry and Urban Development

Mining activities, particularly open-cast lignite mines in northwest Bohemia, have caused grave devastation of the countryside. There are problems of decontamination of the worked-out areas and of reclaiming the strippings. The brown coal extracted is the main fuel for Czechoslovak industry and towns, but because of its high sulphur content and other volatile ingredients, its use leads to considerable air pollution. The severe environmental consequences and the great energy consumption of lignite mining itself, on the one hand, and its economic importance on the other, poses a dilemma that will be very hard to solve.

As already explained in section 1.1, the acute air pollution problems of Czechoslovakia originate from domestic as well as foreign sources. The emission of solid harmful substances in Czechoslovakia amounts to 1.4 million tons per year. Most of it (400,000 tons) is deposited in North Bohemia. The next worst location for the production of solid pollutants is the North Moravia, with 300.000 tons per year. In the SSR, the total annual solid emissions amounts to 400,000 tons, the main source of which is the power generation system. Gaseous emissions amount to 3 million tons per year (2.4 million tons in the CSR, much of it (700,000 tons) in North Bohemia, and 600,000 tons in the SSR). Vehicle exhausts also make a major contribution to air pollution.

The most evident indicator of air pollution is the poor state of the country's forests (see also section 1.1). In North Bohemia, particularly in the mountains, hundreds of thousands of hectares are affected (Figure 9). The problem is compounded because the weakened trees have little resistance to pests (especially insects) and disease, which leads to calamitous losses. Furthermore, reafforestation is hindered by a lack of healthy young trees and uncontaminated soil. Thus, areas of great ecological importance and high recreational value have been seriously affected, of which the Krkonose National Park is perhaps the most striking case.

Mining, industry and towns also produce a large quantity of waste causing widespread and severe water pollution, especially of streams (see section 1.2). Without sufficient recycling facilities, solid waste is deposited in the countryside creating difficulties. Heaps of solid waste material are often piled in locations important for ecological stability and diversity of the countryside (such as small gorges).

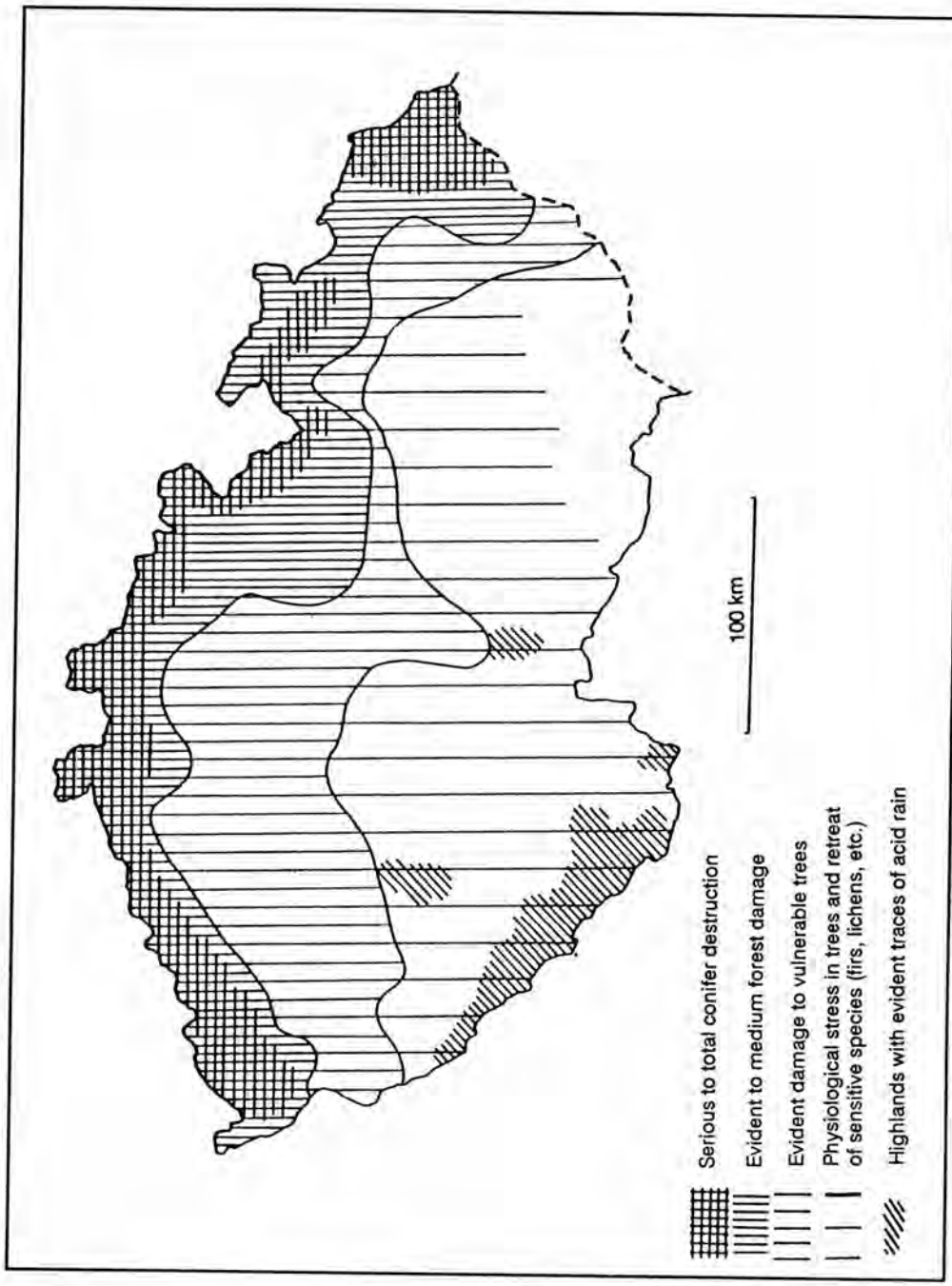

Figure 9: Estimated distribution of forest damage caused by industrial emissions in the CSR by the 1990s.
(Source: Czechoslovak Scientific-Technical Society, 1983)

Plate 13: Trees dying of emission impact in Krkonose (Giant Mountains) National Park *(Photo: V. Obereigner).*

3.2 Agricultural Industrialisation of the Countryside

As in other European countries, the development of agriculture and its environmental impact has become one of the key factors of environmental deterioration in Czechoslovakia (see also section 1.3). During the past 40 years the population of Czechoslovakia has grown by 3 million. Using traditional farming methods, this growth would require approximately one million hectares of new agricultural land to cover its needs. In contrast, however, the total area of agricultural land actually decreased during the same period by 700,000 ha, whereas non-agricultural land use expanded by 800,000 ha.

Due to the population increase, it has been necessary to raise the production of grain crops from 1.50 tons to 4.8 tons per ha (3.2 times), potatoes from 11.0 to 18.4 tons per hectare (1.7 times), sugar beet from 23.6 to 37.7 tons per hectare (1.6 times), forage from 3.15 to 6.8 tons per hectare (2.2 times), and eggs from 1,109 million to 5,300 million (4.8 times); annual timber production has grown from 10 million m^3 to 19 million m^3 (1.9 times).

These increased levels of production which, by the way, have not made Czechoslovakia self-sufficient in basic foodstuffs, has been achieved only after considerable cost to the environment through habitat destruction and increased use of fertilizers. Whereas in 1947/48 only 13.9 kg of manure were applied on 1 ha of agricultural land per year, in 1985 the doses applied reached an average of 258 kg (18.6 times increase), with as much as

337 kg (24.4 times increase) on arable land. Even in the Krkonose National Park, farmers apply 270 kg/ha/year of artificial nitrate manure to raise grassland productivity.

The problem here is that approximately 40% of the fertilizers applied are not used by crop plants. The excess nutrients leak into and cause eutrophication of watercourses. Similarly, the application of the numerous biocides used to protect crops contaminate watercourses and soils. The applicaton of selective herbicides in some Czech meadows has, for example, lead to a total loss in them of once common plants such as primrose *Primula elatior* and wood anemone *Anemone nemorosa*. Moreover, the biocides can enter human food and cause health problems.

Czechoslovak agriculture and food production consume large amounts of energy, representing about 10% of the country's total energy consumption. In agriculture this consumption is growing by 23.4% per year (2.77 million KW in 1955, 18.15 million KW in 1983). The majority of this is expended by heavy machines.

Ploughing arable land contributes to loss of soil fertility by destroying the soil structure. Due to a whole complex of reasons, the humus content of the soil is steadily decreasing and the activity of soil organisms waning. Soil erosion has been heightened by the creation of extensive areas of arable land (see 1.3), not only in flat countryside, but also on slopes.

3.3 Ecological Stress and Human Health

There are direct links between the quality of the environment and the quality of human health; indeed, health can be regarded as an indication of the quality of the environment and, therefore, the upset ecological balance in Czechoslovakia poses a threat to man's health.

Epidemiological studies show that 80% of malignant tumours are demonstrably related to living conditions. Tumours are the second most frequent cause of death, claiming 20% of all deaths; long-term monitoring has revealed an increasing trend in cancer of the lung, colon and rectum. There is unequivocal evidence that in the coal mining region of North Bohemia paediatric hospitalization is as much as 75% higher compared with less polluted areas. The general sickness rate in these polluted areas is 2-12 times more than elsewhere. The loss of forests is associated with a deteriorating state of health, especially of the respiratory system. Clinical examination of children living in highly degraded environments has shown a bone maturation delay of 6-8 months, lower humoral resistance and increased incidence of serious and complicated diseases affecting the upper respiratory system. The growth of allergic diseases (tenfold from 1962 to 1982) in Czech pre-school and school children is alarming. A similar increase has been reported for congenital development defects as well as sight defects.

According to a five-point scale of environmental deterioration (toxic substances in the air, noise level of road and air traffic, extent of mining, disposal of industrial and urban waste, content of toxic agents in water), 45% of the population resident in Central Bohemia live in a highly deteriorated environment. Even in South Bohemia, one of the Czechoslo-

vakia's comparatively unpolluted regions, one-third of the population lives in a badly deteriorated environment.

In Czechoslovakia, toxic metals such as lead, mercury, copper, cadmium, zinc and aluminium are not only found in industrial wastes: they enter the human diet through the food-chain, causing disorders to the nervous system and major organs. Other agents contaminating food include nitrates, mycotoxins and pathogenic microflora. Similarly, there has been a continuous deterioration of water quality. Of all the tap water produced in Central Bohemia in 1984, for example, only 50% consistently met health standards. The increasing concentration of nitrates in water and food (particularly by the recent excessive use of manure) led to 208 recorded cases of methemoglobinaemia ("blue baby syndrome") in Czechoslovakia between 1975 and 1980.

3.4 National Park and Protected Area System

The most important information about the protected areas in Czechoslovakia is given in section 1.6. The system of protected territories since its origin reaching back to 1838 has been developed with increasing attention and care as one of the most important tasks of the State Nature Conservancy. The latest developments in the Czech Socialist Republic are presented in Table 10.

Czechoslovakia is implementing a long-term programme to establish a representative protected areas system. The main objectives and components of the programme are: selection of new sites for special protection; reviews of the existing sites; management of protected areas according to each one's specific category, features, values, functions and development; use of protected areas for research monitoring, natural resource conservation, biological diversity preservation, ecological landscape maintenance, education and training, and, in some cases, tourism and recreation as well. For the system to be truly representative both typical and unique samples of particular geological and biological features, as well as whole ecosystems, need to be contained in each landscape conservation unit, termed a "socioecological region". The basic approach is flexible; the main concepts are: (i) the priority position of the large-size protected areas, especially Protected Landscape Areas as pilot sites for the implementation of ecologically sound, sustainable, development of a cultural landscape; (ii) recognition of the fact that sites which may lose their ecological value and thus justification for special protection, other ones may gain new qualities that qualify them for a special protection; and (iii) allowance in selection criteria for protected areas to cover not only "original" but also man-modified (semi-natural) ecosystems.

The environmental threats briefly described in 3.1 and 3.2 above, also have an impact on the protected areas system. Some sites have had to be deleted from the network because these impacts have been severe enough to undermine their conservation value. In other places, a vigorous management regime appears to be necessary to maintain them. Clearly it is imperative to combine the care of protected areas with environmental conservation as a whole.

Table 10: Growth of the protected areas system in the Czech Socialist Republic since 1965.

Period	National Park		Protected Landscape Area		State Nature Reserve		Protected Habitat		Protected Park and Garden	
	No.	ha	No.	ha	No.	ha	No.	ha	No.	ha
Until 1965	1	38,500	3	184,700	383	25,420	8	14.00	-	-
1966-1970	-	-	4	200,500	60	2,853	12	103.00	2	4.3
1971-1975	-	-	4	223,200	51	2,146	17	70.00	-	-
1976-1980	-	-	8	390,800	23	8,390	7	16.00	-	-
1981-1985	-	-	1	4,000	12	963	-	-	1	66
1986-1988	-	-	-	-	9	1,516	1	1.40	-	-
Total as at 1 Jan 1988	1	38,500	20	1,003,200	538	41,289	45	204.40	3	70.3

Table 10: Continued

Period	Protected Study Area		Protected Natural Feature (Creation)		Protected Natural Monument		Small-size totally protected territories	
	No.	ha	No.	ha	No.	ha	No.	ha
Until 1965	-	-	15	101	-	-	406	25,535
1966-1970	-	-	43	206	-	-	117	3,167
1971-1975	2	40	21	1,167	2	14	93	3,437
1976-1980	2	3	62	286	5	58	99	8,753
1981-1985	-	-	270	3,918	4	284	287	5,232
1986-1988	-	-	30	266	-	-	40	1,783
Total as at 1 Jan 1988	4	43	441	5,994	11	356	1,042	47,906

3.5 Tourism and Recreation as Environmental Factors

Recreation has become the third most important cause of environmental change and deterioration, after industrial and urban development, and agriculture. Second, or holiday, homes are now very popular and widespread and a Czechoslovak family without a second home is becoming more and more exceptional.

The first type of second home, where people usually spend weekends and holidays, and maybe most of their time when they retire, are disused houses in the country, such as old farms. In many cases these are monuments of folk-architecture which their new owners help to preserve. This is quite important even in some Protected Landscape Areas, where the preservation of folk-architecture forms part of the PLA's objectives. The second type are cottages or bungalows, built for this special purpose, in most cases with small gardens. Since the Second World War, they have spread all over the country usually occupying areas of outstanding scenic beauty and variety (and therefore also of conservation value). They have now become a significant source of visual and actual pollution because of inadequate waste and hygienic facilities, and contribute to habitat destruction and loss of biological diversity. In Cesky kras (Bohemian karst), a varied landscape southwest of Prague, there are approximately 1,500 private cottages (with an estimated 6,000 beds) within the Protected Landscape Area (of 13,200 ha area) and close to its borders there are another 4,000 bungalows with some 16,000 beds. Further to the southwest, in the PLA and Biosphere Reserve of Krivoklatsko (63,000 ha), there are more than 6,000 holiday cottages (built before the establishment of the PLA). During the last few years a third type of holiday home has appeared: gardener colonies. They consist of tens to hundreds of allotments with simple huts. As they are promoted by authorities and influential organisations as a suitable use of "barren lands", they pose a real threat to some of the last remaining wildlife habitats.

Hiking is very popular in Czechoslovakia, a country with perhaps the best developed and marked network of trails in the world. Recently, the situation described in 3.1 and 3.2 above discourages hikers from industrial, urban and agricultural areas, and a growing pressure of them on all categories of protected areas is being felt. Most frequently visited are the mountains (in which the most valuable National Parks and PLAs are situated), where winter sports and the development of facilities required by them present another serious threat to the natural environment. The annual number of visitors to the Krkonose National Park (38,500 ha) exceeds 8 million, thus placing this area among the most heavily frequented National Parks in the world. A significant factor causing environmental impact is the flow of tourists from the German Democratic Republic. Otherwise, foreign tourism in Czechoslovakia is mainly oriented towards urban centres, especially Prague, and "ecological tourism" is almost non-existent with the exception of several tours to study the forest decay in the northern half of Bohemia.

3.6 Public Awareness and Participation

A growing public interest in environmental affairs has recently become apparent. The reasons for this are obvious: first, the visibly deteriorating environmental situation harms

human health, social structure and social relations; second, there is a more open flow of information - undoubtedly under the beneficial influence of the Soviet *Glasnost*; and third, the fruition of environmental education efforts expended over the last few decades.

There has been a remarkable increase in the quantity of environmental information provided by the mass media (press, radio and television), although in some cases they are still reticent about revealing all the problems and dangers. Nevertheless, several books have been published, publicly exposing the problems affecting the environment. National ecological campaigns have been regularly organised since the 1970s: "Ekofilm" (international environmental film festival, every year in Ostrava); "Ekoplagat" (ecoposter, international exhibition and competition, every three years in Zilina); "TSTTT" (Tyka se to také tebe - *This concerns you!* - every year in Uherské Hradiste is a national festival of environmental amateur films and video recordings); "Na obranu prirody" (In defense of nature - a national festival of audiovisual environmental programmes, every second year in Prague).

Citizen action was initiated in the CSR in the1970s by the Socialist Union of Youth (SSM) through the "Brontosaurus" campaign ("Brontosaurus was not wise and did not survive, we people are reasonable and we will manage"). Later, SSM in the SSR led a campaign entitled "Strom zivota" (The tree of life). Conservation Unions were established in the late 1970s; some of their local organisations are at least partly performing the role of environmental citizen action groups. The first distinct conservation victory in Czechoslovakia - the government decision not to build a dam in the Krivoklatsko PLA and Biosphere Reserve - would probably not have been gained without bringing the matter into the public arena.

3.7 Development of Environmental Education

As in other countries of the world, the key importance of environmental education in Czechoslovakia was recognised and promoted by nature conservationists in a pragmatic way. Today, many of the protected areas provide outdoor classrooms for conservation education (Table 11). In this capacity they play important roles in both formal and informal education, as well as occasionally focusing on certain target groups.

Since the early 1970s, sophisticated environmental education (now rather called - as in other socialist countries - "ecological education") programmes have been elaborated in government departments of education, particularly in the education ministry of the CSR. Many of the projects, however, have not yet achieved proper implementation in the school system, although they have been appreciated and recognized even in international circles. There is good development of environmental education at the university level (see Chapter 2). One of the latest achievements has been the incorporation of a new environmental course into the vocational training of middle-ranking professional workers.

Table 11: Educational facilities available in Czechoslovak large-size protected areas (6 National Parks and 32 Protected Landscape Areas) *(Source: Cerovsky, 1988)*

Facility	Number
Nature trail	68
Botanic garden	4
Zoo	1
Museum exhibit	11
Publicly access. cave	15
Visitor centre	15
Other educational centre	6
National conservation training centre	2
Special journal or bulletin	9

Environmental education outside of school is not sytematically organised. However, quite a lot of activities are undertaken by organizations such as the Young Pioneers (with special conservationist groups, young naturalist centres, etc.), Socialist Union of Youth (see above), and Czech and Slovak conservation unions. Apart from the facilities provided by the State Nature Conservancy (see Table 11) there are no special professional environmental education centres. There are some cases of a top-level work (such as the first Czechoslovak School Nature Reserve at Prachatice, South Bohemia, a mixed school and extra-mural field centre, whose 20th anniversary was celebrated by an IUCN workshop in 1987), but they are still rare exceptions run by enthusiastic volunteers rather than widespread establishments adequately staffed by professionals.

3.8 Projects of Ecological Optimisation

The recent trend of launching sustainable development programmes has, in Czechoslovakia, resulted in various initiatives aimed at achieving "ecological optimisation of the economic use of landscape". The most important pilot project of this sort is located in the Trebonsko Biosphere Reserve and Protected Landscape Area in South Bohemia. It was started at a colloquium of ecologists, conservationists, managers and decision makers held

in Trebon in 1978. Guidelines were developed of how to achieve sustainable development of the area, ensuring both conservation of natural resources and landscape values as well as their rational use. These guidelines were approved by the CSR Government. Another colloquium in 1988 reviewed the progress accomplished during the past ten years and made further recommendations.

As a practical effort towards implementation of the World Conservation Strategy, another pilot study, "Project Frysavka" (Frysavka is a small river in the Czech-Moravian Highlands), was launched at the beginning of the 1980s. It is trying to introduce the sustainable-use concept in an agricultural area.

Also in the early 1980s, an attempt was made to promote a federal Czechoslovak "Ecoprogramme", encompassing the goals and objectives of the World Conservation Strategy. At present, the Ecoprogramme is being developed chiefly at district level; some Czech districts (especially Rakovnik and Kolin in Middle Bohemia) are particularly active in this regard.

In pursuing sustainable development, it is essential to ensure the preservation and creative conservation of ecologically sound components of the environment. Accordingly, during 1988 important landscape elements were identified throughout the CSR. This task, named "Balance sheet of important landscape elements" was ordered by the Czech government and accomplished jointly by the State Nature Conservancy and TERPLAN - the Czech Institute for Physical (Territorial) Planning.

3.9 The Role of Science and Research

There is an increasing interest in studies concerning conservation and the environment. The importance of a theoretical scientific base has been recognized and ecology has become one of the key scientific disciplines. A group of scientists from the national scientific research centre of the Czechoslovak Academy of Sciences have developed the concept of "anthropoecology", the study of inter-relations between man and his natural environment. Likewise, the State Nature Conservancy espouses "socioecology" as its theoretical foundation (Shaposhnikov, 1969).

Environmental conservation research has grown rapidly during the past two decades. Within the State Plan of Basic Research there are many environmentally oriented projects, some of them grouped in special programmes. Of particular importance is the research programme of the Czechoslovak Academy of Sciences devoted to biological diversity and its conservation. This includes, in cooperation with the State Nature Conservancy, the preparation of the Czechoslovak Red Data Book.

Steps are being taken to record and evaluate the rate of environmental change. Monitoring of the environment is therefore being developed in various forms and localities. For example, there are several institutes using remote sensing such as the State Institute for Protection of Monuments and Nature Conservation in Prague which operates its own Remote Sensing Laboratory principally for monitoring environmental deterioration in large-size protected areas.

3.10 Participation in International Cooperation

Since the beginning of the 20th century, conservationists in Czechoslovakia have ascribed great importance to international cooperation.. The State Nature Conservancy of Czechoslovakia has been active in this sphere according to the opportunities afforded by its institutional capacity, regional and global developments, actual environmental situation and - last but not the least - the contemporary state of both national and international politics.

There is a rapidly growing interest in such cooperation, and top Czechoslovak politicians are taking the initiative in the field of international "ecologial collaboration and security". This important trend might have a positive influence in speeding up the solution of urgent domestic environmental problems. The existing links and opportunities in international cooperation are dealt with in more detail in Chapter 5.

CHAPTER 4: PRIORITY INITIATIVES

From the previous account of the environmental situation and trends in Czechoslovakia, priorities for action can be easily derived. They are briefly described in the six points below.

4.1 A better control of environmental pollution and contamination. This concerns both air and water pollution. The principle methods for improvement appear to be installing cleaning equipment, changes in industrial technologies as well as in heating, and perhaps also more efficient us of energy. The risk of pollution by toxic substances should be particularly avoided and prevented. A crucial factor here is to stop environmental (including food) contamination through food chains caused by excessive and often unnecessary use of fertilizers and biocides (pesticides).

4.2 Ecological optimisation of land-use. There is a need to stop the conversion of arable land into urban and other areas, to fight the dangers of soil fertility loss, and to control eutrophication, pollution and contamination caused by an industrialised agricultural system. Soil erosion needs to be restrained. Biological diversity can be used to help landscape maintainence. This will mean preservation, reintroduction, rehabilitation and reconstruction of populations of wild plants and animals and their habitats. The scenic values of the countryside, especially small wetlands and streams, and other natural and semi-natural ecosystems, also need to be maintained and enhanced. The role of physical (territorial) planning has to be strengthened and the elaborated and approved plans must be fully respected and followed in land-use practice.

4.3 Abolition of environmental illiteracy and encouragement of environmentally sensitive attitudes among the general public. This will mean that environmental education is paramount for decision makers. A comprehensive system of environmental education has to be fully implemented in both formal and informal sectors of education. Environmental illiteracy not only stems from ignorance, but also from deep and too specialized knowledge. Interrelations have to be observed, respected and interpreted taking into consideration their practical environmental impacts. The proportion of the population reached by environmental education must be substantially increased. New attitudes cannot be fostered by abstract ideas: it is necessary to seek new ways of stimulating environmental awareness in the public, for example by introducing financial rewards for workers who follow ecological principles.

4.4 Stronger environmental conservation authorities and organizations. The present structure (see Chapter 2) with a totally inadequate federal environmental administration and, even at the Republic level, the division of (anyway rather weak) competences between several bodies (some of them with clearly prevailing exploitation interests) is no longer acceptable. An efficient and competent environmental author-

ity with sufficient staff and finance has to be established to advise authorities and voluntary organizations involved in the use of natural resources and in the shaping of the landscape. Stronger public control and participation in the decision-making process concerning matters of environmental conservation is desirable; a higher level of citizen action is needed.

4.5 Development of a scientific base for environmental conservation. Research in environmental problems has to move closer to real life and its requirements. It must be oriented at the most urgent issues and make proposals for solutions. An ecological point of view must be combined with economic analysis resulting in recommendations which should be acted upon.

4.6 A better standing in international cooperation. For a small country like Czechoslovakia, with a frontier cutting through homogeneous biogeographical units, and a high rate of exchange of both natural components and troublesome waste, good international cooperation is imperative. This should be pursued by membership of all leading international organizations (including Czechoslovak state membership of IUCN), by intensive collaboration with neighbouring countries in environmental matters, by bilateral and multilateral international agreements and treaties, and by accession to existing and future international conservation conventions. At the time of writing, Czechoslovakia was not a Party to any international conservation convention; joining the Ramsar Convention (Figure 10) may occur soon - largely due to the existence of the IUCN East European Programme).

The Government of the CSR, by Decree No. 219/1988, set out its principal strategic goals according to the State Strategy for Creation and Protection of the Environment and Rational Use of Natural Resources (which might in fact be regarded as the national environmental conservation strategy) until the year 2000. The principal goals are:

a) prevention of new investment, modernization and reconstruction unless there is an adequate assessment and solution of their environmental impacts;

b) to invest in the installation of water and air cleaning facilities as well as equipment for waste disposal to combat existing sources of pollution sources, and at the same time to seek other ways of tackling pollution through structural changes, modernisation, lower consumotion and production, etc.;

c) to limit the deterioration of the environment and natural resources resulting from the development of industry, construction and other economic activities called for in regional and territorial plans;

d) to improve water resource conservation by better water retention, revoking exceptions from the Water Act for pollution sources and limiting discharges to 155,000 tons per year of BSK_5 (83,000 tons per year in the CSR, 72,000 tons per year SSR) and to 166,000 tons per year of insoluble substances (108,000 tons per year in the CSR, 58,000 tons per year in the SSR);

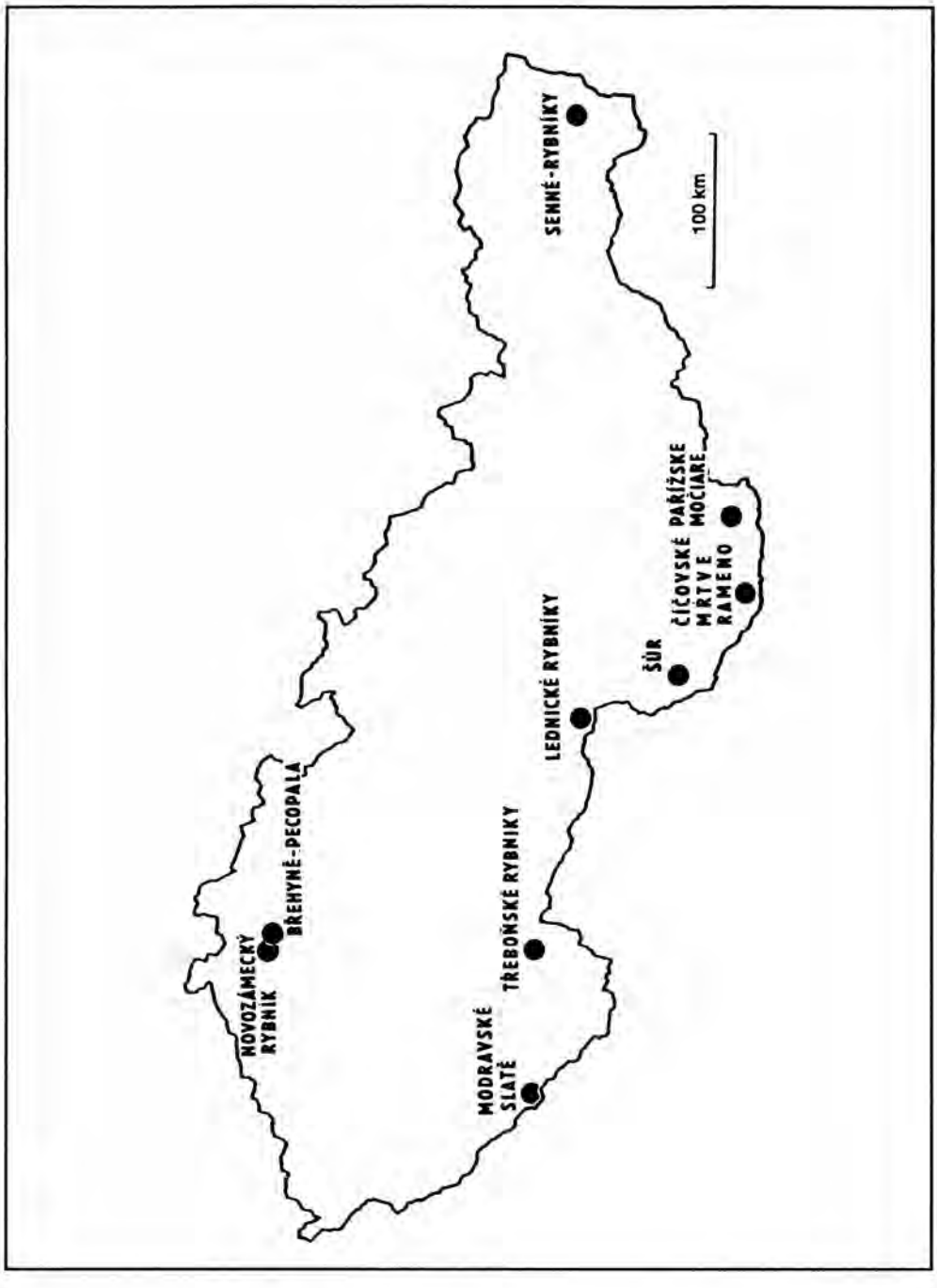

Figure 10: Wetland sites in Czechoslovakia proposed for listing under the Ramsar Convention.

e) to decrease the area threatened by erosion to 30% of all agricultural and forest land iby improving applied agrotechnology; to rationalize the inputs of nutrients, pesticides and motor fuel and at the same time to improve soil quality and fertility;

f) to lower the total emission of sulphur dioxide below 1.9 million tons per year (1.5 million tons per year in the CSR, 400,000 tons per year in the SSR), and emissions of solid substances below 1 million tons per year (700,000 tons per year in the CSR, 300,000 tons per year in the SSR);

g) to limit gradually waste disposal by landfill and to achieve the re-use of industrial waste by 60% and communal waste by 40%;

h) to assign investment for environmental conservation projects in the state budget during the periods of the 9th and 10th five-year-plans, at least to achieve the Strategy's objectives;

i) to improve the supply and use of building and engineering materials to enable environmentally sound construction projects to be undertaken, including methods for protecting the environment in its own right.

By Decree No. 243 of 31st August 1988, the Federal Government charged Ministers and other leading politicians with concrete tasks to ensure the accomplishment of the new environmental goals and perspectives. These were adopted for execution by the national Governments of both the CSR and the SSR.

The CSR has made funds available for ecological investment. The amount allocated for the 8th five-year-plan (1986-1990) was reached 17.5 billion Crowns. For the following five-year-plan periods a considerable growth of this finance is expected.

CHAPTER 5: OPPORTUNITIES FOR REGIONAL AND INTERNATIONAL COOPERATION

Czechoslovakia is a small mountainous country located "on the roof of Central Europe". This means that Czechoslovakia receives hardly any meaningful contributions to it's water balance from accross its's borders: on the contrary, Czechoslovak rivers flow into neighbouring coutries, and therefore the quality and quantity of water is extemely important not only for Czechoslovakia but also for it's neighbours. The biogeographical units with the greatest conservation interest - mountains in Bohemia, North Moravia and North Slovakia, river flood-plains with ox-bow lakes, pools and riverine forests in South Moravia and southwest Slovakia, the karst area in southeast Slovakia (the largest in Central Europe) - are all divided by the Republics' frontier, effectively splitting responsibility for conservation of the country's natural heritage. Czechoslovakia is a big "exporter" and at the same time also "importer" of a disastrous level of air pollution. These reasons certainly make a strong case for good international cooperation in environmental conservation anywhere: in Czechoslovakia it is absolutely essential.

The Czechoslovak "Conservator General" of the State Nature Conservancy attended both preparatory conferences which led to the establishment of IUCN - in Basel in 1946 and in Brunnen in 1947. Political developments prevented Czechoslovak delegates to be at the inauguration of IUCN at Fontainebleau in 1948. The first Czechoslovak attendance at an IUCN General Assembly dates back to 1956, in Edinburgh. The first Czechoslovak member organization (State Institute for Protection of Monuments and Nature Conservation, Prague) joined IUCN in 1958. Since 1956 there has been Czechoslovak representation at all General Assemblies of IUCN. The current membership amounts to three organizations: besides the above mentioned they are the Slovak Centre Board for Nature Conservation at Liptovsky Mikulas and the Krkonose (Gaint Mountains) National Park Administration at Vrchlabi. At the moment the difficult convertible currency situation in the country, does not allow Czechoslovak member organizations to afford more than affiliated membership. The administration of Tatra National Park (the first and still the most important protected area in Czechoslovakia) ceased membership in 1988, but hopes to renew it soon.

Other organizations, though not members, and some individual specialists, have been collaborating with IUCN in various capacities, mainly as members of its Commissions, Committees and working groups. Those active in IUCN meet at least twice a year to coordinate their international work. By 1988 this informal group had virtually become the Czechoslovak IUCN Committee, and this body will finally be authorised in 1989. The committee is seviced by the State Institute for Protection of Monuments and Nature Conservation in Prague. In 1969-1972 a Czechoslovak specialist worked professionally in the

Plate 14: One of the promising achievements of species preservation in Czechoslovakia has been the establishment of a reintroduced lynx population in the Sumava (Bohemina Forest) Mountains *(Photo: M. Hain).*

Plate 15: Bilateral national parks and bilateral cooperation play an important role in Czechoslovak nature conservation: the highest peak of Krkonose (Giant Mountains) is divided by the Czechoslovak-Polish frontier *(Photo: M. Hladik).*

IUCN Secretariat as Education Executive Officer, and in 1984 two Czechoslovak candidates were elected IUCN Regional Councillors. IUCN enjoys a considerable reputation in Czechsolovakia, its materials and directives being widely used and applied. Many Czechoslovak journals and magazines, and primarily the official journal *Pamatky a Priroda* (Monuments and Nature), regularly publish information from IUCN sources.

Leading conservationists from East European Socialist countries have often met together since the mid-1950s to exchange information about developments in their countries and to consider new initiatives. In the early 1970s several working groups on various environmental programmes, mainly at a coordinating and research/surveying level, were created within the Council for Mutual Economic Assistance.

The first organized international body of East European conservationists, however, was the East Europe Regional Committee of the IUCN Commission on Education, founded in Prague during an international conference in 1967. Since then it has worked continuously and cooperated with its sister Northwest Europe Regional Committee providing links for broader European contacts and activities. In 1984 the first joint meeting of both Committees was held in Helsinki, Finland. Since then, such a meeting has been organised every two years together with a subject-oriented conference. In 1986 the place was Keczkemét and the Kiskunsag National Park and Biosphere Reserve in Hungary with the conference on education activities in European national parks and protected areas; in 1988 the meeting was hosted by Norway in Bo, Telemark, and the large conference was devoted to educational implications of the Brundtland Commission's report. The 1990, meeting will be held in the German Democratic Republic and the conference is expected to deal with environmental education in rural, particularly agricultural, areas. Under the sponsorship of the IUCN Commission on Education and Training a successful workshop on environmental education field centres was held in Volary, Czechoslovakia, in May 1987.

Czechoslovak specialists were instrumental in the establishment of a second regional IUCN Committee operating predominantly in the East European Region, and have played a leading role in its activities. This is the Committee for Ecodevelopment in Cultural Landscapes of the IUCN Commission for Sustainable Development. The Committee has organised a series of meetings, the last one of which was the symposium entitled "Strategia pro natura et populo" held in Kielce in Poland in 1988, one of the first activities undertaken within the framework of the IUCN East European Programme.

The Czechoslovak Government participates in the environmental activities of the United Nations and their specialised agencies, particularly UNESCO, UNEP and the Economic Commission for Europe. Czechoslovakia plays an active part in the Man and Biosphere (MAB) Programme of UNESCO. This is coordinated by the National MAB Committee of the Czechoslovak Academy of Sciences, and initiatives have been undertaken through regional cooperation: the countries of the East European Region form a sub-regional "SocMAB" grouping. In May 1989, Czechoslovakia will host the second regional European MAB Conference. In 1986, the Czechoslovak National MAB Committee organised a regional meeting in Ceské Budejovice on the elaboration of the Biosphere Reserve Action Plan produced by the First International Congress on Biosphere Reserves (Minsk, USSR, 1983). In Czechoslovakia there are four Biosphere Reserves, all bearing

the national conservation status of Protected Landscape Area: Krivoklatsko, Palava, Slovensky kras and Trebonsko. Other sites are being prepared for submission to UNESCO.

The bilateral protected areas concept in Europe was born in Pieniny, an outstanding canyon of the river Dunajec which runs along the border between Polish and Slovak mountains, in the early 1020s. Today, the area is a twin Czechoslovak and Polish National Park. Other border National Parks with Poland are Vysoké Tatry (High Tatra) and Krkonose (Giant Mountains). Close cooperation exists between the Administration and Advisory Councils of the Czechoslovak and Polish bilateral National Parks, manifested by exchange of experience, joint meetings and projects, and coordination of management, planning and implementation. Three of four Czechoslovak Biosphere Reserves are situated at the frontiers: Trebonsko and Palava alongside Austria, and Slovensky kras alongside Hungary (contiguous with the Aggtelék National Park and Biosphere Reserve with which good cooperation has been established). Elsewhere, the Sumava (Bohemian Forest) Protected Landscape Area (and candidate National Park and Biosphere Reserve) borders the Bavarian National Park and Biosphere Reserve in the Federal Republic of Germany Labské piskovce (Elbe Sandstones) PLA lies alongside the Sachsisch Schweiz (Saxonian Switzerland) protected area in the GDR, and Horna Orava (Upper Orava) PLA joins with the Polish National Park and Biosphere Reserve of Babia Gora.

During the last few years in particular, Czechoslovakia has greatly increased cooperation with neighbouring countries in broader environmental matters: for example, in air pollution control with FRG, GDR and Poland, in water management and nuclear safety with Austria, and in river regulation (of the Danube in particular) with Hungary. Both regular and *ad hoc* meetings of specialists and decision makers are held, with symposia examining the problems, joint projects and measures undertaken, and agreements concluded. Environmental cooperation has recently been included in the scope of "friendship relations" between Czechoslovakia and neighbouring countries.

Unfortunately, Czechoslovakia is still not a Contracting Party to any of the major international conservation conventions. Preparation, however, has been completed concerning the Ramsar Convention, and it is hoped that Czechoslovakia will ratify it soon.

Quite recently Czechoslovak political leaders made several appeals to the international community expressing the desire for international ecological collaboration and security. The Prime Minister of the Czechoslovak Socialist Republic invited the Prime Ministers of neighbouring countries to a meeting to discuss these matters. The invitation has been accepted and preparations are underway.

BIBLIOGRAPHY

Belochová, I. (ed.) (1988). *Vychova k peoi o prirodu a zivotni prostredi.* Sbornik referatu. Sprava Krnap, Vrchlatoi.

Cerveny, J. a Kol (1984). *Podnebi a vodni rezim CSSR.* Statni zemedelské nakladatelstvi, Praha.

Cerovska, J. (1988). *Sustainable Development and Health - Features Common to Prevention in Medicine and in Environmental Management.* "Sustainable Development - Learning for Tomorrow's World", Int. Conf. Report, p.94-97, Bo, Norway.

Cerovsky, J. (1988). *Nature Conservation in the Socialist Countries of East Europe.* Ministry of Culture of the Czech Socialist Republic. 2nd Edition. Praha.

Cerovsky, J. and Petricek, V. (1985). *Rukovet ochrance prirody.* Ministerstvo kultury CSR ve Statnim zemedelskem nakladatelstvi, Praha.

Cerovsky, J., Petricek, V., Trpak, P. and Damohorsky, M. (1988). *Rukovet ochrance prirody 3.* Ministerstvo kultury CSR ve Statnim zemedelskem nakladatelstvi, Praha.

Demek, J. and Voracek, V. (Eds.)(1974). *Zivotni prostredi Ceské socialistické republiky.* Geograficky ustav CSAV, Brno.

Department of the Interior, Bureau of Mines (1985). *Minerals Yearbook 1985* Vol. 3, V.5. Washington 1987.

Geofond (1988). *Bilance zasob nerostnych surovin Ceské socialistické republiky k 1.1.1988.* Geofond, Praha.

Holub, J., Prochazka, F. and Cerovsky, J. (1979). *Seznam vyhynulych,endemickych a ohrozenych taxonu vyssich rostlin kveteny CSR (1. verze)* - List of extinct, endemic and threatened taxa of vascular plants of the flora of the Czech Socialist Republic (first draft). Presilia 51: 213-237, Praha.

Janech, J. and Menzlova, M. (1985). *Nepriznivy zdravotni stav obyvatel ostravské prumyslové aglomerace.* Sbornik lékarsky, 87, 2-3, Praha.

Juva, K., Klecka, A, and Zachar, D. a kol (1981). *Ochrana krajiny CSSR z hlediska zemedelstvi a lesnictvi.* Academia, Bratislava.

Klinda, J. (1985). *Chranené uzemia prirody v Slovenskej socialistickej republike.* Obzor, Bratislava.

Kodl, M., Kriz, J. and Sulc, A. 91987). *Vztah mezi charakteristikou zivotniho prostredi a zdravotnim stavem obyvatelstva.* Cs. Hygiena, 10, Praha.

Kriz, J. (1987). *Soucasny stav a vysledky studia zdravotniho stavu obyvatel ve vztahu k zivotnimu prostredi.* Cs. Hygiena, 32, Praha.

Kucera, B. (1986). *Rozvoj statni ochrany prirody.* Ustav pro vyzkum kultury a Statni ustav pamatkové péce a ochrany prirody, Praha.

Libalova, J. (1986). *Aktualizované mapy nerostných surovin pro skolni atlas CSSR.* UUG, Praha.

Maglocky, S. (1983). *Zoznam vyhynutych, endemickych a ohrozenych taxonov vyssich rastlin flory Slovenska.* Biologia, 9: 825-852, Bratislava.

Marsakova-Nemejcova, M. and Mihalik, S. *et al.* (1977). *Narodni parky, rezervace a jina chranena uzemi prirody v Ceskoslovensku.* Academia, Praha.

Midriak, R. (Ed.)(1988). *Aktualne problémy ochrany biosféry CSSR.* Zbornik referatov. Vysoka skola lesnicka a drevarska, Zvolen.

Mikula, S. (1988). *Zakladni zamery resortnich koncepci péce o zivotni prostredi.* Uzemni planovani a urbanismus, 15, 3: 139-144. Praha.

Odehnal, L. *et al.* (1966). *Mapa lozisek nerostnych surovin* 1: 100,000. Geologicky atlas CSSR, UUG, Praha.

Petricek, V. and Cerovsky, J. (1986). *Rukovet ochrance prirody 2.* Ministerstvo kultury CSR ve Statnim zemedelském nakladatelstvi, Praha.

Prehled chranenych uzemi v CSR. Studijni podklady a informace k péci o zivotnim prostredi. Rada pro zivotni prostredi pri vlade CSR, Ministerstvo kultury CSR, 1986 Praha.

Samek, V. and Moucha, P. (eds) (1988). *Rekreace a ochrana prirody.* CSVTS, pobocka pri Stredoceskem SSPPOP, Praha.

Svoboda, J. (ed.) (1988). *Chranena uzemi prirody CSSR 1:750,000.* [Map of protected areas with explanatory text]. 3rd ed. Geodeticky a kartograficky podnik, Praha.

Sedlacek, K. *et al.* (1988). *Cervena kniha ohrozenych a vzacnych druhu rostlin a zivocichu CSSR - 1 Ptaci.* Statni zemedelské nakladatelstvi, Praha.

Stepan, J. (1988). *Zakladni dokumenty pro péci o zivotni prostredi v osmém petiletém planu.* Uzemni planovani a urbanismus, 15, 3: 134-8. Praha.

Vanecek, M. (1987). *Rozvoj a efektivni vyuzivani nerostné surovinové zakladny CSSR.* Zprava pro prubezné opon. Rizeni prognozy VTR SMS 01; Pr FUK, Praha.

Vavra, Z. (1988). *Nepritel oxid siricity.* Rudé pravo, Praha.

Journals: *Chranené uzemia Slovenska*, Bratislava
Pamatky a priroda, Praha
Pamiatky a priroda, Bratislava
Zivotné prostredie, Bratislava

IUCN EAST EUROPEAN PROGRAMME

Environmental Status Report 1988/1989

HUNGARY

Compiled by
Dr Zoltan Szilassy
Ministry for Environmental Protection
and Water Management
Department for Nature Conservation

Budapest, 1989

CONTENTS

CHAPTER 1: INVENTORY OF NATURAL RESOURCES

1.1 Air protection

The state of Hungary's air pollution (Table 1) could be considered to be moderate in relation to European standards. Some 40-45% of the emitted air-polluting materials are of industrial origin, while 35-40% originate from traffic, and about 20% from communal heating. The concentrations of acidic compounds such as sulphur dioxide and nitrogenous oxides during rush hours in industrial areas and inner cities are sometimes higher than the permitted level. However, the average concentrations in Hungarian towns are lower.

Table 1: Annual amount of air pollution of anthropogenic origin (Data from 1985)

	Tons
Dust	800,000
Sulphur dioxide	1,400,000
NOx	300,000
Carbon-monoxide	2,400,000

Dust pollution is very high in some areas with a heavy concentration of industry where the annual average surpasses the permitted level, for example at Labatlan, Dorog, Ajka, Varpalota, Tatabanya, Dunaujvaros and Ozd. A fall in dust pollution has been observed in Budapest, Gyor, Tatabanya and Ozd, but it has increased in Varpalota, Kecskemet and Dunaujvaros.

East of the river Tisza, in the region between the Danube and the Tisza river, and in the northern and southern parts of Transdanubia, the high amount of airborne dust, which often exceeds the norms, mostly originates from soil-blow. (The alkaline nature of this dust moderates the acidity of rainfall, indeed alkaline precipitation of about pH 8 has been recorded.)

The quality of air is acceptable in the overwhelming majority of Hungary's built-up areas. The state of the air in recreation areas could be classified as good or adequate bar some town centres that have high traffic levels (Table 2). Hungarian territories with serious air pollution are shown in Figure 1.

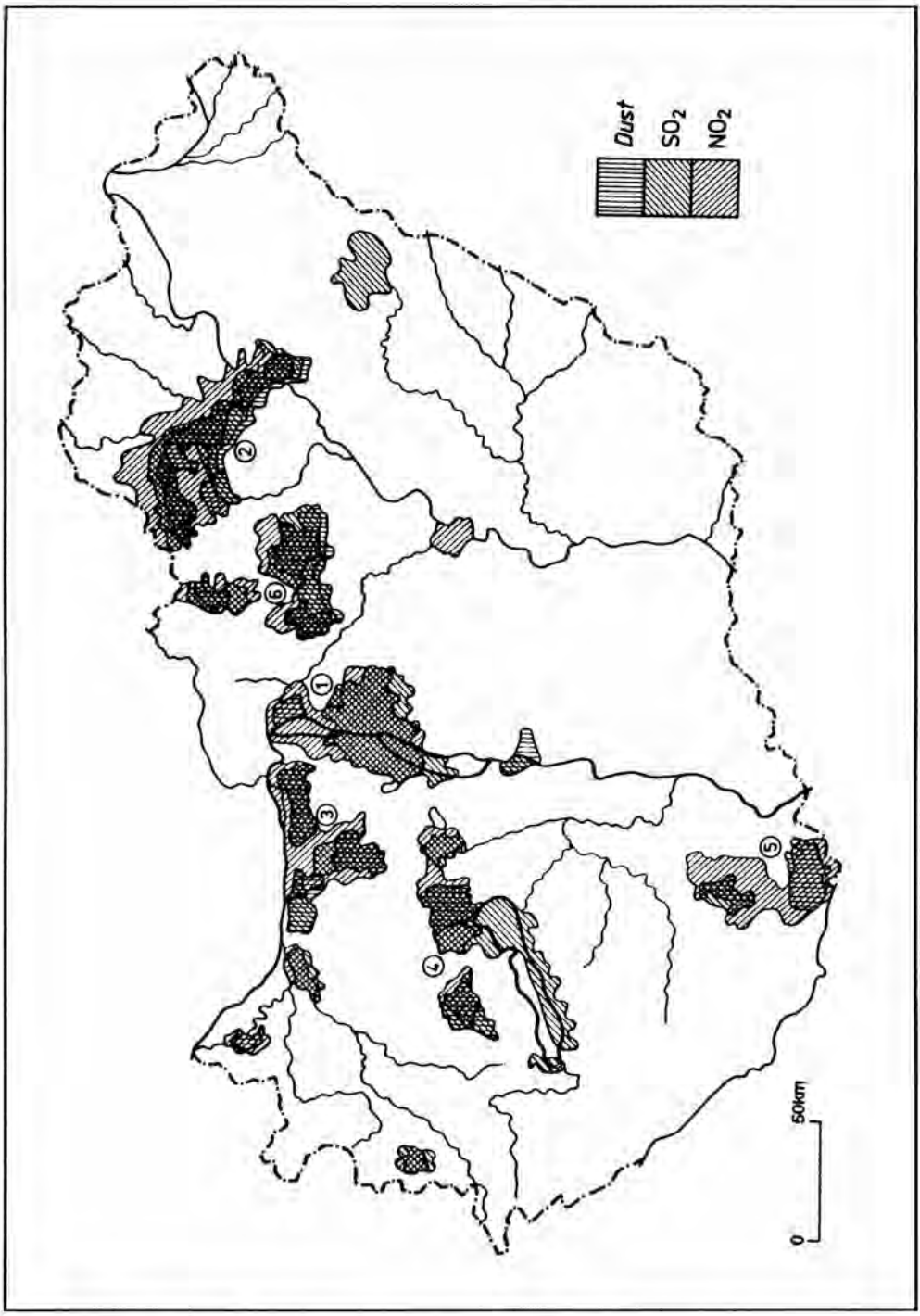

Figure 1: Regions of Hungary heavily affected by air pollution.
(Source: National Authority for Environmental Protection and Nature Conservation, 1987.)

Table 2: Areas and their populations suffering from air pollution

	Area (sq. km)	Inhabitants (10^3 head)
1. Budapest and its environs	1.946	2.527
2. Borsod area	2.225	0.512
3. North-Transdanubian industrial area	1.369	0.277
4. Mid-Transdanubian industrial area	1.283	0.310
5. Baranya area	1.304	0.271
6. Nograd-Heves area	1.154	0.221
Towns outside the above areas	1.136	0.613
Total	**10.446**	**4.731**
Out of these:		
Budapest	0.525	2.064
Other polluted towns	3.218	1.821
Other polluted built-up areas	6.703	0.846

1.2 Water Protection

In spite of the significant pollution, most of the country's surface waters are of acceptable quality. The quality of water in Hungary's main rivers (Danube, Tisza, Drava) is mostly class II, partly class I (Figure 2). Although the water quality of smaller rivers (Sajo, Zagyva, Kraszna, Maros, Sed, Kapos, etc.) is higher in parts, they are in general of lower quality. The water quality of the country's main lakes (Balaton, Lake Velence, Lake Ferto) is acceptable for bathing.

Between 1981 and 1985 water quality conservation measures, which cost in excess of 20 billion Ft (about US$400 million), had a stabilizing effect on the water quality of the country's surface waters. In fact, in some areas (Budapest, North-Transdanubia, Balaton), water quality improved. However, the continuous degradation of the country's groundwater is a serious problem (Figure 3). External pollution directly contaminates about 60% of the country's primary groundwater supplies. Sources include sewage infiltration in non-canalised areas, the improper use of chemicals in agriculture, wastes produced by animal husbandry and industrial effluent. Nitrate pollution is particularly severe: out of the country's annual 1 billion m^3 or so waste water cleaning requirements, only 186 million m^3 (19%) are correctly treated. The capabilities of waste water plants are far lower than those of the water supply plants, but with the enforced improvement of canalization and sewage

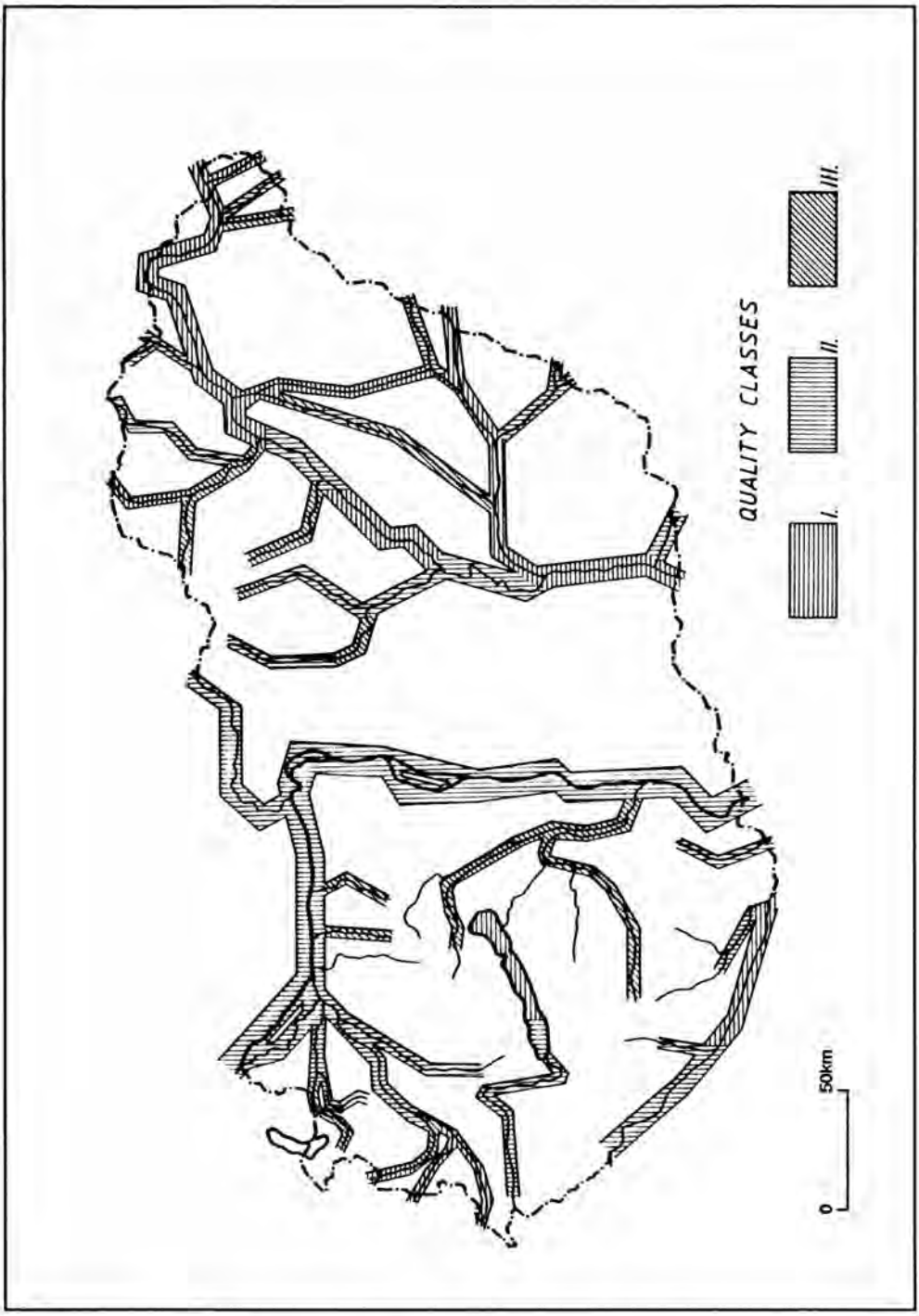

Figure 2: Quality of watercourses in 1985.
(Source: National Authority for Environmental Protection and Nature Conservation, 1987.)

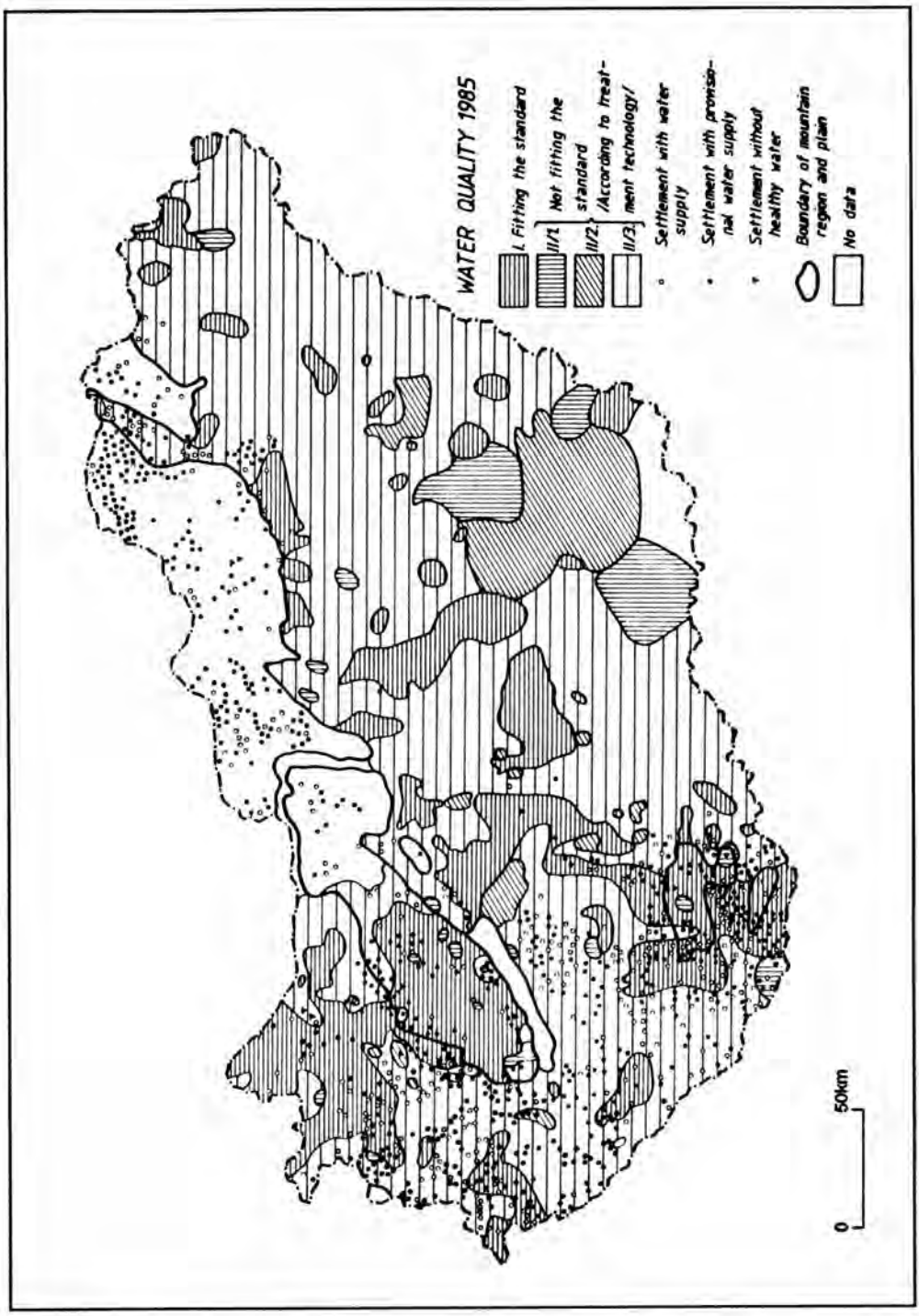

Figure 3: Quality of groundwater (20-50 m depth) in 1985.
(Source: National Authority for Environmental Protection and Nature Conservation, 1987.)

treatment facilities this shortcoming should gradually diminish. At the moment, the shortfall between the water supply and sewage treatment averages about 38% so the need for protecting drinking water resources is acute.

1.3 Soil protection

Hungary's surface area totals 9.3 million ha, of which some 89% is countryside (and 70% farmed). Residential and industrial areas, roads, etc. cover the remaining 1 million ha (11.2%). In 1984, the land use pattern was as follows:

Cropland	50.4%
Gardens	3.6%
Orchards	1.2%
Viticulture	1.7%
Pasture	13.6%
Forests	17.6%
Reed-beds	0.4%
Fishponds	0.3%

There are 29 recognised soil types in Hungary (Figure 4). Hungary's arable soils represent about 20% of its national estate. However, productivity is restricted on more than half of Hungary's cropland by unfavourable natural or anthropogenic circumstances. On about 2.3 million ha of mountainous and hilly ground, erosion is the damaging factor: 554,000 ha are presently highly eroded. Soil wash in these regions is estimated at 30 tons/ha/year, filling valleys and watercourses with sediments. Wind erosion affects about 1.4 million ha of Hungary's light sandy and peaty soils and mobile sand covers an area of 362,000 ha. Flooded areas constitute an annual average of 130,000 ha, and waterlogging problems impede soil cultivation on 500,000 ha.

Soil acidification mostly results from human influences, such as applying fertilizers. The average pH value of Hungary's soils has decreased by a full point in the last 30 years (Figure 5). Out of the total 2.3 million ha of acidic land, 23% is only slightly acidic, while 66% is moderately and 11% highly affected (Figure 6). The area of Hungary's inherently alkaline soils is about 560,000 ha, of which two-thirds are non-calcareous (solonec) and one-third sodic (solonchak) soils. Secondary alkalinisation may affect a further 400,000 ha as a result of improper irrigation. Out of 940,000 ha of sandy soil (38% of which is composed of mobile sand), about 590,000 ha of poor sand needs improvement.

In 1984, 234,439 ha were irrigated, using 491 million m^3 of water. Sprinklers were used on 185,000 ha, while surface irrigation was applied to 38,000 ha and sub-surface irrigation to 9,400 ha. Between 1980 and 1984 a total of 175,176 ha of acidic, 11,562 ha of solonec, and 11,046 ha of sandy soils underwent chemical soil conservation measures.

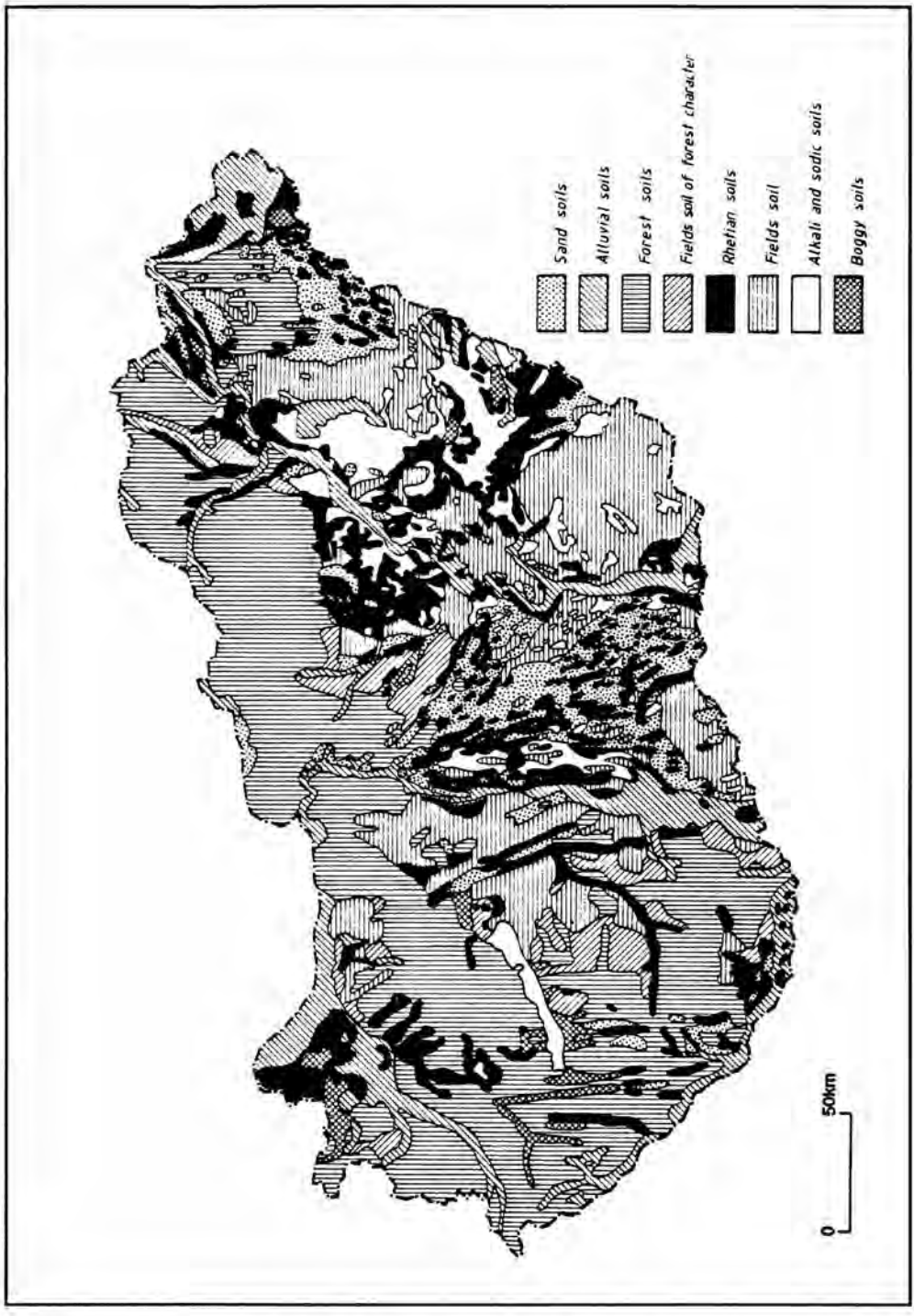

Figure 4: Major soil types of Hungary.
(Source: KSH, 1986.)

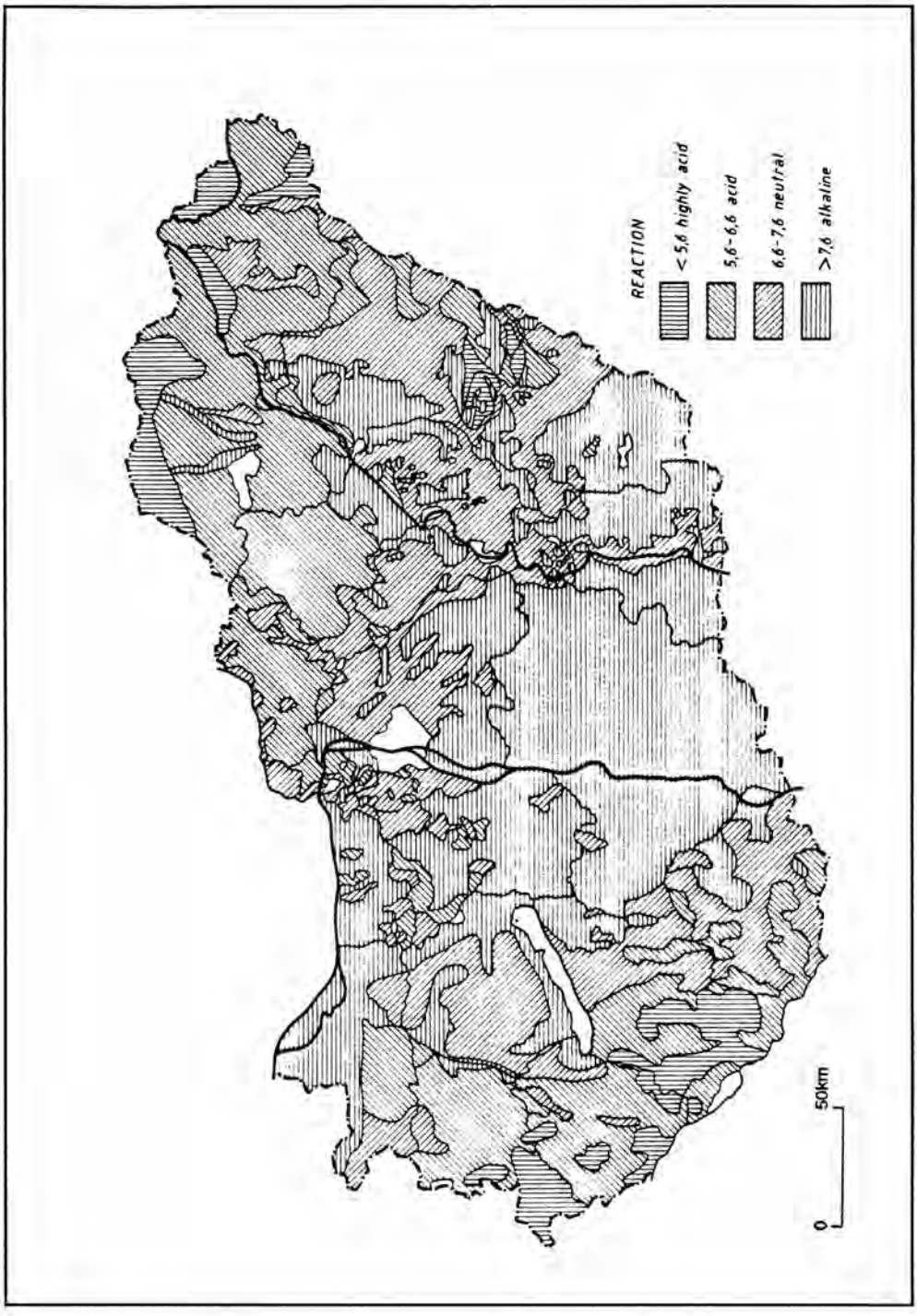

Figure 5: Soil pH.
(Source: KSH, 1986.)

Figure 6: Distribution of acid, alkali and sandy soils.
(Source: KSH, 1986.)

1.4 Mineral Resources Protection

Hungary's known and estimated mineral resources are given in Table 3 (and see Figure 7). According to the available data, most of Hungary's crude oil and natural gas can be exploited by primary methods. However, even at current utilisation levels, the reserves will be exhausted in 15-20 years. Hungary's energy generation industry has had to import raw materials for years and at present 30-35% of the country's electric power is imported.

Hungary's coal resources appear to have a long-term sufficiency although their economic and environmentally sound exploitation has not been possible during the last decade. 14.6% of the country's industrial coal is black, 15.3% is good quality brown, 6.5% is poor quality brown, and 63.6% lignite with open-cast mining potential. Coal, however is one of the worst energy-sources from the point of view of worldwide environmental protection.

Table 3: Hungary's mineral resources (January 1986) in 10^3 tons.

Minerals	Total economically exploitable (industrial) resources	Production in 1985	Anticipated resources
Crude oil*	26.5	2.0	58.6
Natural gas	131.7	7.6	175.0
Coal, black	661.5	2.9	55.0
Coal, brown	988.9	15.6	305.0
Lignite (open mining)	2,885.2	6.5	1,124.0
Bauxite	88.0	2.8	63.3
Lead-zinc ore	24.7	0.1	57.0
Copper ore	170.7	None	58.5
Iron ore	12.9	0.3	12.0
Manganese oxide ore	2.4	0.1	1.9
Manganese carbonate ore	3.9	No production	-
Mining minerals (raw materials)	1,150.0	4.9	490.5
Raw materials for cement industry	2,533.2	8.2	xx
Construction and ornamental stone	1,310.5	9.0	xx
Sand- and gravel-based industrial	976.5	27.5	xx
Fine and coarse ceramic materials	683.0	6.9	xx

* = 1,000 m^3 natural gas = 1 ton crude oil
xx = country-wide survey under way

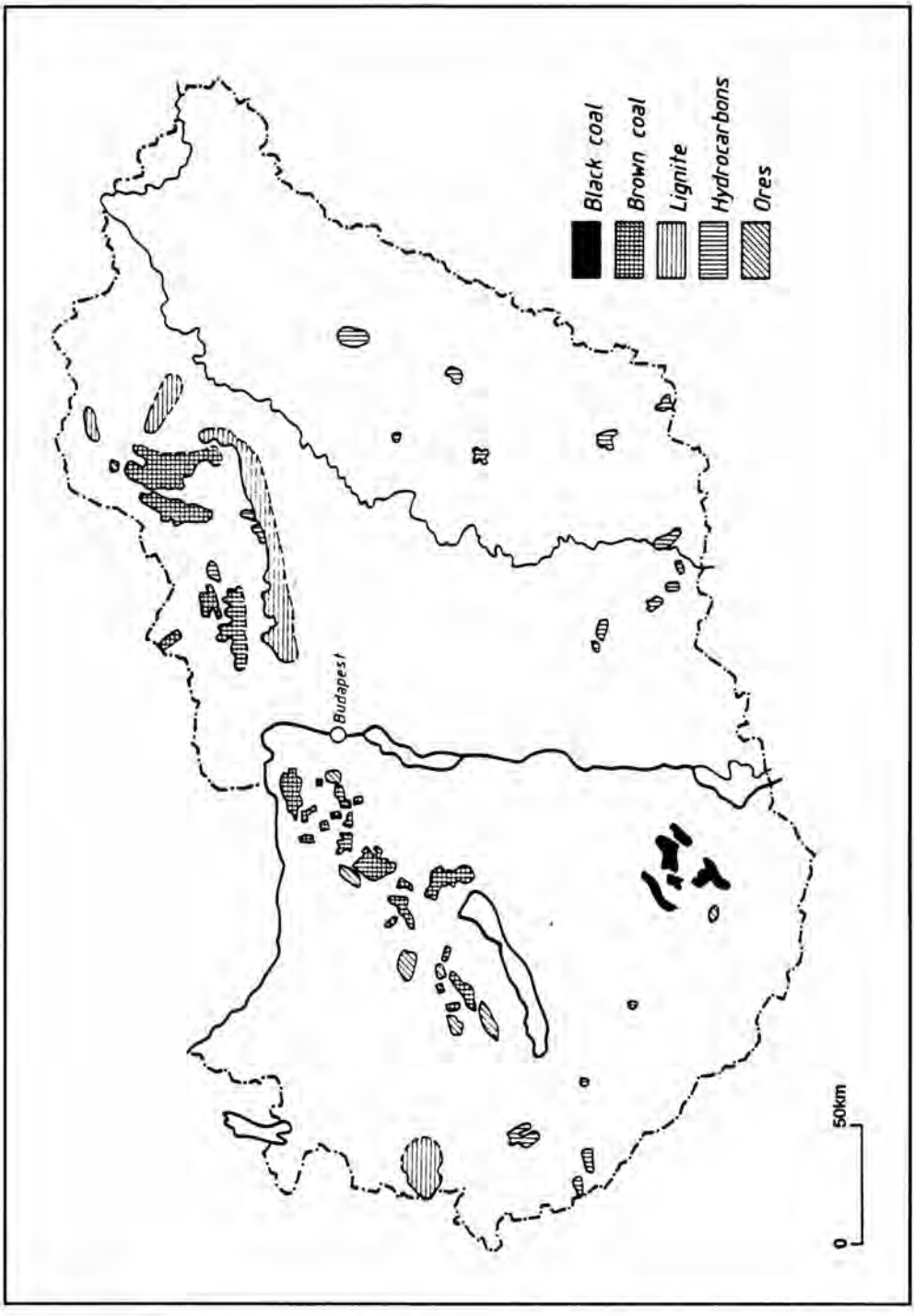

Figure 7: Deposits of coal, hydrocarbons and ores in Hungary.
(Source: Toth, 1988.)

Most of the country's iron ore is imported, but the bauxite supply will last for more than 50 years and all its other minerals and construction/industrial raw materials will last for several centuries. Of the non-metallic solid minerals, Hungary has relatively large quantities of high quality dolomite, glass-sand, foundry-sand, perlite and zeolite as well as medium quality limestone and bentonite.

As Figure 7 indicates, most of Hungary's coals or metallic minerals are concentrated in the Hungarian Central Chain mountains and the hydrocarbon deposits in the plains or in southern Transdanubia.

1.4.1 Subsurface (karstic) water

Hungary has a significant amount of karstic water which could be abstracted at about 300 m^3/min. This would seem advantageous from the point of view of providing drinking water and warm water, but poses great difficulties as karstic waters occur in the same sites as, but in the layers above, coal and bauxite seams.

The country's thermal water supply is relatively rich in supplies that are warmer than 35°C and lie no deeper than 2,000 m. Indeed, the geothermal gradient of the Carpathian basin is so favourable that half of the whole thermal water supply is warmer than 50°C and one-third is even more than 80°C.

Most of the karstic water sources lie under the Central Chain mountains in their Trias layers, while the thermal waters lie dispersed over nearly all the country. Two-thirds of these subsurface waters lie at industrially exploitable depths, partly as Triassic karstic water, partly as thermal water in Pannonic sediments.

1.5 Natural resources protection

The total number of animal species inhabiting Hungary, from micro-organisms up to the mammals, is estimated to be around 30,000, of which 25,000 are insects. A breakdown of the vertebrate fauna is given in Table 4. The economic or scientific importance of the great majority of species in Hungary's fauna can not be assessed. Moreover, Hungarian conditions and present methods are not adequate for working out the environmental importance or conservation requirements of more than a few species.

Table 4: Quantitative list of vertebrate species.

Fish	61
Amphibians	15
Reptiles	15
Birds	400*
Mammals	84

**includes subspecies*

Table 5: Estimated numbers of native Hungarian plant species.

Pteridophyta and Phanerogamic plants	2,411
Mosses	520
Lichens	900
Fungi	200
Algae	3,000

Table 6: Numbers of species listed in the Hungarian Red Data Book according to threat categories.

		Endangered			
	Extinct	Directly	Actually	Potentially	Total
Mammals	5	7	7	1	20
Birds	13	21	40	9	83
Reptiles	-	3	-	1	4
Amphibians	-	-	1	-	1
Fish	-	2	-	-	2
Vertebrates (total)	18	33	48	11	110
Crustaceans	-	-	-	-	-
Molluscs	-	1	17	-	18
Insects	35	41	145	51	272
Invertebrates (total)	35	42	162	51	290
Animals total	**53**	**75**	**210**	**62**	**400**
Angiosperms	35	40	114	384	573
Gymnosperms	-	-	-	2	2
Pteridophytes	1	1	13	20	35
Mosses	4	32	39	45	120
Plants total	**40**	**73**	**166**	**451**	**730**

An estimate of the numbers of native Hungarian plant species is given in Table 5. The status of Hungarian flora and fauna in relation to their endangered status is presented in the Hungarian Red Data Book which includes data upto 1986 (Tables 6 and 7). The supervision of hunting wild game (Table 8) and the care of all wild plants and animals not included in the nature conservation and protection programme are in the hands of the Ministry of Food and Agriculture. In connection with natural ecosystems, the management and protection of forests is also a task of this Ministry.

Current major initiatives are include a research programme on invertebrates;a survey of endangered fish; a survey of the habitats of amphibians and reptiles; a survey of small mammals; increased protection for the great bustard, with special emphasis on unprotected habitats; and reintroduction programmes for the white-headed duck *Oxyura leucocephala*, eagle-owl *Bubo bubo*, and the beaver *Castor fiber*.

Table 7: Protected animal and plant species.

	Number of protected species	Intensively protected species
Invertebrates	153	-
Vertebrates	416	34
Fish	18	-
Amphibians	15	-
Reptiles	15	1

Table 8: Populations of significant game species

Red deer	54,600
Roe deer	227,000
Wild-boar	33,100
Fallow-deer	13,800
Moufflon	8,600
Pheasant	1,202,500
Partridge	74,000
Hare	745,000

1.6 Protected Areas

In Hungary, protected areas are designated at the national or local level, according to their degree of importance. Those of national (and in some cases international) importance are: National Parks, Landscape Protection Areas, and Nature Conservation Areas; in addition, caves form a special category and all caves are under national protection. Sites of local importance are: County Nature Protection Areas, and Natural Monuments.

At present, there are in Hungary four National Parks (covering 141,100 ha), 36 Landscape Protection Areas (covering 348,200 ha), 115 Nature Conservation Areas (covering 29,500 ha), and 2,245 caves. The total area of the 156 protected areas of national importance is 518,800 ha. Local authorities supervise a further 36,000 ha spread across 791 localities. The overall extent of these protected areas accounts for 5.9% of the total area of the country (Figure 8).

For certain special biotopes of some rare species, areas of intensive protection (including 92 caves) are defined within the national parks and landscape protection areas. These intensively protected areas are open for scientific research purposes only and closed to the public. Most of the nature conservation areas may be visited free with few restrictions.

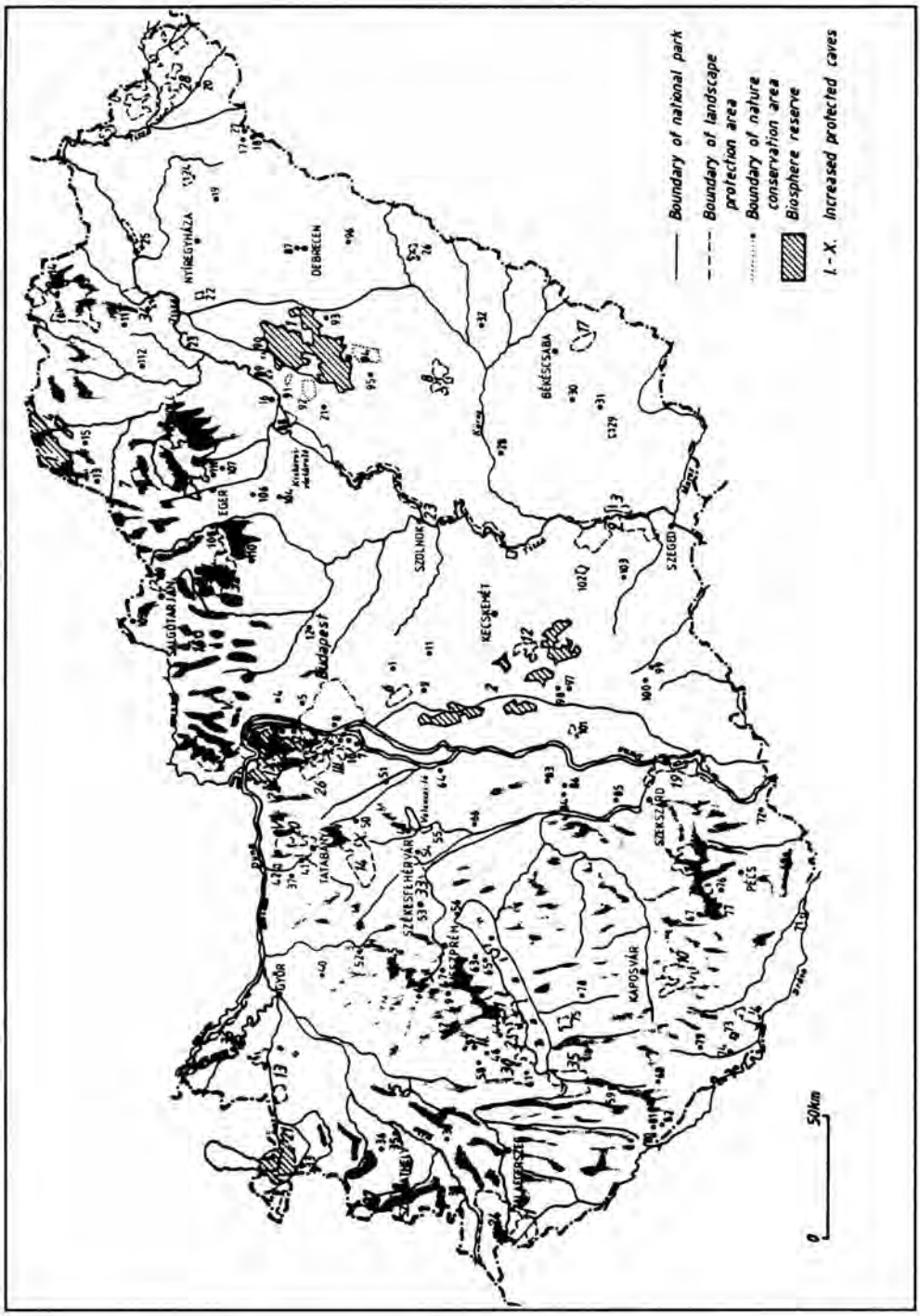

Figure 8: Protected Areas and Caves of national importance.
(Source: National Authority for Environmental Protection and Nature Conservation, 1987.)

CHAPTER 2: INSTITUTIONAL STRUCTURE AND LEGISLATIVE FRAMEWORK

2.1 Short History of Environmental Protection in Hungary

Nature protection in Hungary originates from the activities of forestry organisations. Hungary's first nature protection law was passed in 1879 as the First Forestry Law. While it gave no prescriptions for protection, it cleared the way for appropriate measures. However, not much could be done for over half a century owing to the coming of World War I and the following postwar period. Hungary's second law of Forestry represented a fresh start for nature protection, thanks to the pioneering work of the excellent forester, Karoly Kaan. Following his lead, in 1939 the country's first nature conservation area - the Nagyerdo (Big Forest) at Debrecen - was designated, but the outbreak of World War II prevented the execution of the law.

Immediately after the war there were no real opportunities to pursue environmental protection until the 1950s. The protected areas were at first relatively small, and by 1970 their total surface area was still only about 15,000 ha. Meanwhile, the third statute on nature protection came into operation and the National Authority of Nature Protection was created as an independent agency. The statute was amended in 1971 and a new definition of nationally significant natural resources was declared and the establishment of national parks was made possible. The management of the protected areas of national importance was placed in the hands of the national authority while those of local significance were placed under the charge of county councils, who were also given the power to select protection areas themselves.

Following the introduction of the new law, Hungary's first National Park, Hortobagy, was established in 1973. New protected areas, landscape protection areas and nature conservation areas, all of national importance, were also created so that within less than ten years the protected areas system exceeded 400,000 ha in total.

On 1st October 1977, the National Authority for Environment Protection and Nature Conservation was established as the successor to the National Authority of Nature Protection and the National Secretariat for Environment Protection. With this measure, all activities concerning the coordination and control of environmental protection and nature protection passed into the hands of an authority which was directly responsible to the Cabinet. The amalgamated National Authority introduced the following new regulations to replace the standard recommendations for environmental protection at the departmental level:

- Act No. II of 1976 on the Protection of the Human Environment
- Cabinet Decision 1003/1979 on the Direction of Activities Related to the Protection of the Human Environment
- Cabinet Decree 58/1981 on the Control of the Origin of Dangerous Wastes and their Neutralisation

- Bill No. IV of 1982, and Cabinet Decree No. 8/1982 on Protection of Nature
- Cabinet Decree 12/1983 on the Prevention of Noise and Vibrations
- Cabinet Decree 21/1986 on the Conservation of Air Purity

By the end of 1987, the protected areas system covered 550,000 ha, following a short period of inactivity during the early 1980s.

Planned water management has a 200-year history in Hungary. Apart from flood control, the increasing demand for water conveyance and the potential for reclaiming cropland hastened the regulation and canalisation of Hungary's main rivers. The regulation of the Tisza river began in 1846 under the direction of Count Istvan Széchenyi (one of the most important personalities during Hungary's accelerated development era), according to the plans of the civil engineer, Pal Vasarhelyi.

The territorial consequences of World War I disrupted the previously uniform hydrographic state of the country. Since that time, 95% of all Hungary's fresh water has come from external sources. The Trianon Peace Treaty only partly regulated the water management problems of the area: the bilateral and multilateral agreements between the states along the Danube and the River Tisza continue to play an important role in this issue. Between the two world wars, the water management administration operated as a separate department inside the Ministry for Agriculture. In June 1948, Cabinet decree No. 6060/1948/VI.2 declared that all water management organisations should be nationalised, and established a special head office for the National Authority for Water Management. In 1955, the first National Water Management Plan was approved. In 1964, a new Water Rights Act was passed (Act No. IV), which assured the legal basis for water management and conservation up to the present day.

This period saw the start of the construction of drainage systems in flood-controlled areas, soil conservation activities and the initial steps toward the introduction of irrigation. At the present time, more than 4,000 km of embankments protect about 25% of the country's total area. The length of Hungary's regulated riverbeds is around 1,500 km, and there are more than 40,000 km of drainage canals; the pumping station system has a total discharge capacity of 840 m^3/sec.

Thus the first century of water management has been principally concerned with flood control, river regulation and the construction of drainage systems. In 1956 the Tiszalök barrage and power plant and some smaller plants were built for the utilisation of hydroelectric power. Later, at the end of the 1970s, the Kisköre barrage commenced operation. However, the last 30 years have been characterised more by activities aimed at establishing water supply systems, sewage canalisation, waste water treatment and enhancing water-quality. Water quality control became problematic owing to the shortcomings of canalisation, the rapid development in the use of chemicals in agriculture, the unsolved problems of sewage treatment and the continuously growing amount of industrial waste discharged into watercourses.

The degradation of the water quality of Hungary's larger lakes has been abated, and their quality levels have even improved. An overall programme for Lake Balaton has been prepared (Phase I of which has already been implemented), while the reconstruction of the biologically ancient Lake Vele ce has won international renown. To assure uniform guidance for both water management and conservation, and environment protection and

development, the Ministry for Environmental Protection and Water Management was created on 1st December 1987 by merging the National Authority for Environment and Nature Protection and the National Authority for Water Management.

2.2 Administrative Structure

The Ministry for Environmental Protection and Water Management is the central body for environment and nature protection and water management. It has a network of 12 Directorates for Environmental Protection and Water Management, as well as four Directorates for National Parks. The Ministry embodies 17 separate technical or operational units among which are those responsible for air protection, water protection, noise and vibration abatement, nature protection, water supply, canalisation and waste water treatment, flood control, river regulation and water conservation. Some diversity of approach to environmental protection is still possible because some aspects of the environment remained under the aegis of other senior authorities: the Ministry of Agriculture still supervises the conservation of soils and forests, the Ministry for Construction and Town Development deals with the development of the urban environment, and the Ministry for Industry and its Central Authority for Geology protects mineral resources.

2.3 Legislative Measures

There are currently 101 major legal instruments applying to environmental protection and water management. This legislation, however, suffers two major weaknesses. First, there is a marked contrast between the intent of the legal regulations and their actual implementation. For example, because penalties for offenders are relatively low, many firms (especially those facing deficits) prefer to pay fines than solve environmental protection problems. Moreover, the official licensing system has not been fully applied to all environmental protection requirements. Second, in spite of the large number of rules, there are too many unprotected sites. Thus environmental interests are under-represented in the application of legislative procedures.

2.4 Environmental Education

Education, training and creating awareness are the keys to encouraging new attitudes to the environment. However, little progress has been made in this regard in spite of the declarations of Act No. II of 1976 on the Protection of the Human Environment, and its related Cabinet Decision (No. 2007/76) which states: "the requirements and tasks of environmental protection should be introduced into the low-, medium- and high-level education teaching system, and all the necessary conditions for the training and extension of environmental experts should be guaranteed."

In Hungary's present education system, environmental protection is not a separate study in lower and medium-level education; however, natural science subjects do cover

many aspects of environmental and nature protection. At university and high school level, environmental protection is discussed at several points but it is not, as it should be, in all parts of the curriculum. At some universities, separate Chairs have been created and special courses introduced (for example at the University for Forestry and Wood Industry, Sopron), but even so, a significant number of students are unable to acquire sufficient knowledge of ecology and environmental protection.

In technical education, graduate-level environmental protection teaching has been established in two places: at the Chemical Engineering Faculty of the Technical University of Budapest, and at the Biological Engineer Department of Eötvös Lorant University, also in Budapest. In addition, special postgraduate courses have been set up at every agricultural university for the training of environmental protection specialists.

2.5 Scientific Activity

The Ministry for Environmental Protection and Water Management and its forerunners have spent about 400 million Ft annually on environmental protection research in Institutes of the Academy of Sciences and several higher-level institutions of education. The results of these investigations are accessible in the literature and are all taken into consideration in the management of environmental protection and water conservation.

However, the research undertaken during the last decade has not brought about any significant prevention of pollution or the harmonisation of natural processes and industrial production activities in the long term. Future investigations must lay a scientific foundation for a complex system of environmental management which clarifies the main ecosystem types and work out the principles and methods by which damaging processes are predictable and how planning and decision-making prior to development might be optimised. Research must also be extended to cover social dimensions of environmental problems.

The main directions of the long-term research and development projects of the Ministry of Environment Protection and Water Management are as follows:

- further development of an information system to facilitate decision-making;
- analysis of protected and threatened areas for determining necessary interventions;
- technical development of measures for the protection of the environment;
- intensive development of solutions to preserve environmental infrastructure;
- resolution of conflicts between environmental protection and the optimal utilisation of social resources;
- continuous improvement of the methods of preparation for environmental impact assessments for large projects;
- research and development of co-ordinated long-term measures for balancing urban development and the carrying-capacity of the natural environment.

CHAPTER 3: ENVIRONMENTAL TRENDS

3.1 Air

Large-scale heavy industrial development based on energy from Hungarian coal, which contains about 2% sulphur, began after World War II. The population of the capital and the industrial regions rose sharply and their air became more and more polluted. Air pollution reached critical levels at the end of the 1950s and in the early 1960s when smog in Budapest during the winter sometimes caused daylight to seem like twilight.

During the 1960s the Budapest Council brought in new measures to ensure clean air: heating by coal was prohibited in the centre of the city, industrial plants were forced to reduce emissions and some had to move out of town.

The countrywide regulation of air purity began in the early 1970s when the National Air Purity Conservation Board and its Operational Secretariat were formed within the Ministry for Building and Urban Development (later incorporated within the Ministry for Environment Protection and Water Management). Cabinet Order No. 1/1973/I.3 and the legal decrees for its implementation classified most rural areas into a generally safe-guarded area called "protected", while National Parks, important nature conservation areas, medical and recreation areas, etc. received "increased protection" with stricter legislation. A category "others" (at the moment called "protected II") was applied to certain industrial areas. In addition, all sources of air pollution from factories, power plants and so on were registered and annual fines imposed on those exceeding permitted levels of emissions. As an incentive, the funds derived from these fines can be used to help finance investment in air protection measures. Organisations taking such steps may also receive a reimbursement of their fines.

Since the passing of Act No. II of 1976 on the Protection of the Human Environment, all new projects and all reconstructions have had to adhere to the environmental protection legislation. Subsequently, the competent authorities based their medium- and long-range air-purity protection plans on the ideas and requirements of the national environment protection plan which was accepted by the Cabinet in 1980. Several producing factories were forced to modify their plans and find measures to reduce their air pollution. A control-measuring system was introduced to back up the legal steps taken by the authorities.

Recently, Hungary has begun updating these now obsolete fifteen-year-old decrees for air purity in accordance with the Geneva Convention. The scope of the regulations have been extended and the fining system has become increasingly discriminative and more progressive.

Through an inter-sectoral action programme, investment has been made in measures to reduce emissions from some 50 factories; these have already started to improve the state of areas and towns badly affected by air pollution. First, the larger metallurgical and

Plate 1: Decreasing air pollution at Almasfuzito Alumina Factory.
(Photo: Z. Szilassy)

Plate 2: Unpolluted pond at the site of a former gravel-pit near the Danube.
(Photo: Z. Szilassy)

manufacturing factories, and coal- and lignite-fired power stations, were equipped with mechanical electrofilters: so far more than 170 kt/year capacity of dust-separating equipment has been installed. Next, steps were taken to neutralise and purify noxious gases and foul-smelling organic emissions. Several outdated factories were closed down because of their air pollution. As a result of a change from coal to hydrocarbon heating in industry and in the home, there was a remarkable nationwide 30% decrease in sulphur dioxide emission, as well as a significant reduction of solid particle emission, between 1960 and 1980. However, this could only be brought about through the use of imported energy. There was a similar improvement in air quality between 1982 and 1987 when four blocks of Hungary's first nuclear power station came into operation.

The principal remaining problem for air pollution control is the development of automobile traffic. There are more than 1.6 million vehicles in Hungary, with a 6-8% rate of annual increase. In places with dense traffic, air purity is now determined by the level of car exhaust fumes.

3.2 Surface and Subsurface Water

3.2.1 Surface water quality

In general, with regard to traditional pollutants such as derivatives of the oil-processing industry and the products of biological sewage treatment (ammonium, nitrite and phosphate ions), the degree of water contamination has diminished or even halted during the last 15 years thanks to considerable financial investment (Table 9). However, bacteriological tests indicate that the biological quality of the country's surface waters is much worse than that suggested by a classification based on chemical tests.

Table 9: Loading of surface waters and the establishment of water protective investments in the first two years of the VIIth Five Year Plan period.

	1985 (base)	1986	1987	87/85 (performance)	Change %	1990 (planned)
Sewage discharge (1,000 m^3/d)	2,947	3,019	3,081	104.5	+4.5	-
Organic load (COI) (t/d)	932	874	847	90.9	-9.1	835
Total salt load (TSM) (t/d)	3,014	2,991	2,995	99.4	-0.6	3,055
Ammonia load (NH+4) (t/d)	72.2	68.4	67.0	92.8	-7.2	59
Oil and fat (OOE) (t/d)	46.9	46.8	45.8	97.5	-2.4	49
Investment (million Ft)	-	4858	3372	-	-	28,213

The water quality of the Danube is now generally class II (Figure 2), mainly because of the wastes from the inflow of the Czechoslovak River Vag, which confluences with the Danube at Komarno. However, even here there has been some recent improvement owing to Czechoslovak water quality control measures undertaken in connection with the Bös-Nagymaros hydro-electric power system. Class II quality water is not deteriorating to class III water, even though there is an inflow of sewage from Budapest, and between Budapest and Yugoslavia there are sections of the river where the water quality reaches class I. This means that the wastes being deposited are still being counterbalanced by natural self-purification processes. It is of particular importance with respect to drinking water taken directly from the Danube or adjacent wells that the ammonium ion concentration has generally stabilized, and that the previously rapid growth of nitrate ion concentration has significantly slowed if not halted. The wastes discharged into the River Sio may cause a high degree of contamination in its small tributaries, but are mostly denatured before they reach the confluence with the Danube.

On the upper reaches of the Tisza, the water is almost pure. In recent years, however, there has been a gradual decrease in water quality, falling by one whole class below the confluences of the Szamos and the Kraszna Rivers. The pollutants brought to the Tisza by the River Sajo from the urban and industrial parts of its catchment area become denatured in the Kisköre reservoir. The waters from the Körös Rivers are generally clean, except at low stream flow periods when water volume is not enough to dilute unusual levels of pollutants. The Maros, entering the Tisza at Szeged, has a continuously declining water quality level, currently at class III.

In the catchment area of the River Tisza, no hope exists for any further lasting improvement without an accelerated water-quality protection programme in the countries upstream. In some places, local water quality improvements are possible (e.g. by cleaning the waste waters from Debrecen a large improvement would take place in the area surrounding the Kösely-Hortobagy-Berettyo river system).

The basic conditions for water quality improvement have already been established around Lake Balaton. However, this work requires a great deal of time and the improvement processes are also time-consuming. Most of the problems are still concentrated in and around the lake's western basin.

3.2.2 Groundwater quality

Groundwater layers are now contaminated in certain parts of Hungary and the water is no longer suitable for drinking (Figure 3). The contamination of groundwater in urban areas has been increased continually since 1920. The degree of water pollution in 1987 may illustrated by the fact that in 670 towns where there were no communal waterworks (i.e. for about 1-1.5 million people) the wells were contaminated by nitrates. Emergency measures were initiated in these towns to install public water tanks containing healthy water for children. Some 20-25% of Hungary's drinking water supply is of class I quality (i.e. is consumable after disinfection) comprising cold karstic waters (from Aggtelek, BÜkk, the Trans-Danubian chain mountains, Mecsek, and Villany), some riverside filtered waters (Szentendre Island's mixed water) and some water-bearing layers (from the Trans-Danubian Small Plain, the region between the Danube and the River Tisza, and some parts of the Maros alluvial cone).

The remaining 75% or so of Hungary's water supply is classified as Class II (i.e. potable after being chemically treated and disinfected). In about 40-45% of the total water supply, iron and manganese trapping is necessary, while high levels of methane occur in 15% of the water supply, which requires special treatment. More than 300 such installations operate in Hungarian waterworks. Some 65 towns in the Hungarian Plains, holding about 450,000 inhabitants, were endangered by arsenic-contaminated drinking water. An these towns, small children and mothers received healthy drinking water and some waterworks applied arsenic-trapping technology, but the proper disposal of the resulting arsenic and iron sludges creates great problems. By December 1988, as a result of a water improvement programme, it is expected that there will be no communal water-supply system where the arsenic concentration is more than double the accepted limit, although this target cannot be met during peak periods.

Ammonia and humic acids are characteristic of stratified waters and do not do any harm by themselves, may be the main cause of secondary water quality water degradation when undergoing disinfectant or other treatments (e.g. gas or iron trapping). However, waters with high ammonia content comprise no more than 2% of the total water supply.

Class III waters (i.e. those which have constituents for which there is no treatment available) are extremely rare. In the last decade only 150 m^3/d of the communal drinking water supply had to be stopped because the quality fell into Class III.

Of the current consumption of 4.8 million m^3/d of drinking water, 2.3 million m^3/d is adequately protected. 2.5 million m^3/d of water supplied is not properly protected, of which 1.3 million m^3/d is supplied to the capital. The quantitative protection of groundwater is strictly bound to the extent of its utilization. In the area of the Trans-Danubian chain mountains a very difficult water management situation has arisen mainly because of the water off-take for the mining industry. The karstic water layer in this area has sunk by an average of about 30m, but in some places where the off-take was intense, the drop exceeded 100m. Consequently, the Hévz medicinal thermal spring was badly affected (half of its original water volume was lost) and the thermal-karstic system of Budapest is also endangered.

In 1987, 262 cases of extraordinary pollution of the country's water were recorded. In 236 cases the surface water, and in 26 cases the sub-surface water, was polluted. The pollution source in 30 of all the cases was of foreign origin. The most common polluting agent was oil and its by-products.

3.3 Soil

The land area utilized by agriculture decreased by 1.21 million ha between 1949 and 1981. Arable land diminished by 367,000 ha between 1970 and 1982. The land area withdrawn from agricultural use increased by 143,000 ha between 1970 and 1984. The land use pattern between 1976 and 1984 is given in Table 10.

As more land is removed from farming for other development purposes, so the growth of agricultural production must be achieved by intensification. As the utilization of the arable land intensifies, so the mechanical and chemical burden grows, leading to the compaction and degradation of the soil. The energy input per hectare grew by a factor of

Table 10: Land use pattern between 1976 and 1984 (in %)

	1976	1977	1978	1979	1980	1981	1982	1983	1984
Cropland	53.2	52.8	52.3	51.6	50.9	50.4	50.3	50.3	50.4
Gardens	1.7	1.7	1.9	2.6	3.1	3.7	3.6	3.6	3.6
Orchards	1.8	1.7	1.7	1.5	1.5	1.3	1.3	1.2	1.2
Viticulture	2.1	2.1	2.0	1.9	1.8	1.7	1.7	1.7	1.7
Pasture	13.8	14.0	14.1	13.9	13.9	13.8	13.8	13.8	13.6
Forests	16.7	16.9	17.0	17.1	17.3	17.4	17.4	17.6	17.6
Reed-beds	0.4	0.4	0.3	0.4	0.4	0.4	0.4	0.4	0.4
Fishponds	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3
Agricultural utilisation in total	90.0	89.9	89.6	89.3	89.2	89.0	88.9	88.9	88.8
Area out of cultivation	10.0	10.1	10.4	10.7	10.8	11.0	11.1	11.1	11.2

31, and the number of tractors rose by a factor of 12, between 1950 an 1980. Larger fields are required in order to ensure the economic use of the constantly increasing numbers of tractors, leaving the exposed earth vulnerable to erosion and wind-blow and an altered water regime.

In order to achieve the present high level of agricultural production, an increase in the quantity of fertilizers used was essential. The quantity of fertiliser applied to each hectare has increased 100 fold since World War II. On average, 83% of all agricultural land on large-scale farms is treated with fertilizer. In practice, only nitrogen, phosphorus and potassium were adequately replenished, while the quantity of lime, humus and trace elements in the soil decreased significantly. The increased run-off of fertilizers can cause acidification and eutrophication in surface waters. Systematic soil research has been necessary in order to counteract these adverse influences.

Parallel with the rapid increase in fertilizer application, animal husbandry methods have changed and the traditional form of solid manure has been replaced by liquid slurry. This slurry is often incorrectly applied and has become a serious pollutant of the environment. Organic manure is applied to 10% of arable land on state farms and to 6% of arable land on cooperatives.

The levels of herbicides used in Hungary are still much too low to cause serious pollution or other harmful biological defects.

A national plan for soil conservation measures has been prepared, and areas of high priority selected. Between 1980 and 1984 about 198,000 ha received chemical soil conservation: 11,600 ha of solonec, 175,200 ha of acidic and 11,000 ha of sandy soils were improved. Between 1981 and 1984 erosion control in the great plains was undertaken on 9,358 ha, and the local drainage systems over 467,398 ha were restored (out of a total area of over 3.1 million ha needing such attention).

3.4 Mineral Resources

The natural conditions of mineral resources are in general unfavourable, the deposits being heavily tectonised, and partly overlain by water or gas. The energy content of domestic coal is only 6-18 MJ/kg and the reactive silicate content of bauxite is about 6-10%; the copper ore content is only 1-1.5% and even that is found only at 1,000m depth. Deposits of uranium ore lie very deep and the metal content is very low. To summarise, Hungary is very poor in valuable minerals: in fact, coal or ores with similar properties are rarely utilized anywhere else in the world.

Nevertheless, Hungary uses its mineral resources to a much higher degree than most of its neighbours, because the quality of goods manufactured by the country's undeveloped industry is so low that exports would not cover the cost of importing better raw materials. This situation is likely to prevail for the foreseeable future, and it is planned that at least half of current and future industrial demand for raw materials should be met from domestic sources. In this respect, ways of reducing demand and making more efficient use of the resources available are constantly being sought. Consequently, new mines are rare in Hungary, although the repair and extension of some existing ones is in progress.

3.5 Wild Plants and Animals

The current knowledge of the status of Hungarian fauna and flora is extremely limited. Only a handful of threatened species, chiefly birds and mammals, are under study and receive active conservation attention. At least 40 plant species (1.3% of the taxa surveyed) have died out since the middle of the last century. Nearly all of them relict elements of wetland habitats, with only one or two populations remaining in the country. Law No. IV of 1984 has had a significant influence in the protection of decorative plant species vulnerable to trade.

Up to 1986, 53 Hungarian animal species have become extinct. Among the vertebrate species currently threatened, most are carnivorous mammals and birds (especially waterfowl). Animal populations suffering the worst losses have been those inhabiting grassy steppes, saline biotopes, meadows, riverine forests, and ancient forests. However, some species, like the lynx, have become re-established. The growing numbers of some game species (Table 13), mainly in forests, is causing serious problems for the foresters and farmers in adjacent areas.

Forest areas have been increased by systematic plantation growing from 12.4% of the country's area at the end of the World War II to 17.9% in 1988. The tree resource is 278 million m^3, of which 85% is deciduous and 15% conifer. 81% of this is intended for wood production, and 19% for environmental and recreational purposes. The timber producing forests provide 66% of the country's 10 million m^3 wood and timber requirement. One of the main problems with reducing the shortfall is the slow pace of afforestation (partly because of the high numbers of game) and natural regeneration. The afforestation plan for 1991-2000 calls for the planting of 150,000 ha of new forests, mainly on non-agricultural land or on areas where current use is not optimal. The new forests will comprise quick-growing species such as pine, poplar and acacia.

Table 11: Numbers of Hungarian game species (in thousands).

Species	1936	1970	1975	1980	1986
Red deer	12.0	32.6	38.7	37.0	54.6
Roe deer	60.0	141.3	177.8	185.0	227.0
Wild-hog	6.0	15.7	6.6	20.4	33.1
Fallow deer	2.5	2.4	4.2	5.7	13.8
Moufflon	0.6	2.3	4.3	5.2	8.6
Pheasant	800.0	1,277.0	2,100.0	1,838.4	1,202.5
Partridge	1.5	585.0	771.0	174.4	74.0
Hare	2,200.0	937.0	1,149.0	706.0	746.0

3.6 Protected Areas

Most of the country's protected areas belong to one of three types of biotope: wetland, grassland and woodland.

Wetlands, including soda ponds and marshes are continuing to dry out and shrink, presumably as a result of the drought of recent years. To counteract this phenomenon, measures have been taken locally to regenerate the water supply, for example at Kunka-polnas and Justus-Feketerét marshes in Hortobagy National Park, and at Mohos lake in the Szatmar-Bereg Landscape Protection Area. In addition, new wetlands have been created to diversify some protected areas. Such investments help to preserve endangered aquatic species. In this context, the Kis-Balaton Landscape Protection Area increased by 5,000 ha as a result of the construction of the first phase of the Balaton Water Conservation System Project.

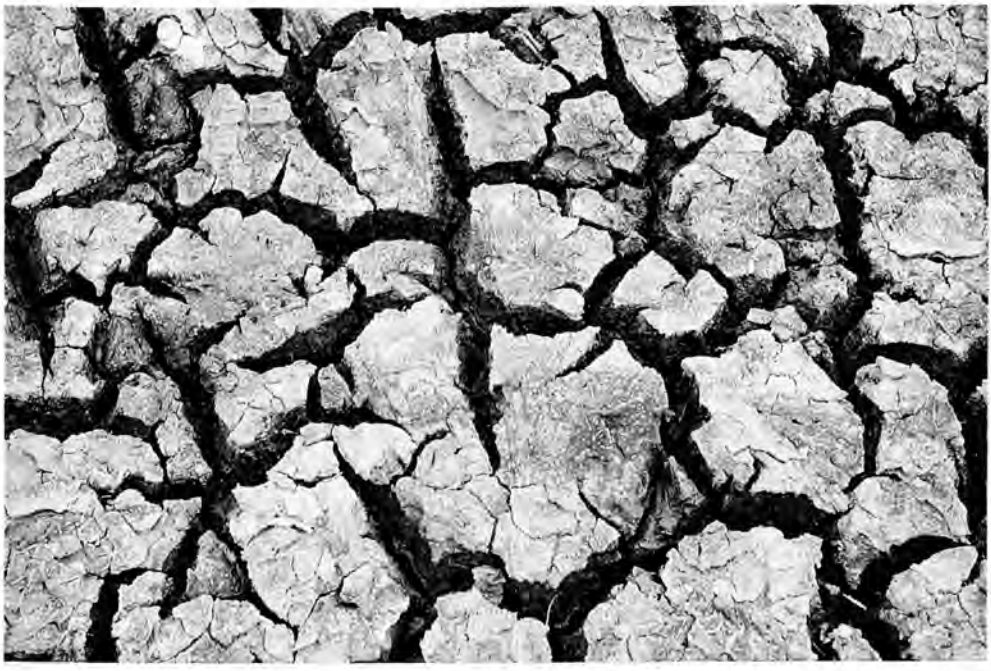

Plate 3: Wetlands, like this dried and shrinking salting, are under threat from a continuing drought in Hungary over recent years *(Photo: Z. Szilassy).*

Plate 4: Old sessile oak ***Quercus patrea*****, like these in Pilis LPA, are highly vulnerable to acidic air pollution** *(Photo: Z. Szilassy).*

The conservation of valuable grassland causes serious problems because the traditional extensive farming methods by which they were maintained are dying out and their restoration is difficult. In some places, a lack of grazing animals has allowed scrub and woodland encroachment. In others areas, on the other hand, highly intensive utilisation acts against conservation interests.

Most of the country's protected areas are covered by forest, much of which is suffering from aerial pollution which primarily affects sessile oaks and for which there is as yet no remedy.

The maintenance of favourable natural conditions and the reconstruction of deteriorated biotopes is of vital importance for the success of nature conservation. Both need active and continuous intervention from nature protection agencies. One of the first steps in the reconstruction of damaged areas is for ownership to be taken over by a nature protection agency and there is continuing programme to acquire the most valuable or the most endangered biotopes in accordance with the country's financial situation.

A small proportion of the country's protected areas include small gardens, orchards and vineyards which are of cultural-historical value, and encouraging progress is being made in their conservation, for example, the restoration of the narrow and steep vineyards and orchards around Holloko village which is a World Heritage site. However, this programme is in financial difficulties.

3.7 Environmental Education

An agreement will be signed in the near future by the Ministry of Environment Protection and Water Management and the Ministry of Education in which the Ministry of Education affirms its decision to support lessons on environmental sciences in the high-schools within its jurisdiction. Several postgraduate courses have been organised for teachers who were already teaching environmental protection without qualifications. The range of such courses is continually broadening and to help the teachers in their work of teaching environment protection a wide range of different publications, radio programmes and video materials in many special fields are planned.

CHAPTER 4: PRIORITY INITIATIVES

4.1 Air

Human health and the quality of the urban and natural environment depend on clean air. This resource is treated as a very precious commodity in Hungary and its protection was declared in Act No. II of 1976 and confirmed in the Environment Protection Strategy and Requirement System approved by the Cabinet in 1980. As a result of air purity protection measures and energy control programmes (see 3.1), a considerable reduction has been achieved in most of the main air pollutants. However,these measures have not been sufficient to cope with air pollution caused by vehicle exhausts, which is growing by 6-8% annually. The possibilities for the reduction of vehicular air pollution limited. Electric public transport is continually being improved (for example, underground transport in the capital, trolley-buses in other towns and the electrification of long-distance rail transport). Local traffic problems in dense traffic areas are being solved by the construction of by-passes and pedestrian zones. In 1985 a new oil refinery was opened for the production of lead-free fuel (the lead content was reduced by 30%) and for the improvement of diesel and heating oil (the sulphur content was reduced by 50%). With further investment, and the planned introduction of three-way catalysers, vehicular emissions may be curbed in the early 1990s.

4.2 Surface Water and Aquifers

Without adequate protection, the threat to the country's present and future drinking water resources will grow; at present, 65% of communal water is being supplied from a polluted environment, although measures to improve this situation have been set out in the VIIth Five Year Plan.

Steps to reduce the contamination of subsurface water have not been effective enough everywhere. In order to improve the degree and efficiency of protection, the imbalance between water supply and waste-water treatment and canalisation must be redressed, and the regional level of other pollutants should be reduced.

Action plans are in progress for improved water quality, conservation, economic use, for example: the Balaton Water Management Development Programme; Lake Velence Development Programme, and South Plain Settlements Drinking Water Quality Improvement Programme. As a result of these programmes the demand for fresh water will decrease by 5%, the pollution load of the surface waters will lessen and the protection of drinking water resources will improve, starting in specially protected areas where 76% of all investment will be concentrated. The same programmes will help to stabilise water usage in selected recreational areas, and overcome the problems of arsenic, methane and nitrate pollution in the water supply for 40 South Plain settlements.

4.3 Soil

Hungary's main task is to maintain the overall area of arable land. Losses to development can be partly offset by the restoration and improvement of reverted fallow, and fragmented or otherwise ruined land. The reduction of arable land cannot be halted completely, but there is hope that with the new Land Protection Act (I/1987), the rate of loss will diminish. This Act sets out various criteria for land use and protection of land quality. These criteria are supported penalties (land misuse fines) as well as financial incentives for restoring waste ground.

Recovery projects were initiated in 33 areas (especially in the catchment areas of Lakes Balaton and Velence) during the VIIth Five Year Plan, requiring state-support of 10,500 million Ft, an increase of 70% compared to the previous period. In such landscape recovery projects, ecological and environmental protection always get priority. Financial support is given for improvements where landscape-protecting grass cover, scrub or forest plots are planted because they not only counteract erosion but also help to enrich the surroundings visually. Such projects should be continued.

4.4 Mineral Resources

The exploitation level of Hungarian mines is in general consistent with the natural resources available and the economic state of the country. The question of open-cast or underground mining is decided in by the environmental impact assessment method. In this way assessment can be made of damage by open-cast mining to agriculture, to thermal springs by mining below the karstic water level, or to road and highway construction or urban and industrial areas.

In Europe, the average geothermal gradient at 1,000 m is about 45°C, but in the Carpathian basin, it is about 65°C. There should be more intensive examination of the possibilities of increased utilization of this natural resource for energy generation. Success in overcoming the problems of exploiting geothermal energy would be of great importance not only for Hungary but also elsewhere.

4.5 Wild Plants and Animals

Future projects and ongoing research programmes include:

- a population survey of endangered plant and animal species;
- basic research on the protection and reconstruction of natural ecosystems;
- research programmes for managing protected areas;
- artificial propagation and reintroduction methods for protected and endangered plant and animal species;
- development of extensive management methods for the utilization of conservation areas to keep them in their original or well-established form.

The basis of all conservation work on different species is the conservation of their habitats. Thus, the country's main duty is to concentrate on the reconstruction of deteriorated biotopes, such as wetlands, grasslands and forests degraded by human and other environmentally harmful influences.

4.6 Protected Areas

As many natural biotopes as possible need to be protected to ensure the adequate survival of native plants and animals. The expansion of the protected areas system and its proper management according to a long-range nature conservation plan, is one of the country's main tasks (Table 12). The establishment of landscape protection areas and the declaration of other protected areas has slowed in the recent years. In spite of this, the planned declarations of protected areas during 1988-89 will very likely be carried out:

- Béda-Karapancsa
- in the Pitvaros puszta
- Mezoség at Borsod
- Karancs-Medves
- East-Cserhat

The survey of the national natural resource must be speeded up and protection programmes elaborated taking advantage of international cooperation. The most valuable and most endangered biotopes must be conserved. Provision must be made for their maintenance and for the restoration of existing degraded biotopes. The efficiency of protection must be raised and the functions of protected areas widened, especially in the interests of public awareness. Existing interpretation presentation facilities and teaching trails are of great importance in this respect and more of these must be provided in the future.

Table 12: Planned protected areas (figures in 10^3 ha)

			According to the Plans:			
	31.10.88		31.12.88		31.12.90	
	No.	Area	No.	Area	No.	Area
National Park	4	141.1	4	146.6	4	146.6
Landscape Protection Area	37	348.2	41	379.4	46	397.2
Nature Conservation Area (of national importance)	115	29.5	125	32.1	185	590.0

4.7 Legislative Measures

Legal regulation is necessary for the establishment of nation-wide priorities for environmental protection on the theoretical basis of equal sharing of responsibility. The legal provisions must, however, be backed up by the implementation of an appropriate system of fines for contravening environmental law if environmental protection is to be assured. An important question in this regard is the development of a system of official licensing of emissions and discharges which is open to public examination.

Apart from these deficiencies in the legal system, care must be taken for the proper enforcement of existing laws. It is a daily experience that the environmental norms which, for example, regulate the purity of air or the quality of water, are seldom attained because many of those responsible for providing the necessary data fail to do so.

4.8 Environmental Education

There is no question that education has the biggest role to play in forming an environmentally sensitive attitude in people, so encouraging the economic and careful use of natural resources. The media and other forms of information dissemination should be utilised very intensively on a professional basis for raising public awareness and knowledge of environmental issues. Books, journals and other publications must be kept continuously up-to-date.

Every citizen has access to elementary education, so this stage of schooling is crucial for promoting environmental awareness: it is necessary to open every possible avenue to teach theoretical and practical nature conservation and environmental protection at this level. This will necessitate new curricula, new text books and modern education methods.

At the secondary school level, the concept of sustainable development should appear in every relevant subject. Special arrangements should be made to teach environmental protection technology at colleges of further education and teacher training institutes. Graduate and post-graduate environmental courses should be available, especially for those intending to work in any branch of government.

CHAPTER 5: OPPORTUNITIES FOR REGIONAL AND INTERNATIONAL COOPERATION

The mutual interdependence which is characteristic of world economic processes becomes more and more obviously reflected in the range of environmental questions. Only coordinated international efforts may solve the ever-increasing global problems of environmental protection, such as transfrontier environmental pollution.

Hungary is an active participant in UNEP, the UN Economic Commission for Europe, and the action programme of the Mar-del-Plata UN Water Conference and the implementation of the International Water Supply and Public Health Decade of the United Nations. In addition, a national programme of action is in progress to implement the recommendations of the World Committee for Environmental Protection and Development (Brundtland Committee). At present, Hungary participates in the following multilateral and bilateral environmental and water management agreements:

- Geneva Convention on long-range trans-boundary air pollution, including the Helsinki Protocol on the 30% reduction of sulphur dioxide emissions.
- Vienna Agreement on the protection of the ozone-layer.
- Washington Convention on International Trade in Endangered Fauna and Flora (CITES).
- Ramsar Convention on Wetlands of International Importance, Especially as Waterfowl Habitat.
- Bonn Convention on the Conservation of Migratory Species of Wild Animals.
- Agreement on the protection of the River Tisza and its tributaries against contamination.
- The joint declaration between the Danube states on management of the river and particularly on the protection of the Danube against pollution.
- Inter-governmental agreements with Austria and, in due course, with the USSR and the Federal Republic of Germany.
- Inter-Ministerial Agreements with all COMECON states, with China and with Finland, Algeria, Sweden, Egypt, Jordan, the United Kingdom, and the Netherlands.
- Cooperation with all five of the neighbouring countries on the management of catchments of Hungary's rivers whose sources lie beyond its boundary.
- Membership by the Ministry for Environmental Protection and Water Management in the International Water Supply Association (IWSA); International Union for Conservation of Nature and Natural Resources (IUCN); International Waterfowl and Wetland Research Bureau (IWRB); International Council for Bird Preservation (ICBP); and Federation of National Natural Parks of Europe (FNNPE).

Hungary's increasing international trade contributes significantly to its international relations. For example, Hungarian experts are playing a significant role in solving the water resource management problems facing developing countries in Africa and Asia within the framework of Hungary's increasing scientific-economic cooperation with UN agencies such as UNDP, FAO, Unesco, WHO and WMO.

The task of international scientific cooperation is to give sufficient warning of the appearance of global environment hazards, to determine their dangers for human health and ecosystems, and to follow the changes by the establishment of a monitoring system. Scientific research is without question very expensive but is much in demand for environmental protection. For this reason, Hungary is pressing governmental and non-governmental organisations involved in bilateral and multilateral technical and scientific cooperation to concentrate their financial or theoretical resources and to increase the efficiency of their research work. International cooperation is needed similarly needed among development engineers, to promote the expansion of "clean" technologies, both in terms of sophistication and availability. For the latter, the free flow of environmental protection equipment and technologies should be encouraged by allowing custom-free or low-rate-tariff importation.

BIBLIOGRAPHY

Anonymous. *Conception and requirement system for the special field of environment conservation*. MEM, K.V.7. Budapest.

Anonymous. *Conservation, irrigation and nutrient management*. Agroinform, Budapest. 2-3.

Anonymous. *Manual for statistics on agriculture*. KSH, Budapest, 1981-85.

Anonymous. *State and protection of environment*. KSH, Budapest, 1986.

Jarmai, E. (1988). Report on the status and some problems of coal mining. *Banyaszat* 121/1, Budapest.

Ministry of Environment Protection and Water Management, Environment Development Dept (1988). *Report on the state of the environment of Hungary to the Council of the MEPWM*. Budapest.

Ministry of Environment Protection and Water Management, Interdepartmental Department (1988). *Recommendations for the elaboration of the Hungarian national action-programme report* "Our Common Future". Budapest.

National Authority for Environmental Protection and Nature Conservation (1987). *The Chairman's report to the Parliament on the results of environmental protection and nature conservation achieved in the period of the 6th Five-Year Plan, the work of the Authority*.

Sefanovits, P. (1963). *Soils of Hungary*. Publishing House of the Hungarian Academy of Sciences.

Szalay-Marzso, L. (1988). Environmental awareness and environmental education. *Vizgazdalkodas* 88/6. Budapest.

Toth, M. (1988). *Potential of natural resources*. H.A.S. Research Institute for Geographic Sciences, Budapest.

IUCN EAST EUROPEAN PROGRAMME

Environmental Status Report 1988/1989

POLAND

Compiled by
Kazimierz Klimek

partly based on the
National Programme forEnvironmental Protection to 2010
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Krakow, 1989

CONTENTS

CHAPTER 1: INVENTORY OF NATURAL RESOURCES

Poland is an East European country of average size which lies within a lowland zone. Only a small southern part of the country has an upland, mountainous terrain (Figure 1). The geological structure of Poland's subsoil, the type of its soils and its climatic conditions determine the quality and number of resources found in the natural environment - raw minerals, surface and underground areas of water, and the plant and animal world. The country's geopolitical location and its socio-political relations determine the way in which these resources should be exploited, as well as the threats that stem from this exploitation.

The escalating threat to the natural environment in Poland was responsible for the preparation in 1988 of the National Programme for Environmental Protection up until 2010 (Anon, 1988). by the Ministry for the Protection of the Environment and Natural Resources. All the numerical data and some of the proposed plans presented in the Polish National Review were taken from this Programme.

1.1 Air Protection

During the latter half of the 1980s, Poland occupied second place in Europe with regard to air pollution. Emissions of gaseous pollution into the atmosphere are very threatening to the natural environment due to their rapid diffusion as well as their direct effect on people, animals and plants, as well as on buildings. In 1986, about 1,200 Polish industrial plants (taken from Main Central Statistical Office [GUS - Glowny Urzad Statystyczny] statistics) emitted 5.3 million tons of these pollutants into the atmosphere (Table 1). Of this, 53% constituted sulphur dioxide, 28% carbon dioxide and 14% nitric oxide. Pollutants emitted from other countries - mainly from Czechoslovakia and the GDR - pour into Poland on the dominant westerly winds (Figure 2). It has been calculated that in the course of a year, these pollutants carry in about 900,000 tons of sulphur, which constitutes as much as 40% of the sulphur deposited in Poland.

The upshot of the negative effects of atmospheric pollution in Poland has not yet been sufficiently identified and is inadequately appreciated. It is only the ill effects stemming from this phenomenon, which have been recorded in the forests, that indicate a large-scale threat. In the Sudeten mountains, many forest stands have been completely degraded, while physiological changes have been confirmed to exist in the remaining areas of Poland in about 40% of the forested area elsewhere in Poland.

In 1986, existing dust collecting equipment filtered only 11% of all incoming pollutants. A shortage of appropriate purification technology has been a hindrance to the introduction of equipment that would reduce pollution on an industrial scale The number of purification units being produced in Poland is inadequate. Moreover, industrial plants emitting

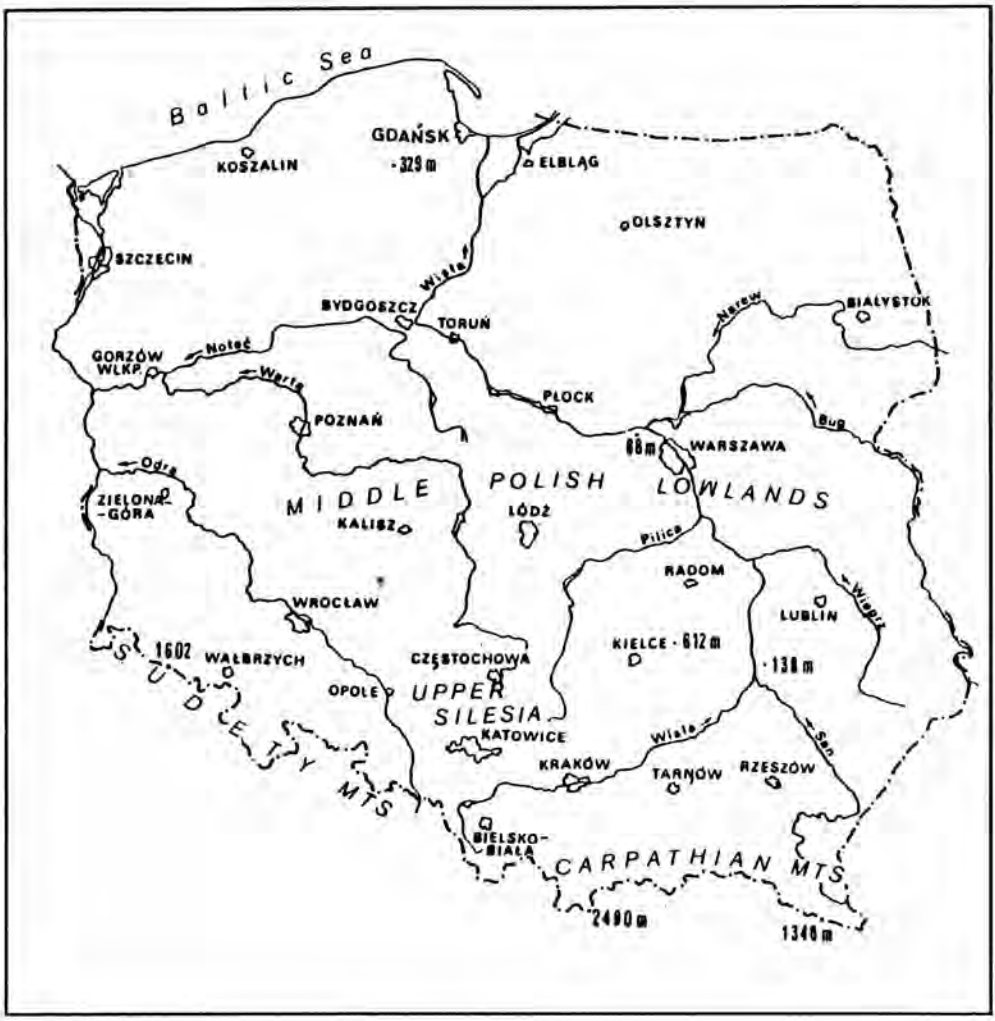

Figure 1: Poland.

pollutants are experiencing difficulties with the financing and implementation of these fittings. Air pollution is also exacerbated by poor utilisation of existing equipment.

Table 1: Actual and forecast emissions of major atmospheric pollutants (millions of tons per year).

Type of pollution	1986*	1995 without programme implementation/with programme implementation	2010 after programme implementation
Dust	2.8	3.3/2.1	2.0-2.2
Sulphur dioxide	4.3	5.1/3.5	2.0-2.5
Nitric oxide	1.5	2.1/1.8	1.0-1.2
Carbon monoxide	3.1	3.7/2.7	1.5-2.0

*State Statistical Office (GUS) data on the main industrial sources of pollution.

1.2 Water Protection

The pollution of surface water areas is, after air pollution, the second most serious factor threatening the natural environment in Poland. It stems, above all, from industrial and municipal wastes that have been channelled into rivers without purification, from the run-off of surface waters that have taken up artificial fertilizers from arable land, from saline mine waters that have been pumped into surface waters and, moreover, from other urban and rural areas, from roads and from polluted atmospheric precipitation. Despite the fact that during the last few years many industrial waste treatment plants have been built in Poland (an average of 200 per year), the cleanliness of surface waters, particularly in principal rivers, is fast declining. In 1986, class I water was only to be found in 4.2% of a river's length, while class II water constituted 27.6% of a river's length, and class III waters 28.8% of its length. Waters that were not subject to any such norms were recorded in 39.4% of the length of all rivers (Figure 3). There are many lakes, marshes and waterlogged areas in northern Poland. Research into some of these has shown that only 1% of them have class I water and 53% of lakes contained unclassed water.

The purification of industrial and municipal waste is totally inadequate. According to figures published by GUS (the Chief Central Statistical Office), out of the 4,639 large industrial plants that between them produce over 80% of all waste, 1,750 of them discharge directly into the urban sewage system. Out of the 2,889 plants that channel waste directly

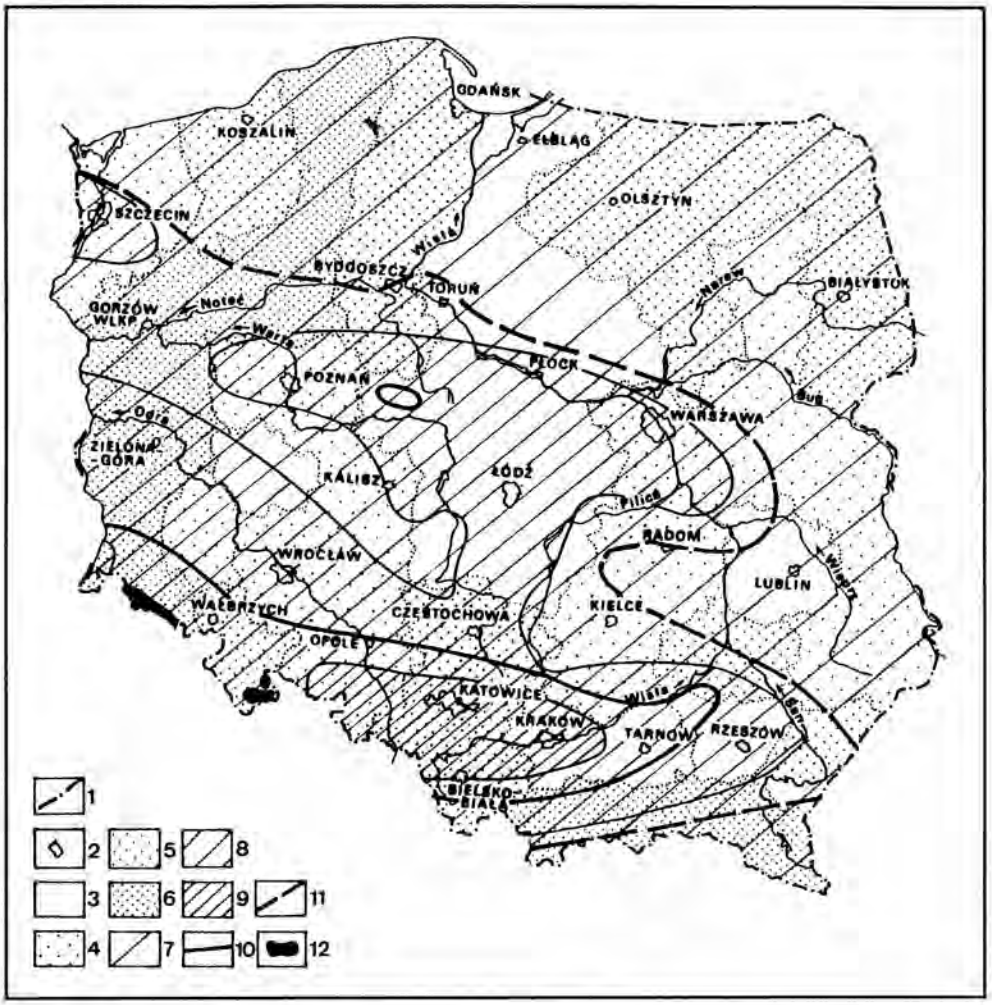

Figure 2: Pollution of the atmosphere with sulphur dioxide.
(Source: NPEP 2010.)

Key:

1 state boundary
2 urban centres
3 forest cover (1985) 9-19.9%
4 forest cover (1985) 20.0-27.6%
5 forest cover (1985) 27.7-37.9%
6 forest cover (1985) 38-48.3%
7 low threat to forests
8 significant threat to forests
9 large threat to forests
10 isoline concentration of SO_2 = 64 ug/m^3 (1987)
11 isoline concentrations of SO_2 =32 ug/m^3 (1987)
12 damaged forest areas.

Figure 3: Quality of watercourses in 1985.
(Source: NPEP 2010.)

Key:

1 state boundary
2 urban centres
3 Class I waters
4 Class II waters
5 Class III waters
6 unclassifiable waters
7 untreated industrial and urban effluent
8 treated industrial and urban effluent

into surface water areas, 2,381 were equipped with purification plants, while 508 discharged waste without any purification.

Out of 813 towns, 775 are equipped with a water-supply service network, while 700 are supplied with a sewage network. Among the towns boasting their own sewage works, only 425 possess a waste purification plant. In 1985, almost 60% of these purification plants were working inefficiently.

Some 950,000 m^3 of saline water is pumped out daily from the coal mines in Upper Silesia (according to 1985 figures). Out of this, an average of 650,000 m^3 per day is fed into rivers that consequently receive salt loads of about 7,000 tons per day. The salt penetrates the tributaries of Poland's principal rivers: the Oder and Vistula (Figure 1). The salinisation of the rivers causes very drastic changes in the biological life of water plants and algae. It is also extremely harmful to industrial installations that collect water for manufacturing purposes and, above all, for people, especially those living in housing estates on lowland plains in large towns, for whom these large rivers are the sole source of water.

1.3 Soil Protection

A considerable part of Poland's surface area is composed of agricultural land. The lowland character of Poland's landscape, as well as its location in the temperate climatic zone, is responsible for its low level of soil erosion. It is only in the southern part of the country, where there is a predominance of low-level mountains and uplands, that the run-off of rainwater down the slopes can cause local soil erosion. The main factors leading to soil degradation or influencing a decrease in the surface soil area agricultural mechanisation, mining of raw materials, and the irrational use of chemicals on soils as well as excessive local drainage. As a consequence of this, there is a constant decrease in arable land. At the same time, during the mid-1980s, the use of farmland by the mining/extractive industries increased from 37,000 ha to 41,000 ha (over 5,400 mine exposures with a surface area exceeding 1 ha were recorded); by towns and housing estates as well as by industry from 840,000 ha to 914,000 ha; and by transportation from 950,000 ha to 981,000 ha. There has been a constant growth in the number of arable and forested "waste lands" from 437,000 ha in 1975 to 497,000 ha in 1986. Deposition of sulphur compounds originating from industrial emissions cause a constant acidifying/souring of the soils (Figure 4). The extent and severity of this acidifying process is not yet known.

1.4 Mineral Resources Protection

The Polish economy depends to a significant extent on the exploitation, processing and export of raw materials, especially coal, sulphur, copper and iron ore (Figure 5). The system of protection and rational exploitation of mineral deposits is far from perfect. The motivation to exploit deposits of poorer quality that lie in more difficult geological conditions for extraction is low: production plants are naturally interested in exploiting the best deposits using the cheapest technology, which does not always promote both their rational exploitation and the protection of the natural environment within mining areas.

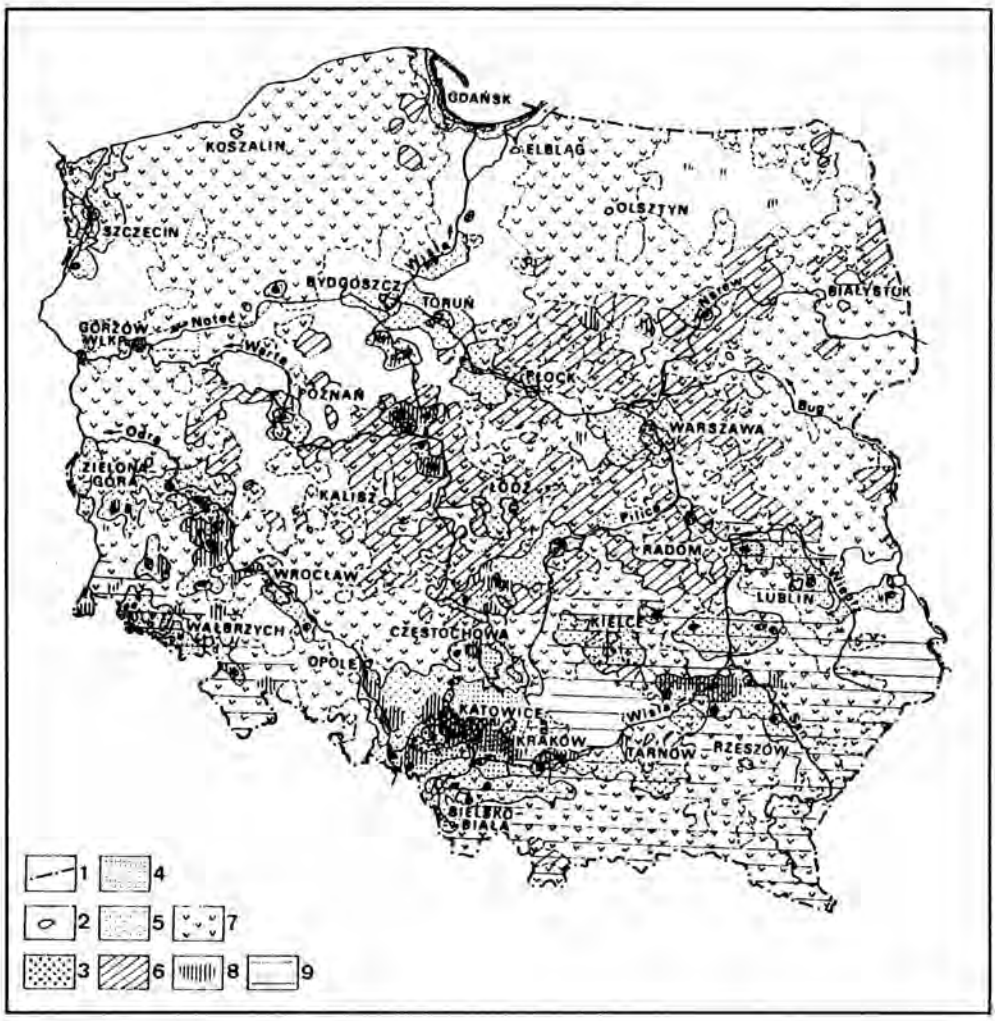

Figure 4: Acidification of soils in Poland.
(Source: NPEP 2010.)

Key:

1 state boundary
2 urban centres
3 badly degraded areas
4 areas that have suffered some degradation
5 areas threatened by degradation
6 areas requiring reafforestation over more than 15% of the land area
7 areas requiring liming (to neutralise acidity) over more than 50% of the land area
8 areas requiring restoration over more than 1% of the land area
9 areas requiring work to combat erosion

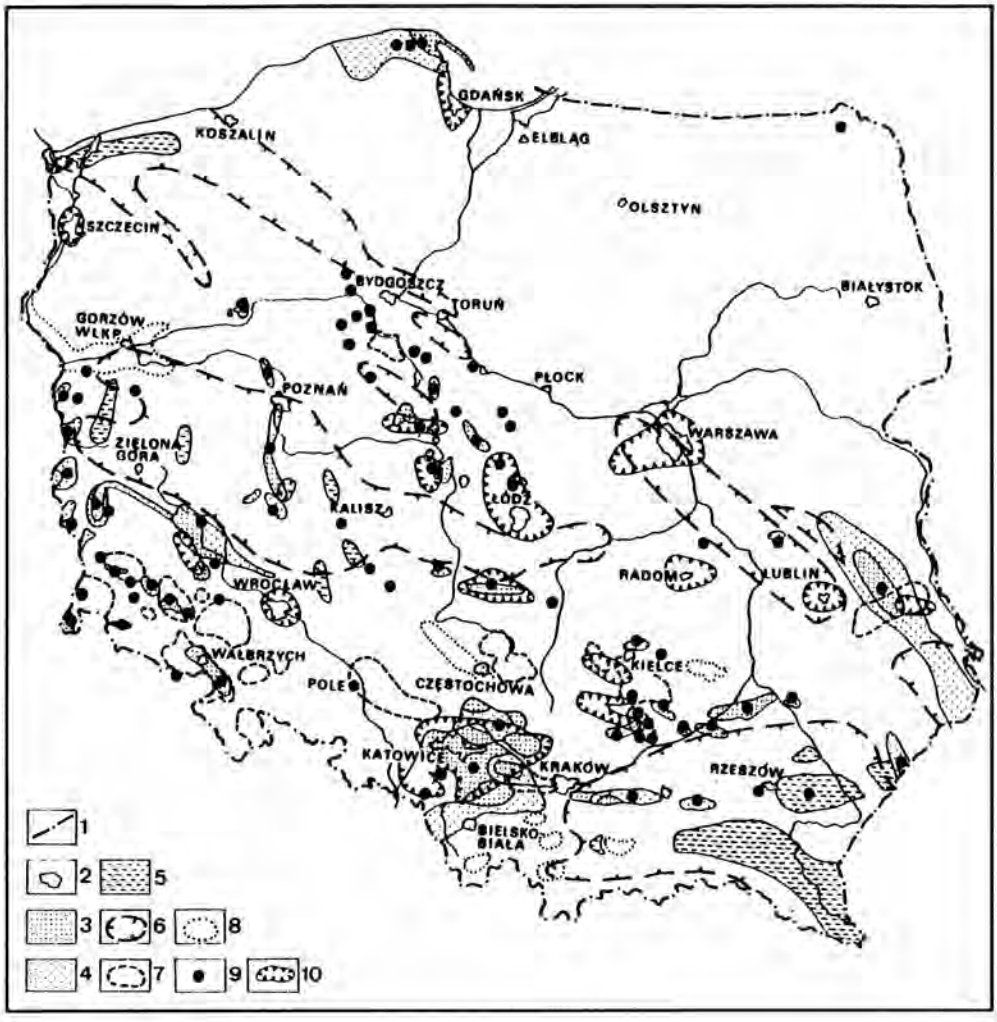

Figure 5: Mineral resources of Poland.
(Source: NPEP 2010.)

Key:

1 state boundary
2 urban centres
3 known and exploited mineral deposits (1985)
4 potential mineral deposits
5 areas of crude oil and natural gas exploitation
6 potential areas for crude oil and natural gas exploitation
7 existing quarries and ore mines (1985)
9 other mineral works
10 basins and areas of intensive groundwater abstraction

1.5 Natural Resources Protection

The sustained exploitation of natural resources in Poland has caused a dramatic change in the composition of native living natural resources, particularly forests, while semi-natural habitats are badly degraded by the excessive pollution of the atmosphere, soils and water by compounds of sulphur, nitrogen, fluorine and heavy metals. Coniferous forests, which are predominate in central and northern Poland, are highly sensitive to and at risk from air pollution. The extent of this damage is constantly rising. Also, some so-called hidden damage occurs which will become apparent only after some time. The phenomenon of forest death, which is in many places assuming the proportions of an ecological catastrophe, is occurring in several areas, notably in the Sudeten mountains and the Krakow Uplands, the Silesian Uplands and in the Krakow region.

1.6 Protected Areas and Species Conservation

Reserves create the necessary conditions for selected flora, fauna or landscapes to survive. Forest and floristic reserves predominate among these. There are very few water and landscape reserves and an insignificant number of peat and geomorphological reserves.

Protected areas in Poland include: national parks, nature reserves, landscape parks and areas of protected landscape. In 1988, 15 national parks (occupying 0.4% of the country's surface area) and over 900 nature reserves existed in Poland.

National parks protect nearly unaltered groups habitats in the various nautral landscape regions of Poland (Figure 6), including mountains, uplands, lowlands with lakes, and coastal landscapes. In several national parks (Ojcowski, Karkonoski, Swietokrzyski and Babiogorski) clear changes in plant communities are perceptible owing to acidification of both soils and surface waters as a result of atmospheric pollution.

Landscape parks (which constitute 2.5% of the country's land area) and protected landscape areas (which occupy over 10% of the country's surface) protect areas that are attractive as landscapes or, in the cultural sense, protect them against industrial and urban development, and intensive farming, especially the breeding of livestock. This form of regional nature protection is, in many parts of Poland, quite inadequate as a result of the imprecise legislation that has been passed for its protection.

There are about 2,300 species of vascular plants in Poland. Many are threatened or becoming extinct. Out of Poland's entire flora, 15% of its vascular plant species are threatened or becoming extinct, as are 29% of its lichen, 20% of its liverwort and 18% of its moss species. The Polish fauna has also suffered losses: of the 625 or so vertebrate species that once occurred in Poland, 15 have become extinct during the last 100 years, including sturgeon *Acipenser sturio,* little bustard *Tetrax terax,* great bustard *Otis tarda,* golden plover *Pluvialis apricaria,* and mink *Mustela lutreola.* Several dozen species have experienced population declines and range contractions, especially those inhabiting ancient forests, marshes, inland waterbodies and coastal zones.

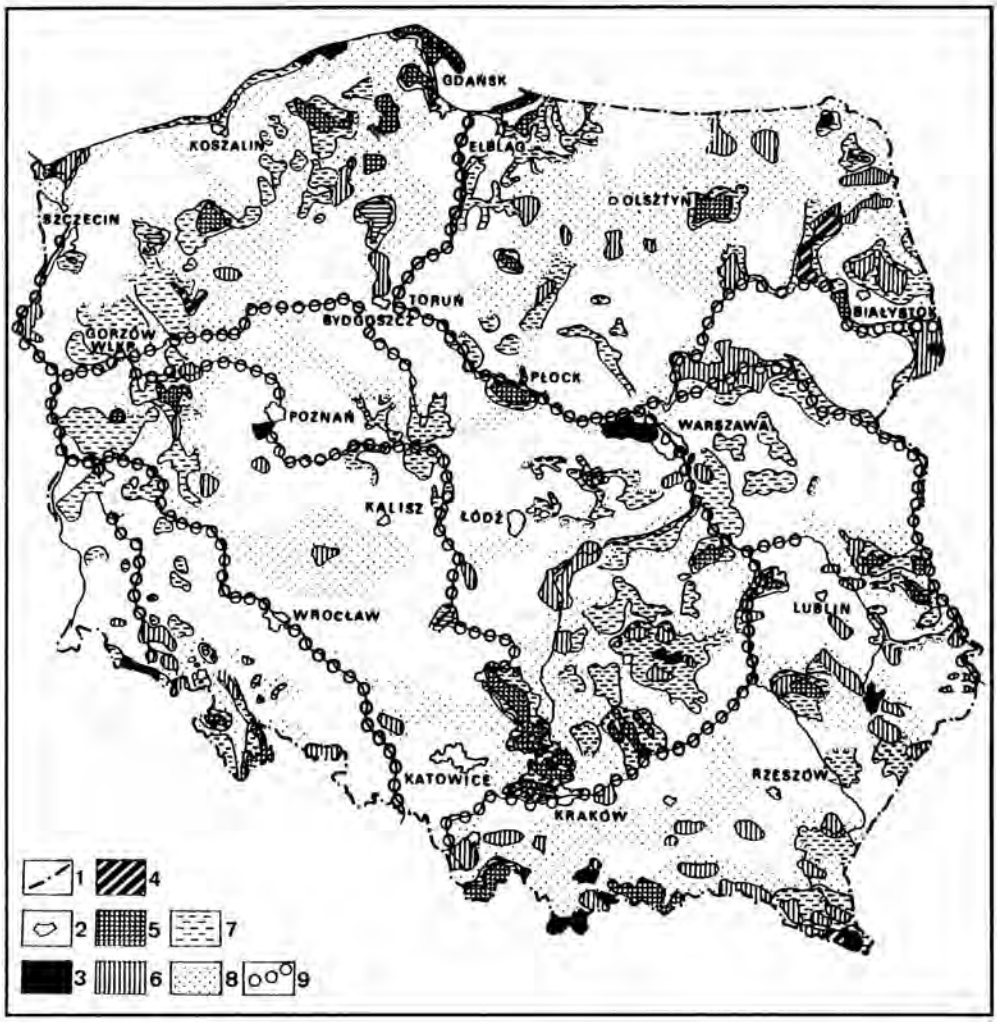

Figure 6: Natural landscape regions of Poland.
(Source: NPEP 2010.)

Key:

1 state boundary
2 urban agglomerations
3 national parks (1986)
4 planned national parks
5 landscape parks (1986)
6 planned landscape parks
7 protected landscape areas (1986)
8 areas of great natural value
9 principal 'corridors' between protected areas

CHAPTER 2: INSTITUTIONAL STRUCTURE AND LEGISLATIVE FRAMEWORK

2.1 Early Conservation Measures

During the 19th century, Poland was under occupation by its neighbours. Despite this, a nature protection movement emerged. Nature protection activists were recruited from scientists, writers and artists who, in various ways, discerned the beauty of nature. After regaining independence in 1918, the so-called "conservationist" direction of nature conservation emerged. In 1919, the State Council for Nature Protection arose, in 1920, the Nature Protection League was formed, and in 1934 the Sejm (Parliament) passed the first law on nature protection. Following World War II, the nature protection movement significantly increased its activities; the Nature Protection Research Centre [Zaklad Ochrony Przyrody (ZOP)] of the Polish Academy of Sciences [Polska Akademia Nauk (PAN)] in Krakow was formed; and the Ministry of Protection of the Environment and of Natural Resources emerged in 1985. Fifteen national parks were created, covering 0.4% of the country's surface area, and over 900 nature reserves were designated; landscape parks and areas of protected landscape were also created.

2.2 Current Situation

The nature protection system that has been set up in Poland barely protects the last bastions of the natural plant cover and the fauna that inhabit it. Nature reserves allow only some of the threatened plant and animal species to escape extinction.

The legislation that concerns the protection of the natural environment in Poland basically encompasses the entirety of these issues. These regulations include: the Statute on the Protection of Nature of 1949, the Statute on the Protection and Development of the Environment of 1980, as well as other detailed laws that go to the heart of the constitutional obligation to protect the environment. The unsatisfactory or catastrophic state of the natural environment in certain areas of Poland, as well as the relatively frequent practice of failing to implement the law indicate that the existing legislation is not, to a great extent, achieving the tasks set before it. The basic fault here is the secondary place given to environmental protection in relation to the entire range of tasks set before the economy. The most significant shortcomings facing the legislative regulation of environmental protection include the following:

(a) A lack of cohesion and uniformity in legislation on the protection and development of the environment; a certain conflict of aims clearly emerges, for instance, within the laws governing mining, geology, the law on the protection of arable and forested land, and water, in which the main objective is the protection of economic goals.

(b) Clear legislative gaps persist, for example concerning the marine environment, and the law on nature protection is out of date.

(c) There is a wide dispersion of legislative provisions among a large number of laws.

(d) The regulations contained in the civil and criminal code, created in response to the needs of environmental protection, are inadequate.

(e) There is an absence of uniformity and consistency in the regulations defining the system of economic mechanisms used for the management of environmental protection.

From the above-stated facts, it appears that there is a need to transform the entire body of legislation concerning the natural environment, the more so since the planned economic reforms require new resolutions with regard to economic mechanisms. It has been suggested that this process could take place in two stages.

During the first stage - leading up to 1995 - Acts on the Protection and Development of the Environment and on Nature Protection would be passed, and there would be environmental amendments made to the forthcoming bills on water resources, protection of the Baltic, spatial planning, state enterprises, the system of national and self-governing councils, mining, and the protection of arable and forested soils. During the second stage - following 1995 - activities will focus upon passing a comprehensive Environmental Protection Code.

2.3 Ecological Education

In Poland, ecological education is implemented in three ways: through formal education, informal education and education implemented through voluntary bodies. The implementation of the National Programme for the Protection of the Natural Environment demands the active participation of the whole population. Aspects of environmental studies and environmental protection are currently included in teaching programmes designed for nursery schools, primary schools, all forms of secondary schools and in many university courses. The subject "The Protection and Development of the Environment" is one of the constituent parts of the teaching programme formulated for various further education study courses, such as biology, chemistry, geodesy, geography, geology, cartography and oceanography. Social and political organisations or official and unofficial social movements that are active in Poland encompass in their programmes or statutes a programmed scheme of activities aimed at the protection of the environment. The issues facing environmental protection are also finding increasing understanding within political parties and religious organisations. A large role can similarly be played in educating society through social organisations such as: the Nature Protection League [Liga Ochrony Przyrody - LOP], the Polish Ecological Club [Polski Klub Ekologiczny - PKE], the Polish Society for Friends of the Earth Sciences [Polskie Towarzystwo Przyjaciol Nauk o Ziemi - PTPNZ], the Polish Hunting and Shooting Union [Polski Zwiazek Lowiecki - PZL], the Polish Anglers' Union [Polski Zwiazek Wedkarski - PZW] and others. The significant role and contribution of the Nature Protection League [LOP], which has over 1.5 million

members, mainly school children, should be mentioned here. The potential for environmental protection education within the Catholic Church has not, as yet, been assessed. This organisation could have a very wide sphere of influence with regard to the large numbers of practising Catholics in Poland.

The committees of the Polish Academy of Sciences [Polska Akademia Nauk - PAN] play a particular role in ecological education as a result of the high social authority held by these bodies, as well as of the high quality of the studies and opinions formulated by them. Alongside PAN's committees there are related committees such as the Man and Environment Committee, the Nature Protection Committee and the Environmental Engineering Committee. Other committees also working towards environmental protection include the National Spatial Management Plan Committee, the Water Economy Committee, the Ecological Committee and the Forestry Studies Committee, and others.

A great scientific potential that could be invested in research on the protection of the natural environment is constituted by postgraduates from environmental courses Many young people who are completing their university or further education studies are able to undertake theses leading to higher qualifications that are partly or completely focused on environmental protection issues. Many higher education colleges possess scientific units (such as institutes, departments and workshops) set up to educate students in environmental protection, in which scientific staff conduct research on various aspects of environmental protection. These scientists often undertake research on the recommendation of or in cooperation with institutions working for the sake of the protection of the natural environment.

Apart from the institutes attached to higher schools of education, Poland also boasts research institutes within PAN or certain ministries, which are geared towards research on the natural environment or certain aspects of its protection. These institutes include: the Nature and Natural Resources Protection Research Centre of the Polish Academy of Sciences [ZOP ZN PAN], which was created in 1953; the Institute for Basic Environmental Engineering of the Polish Academy of Sciences [IPIS PAN] (Zabrze); and the Institute for Environmental Development of the Ministry for the Protection of the Environment and Natural Resources. Research carried out in this field is coordinated by PAN, or it is financed by the Ministry for the Protection of the Environment and Natural Resources, the Ministry of Forestry and Agriculture and others.

2.4 International Commitments

The commitments Poland assumed after the signing of various international conventions, declarations and agreements include the following:

(a) The observance of the World Charter for Nature Protection, which was adopted by the UN General Assembly in 1982;

(b) The Ramsar Convention of 1971;

(c) The protection of the Baltic waters as a consequence of the Helsinki Convention of 1974;

(d) The joint resolution, together with Czechoslovakia, the GDR and the USSR, of the problem facing the protection of waters from pollution;

(e) Ratification of the Geneva Convention of 1985 concerning the restriction of the emission of pollutants into the atmosphere; Poland did not, however, sign the so-called Helsinki Protocol limiting by 1993 the emission of sulphur dioxide by 30% in comparison to 1980 levels.

During the coming years, Poland will aim to intensify its agriculture. By wanting to export its agricultural produce, it must adapt itself to international demands, which relate to the production of healthy foodstuff.

CHAPTER 3: ENVIRONMENTAL TRENDS

In Poland, environmental trends are closely connected, on the one hand, with the main ecological aims laid down in the NPOSP 2010 document (see 3.2 below), while on the other hand they are also related to the plans for the country's socio-economic development until the year 2000.

3.1 The Degradation of the Environment as a Barrier to Development

The poor state of the natural environment in Poland results from excessive pollution of the atmosphere and surface water, the removal of arable and forested lands for the unproductive storage of waste materials, the lack of clean water and the irrational management of raw minerals. This constitutes a difficult state of affairs for people to bear as well as being an increasingly visible barrier to the country's socio-economic development. The intensifying degradation of the environment in certain regions of the country is the reason for the threat to the health of the population residing there. The sources of this degradation are as follows:

(a) The excessive pollution of the air, mainly in Upper Silesia, Krakow, the Jelenia Gora region and other urban concentrations, is the cause of an increase in tumour-related illnesses, inflammation of the eyes and upper respiratory tracts, and toxaemia, particularly in children.

(b) The pollution of surface and subterranean waters leads to diseases of the alimentary tract, as well as toxaemia and various epidemics that are common in children.

(c) The pollution emitted by industry and the communal economy in urbanised areas is causing the contamination of soils and plants with heavy metals. These pollutants accumulate, above all, around non-ferrous metal works.

(d) The stress of over-population and excessive noise levels in town streets, road junctions, supermarkets, workshops and housing estates that have been deprived of aesthetic and nature-oriented values undermine people's immunity to the many factors harmful to health.

The poor state of the natural environment poses a serious obstacle to Poland's socio-economic development for the following main reasons:

(a) The pollution of surface waters necessitates the transport of water from great distances and increases the cost of supplying water to towns (as, for example, to the Upper Silesian Industrial Region, Krakow, Wroclaw, Lodz and to other large towns).

(b) The pollution of surface waters requires the use of expensive technology to make the

water fit for human and industrial consumption and the expenses connected with the corrosion of pipelines are rising rapidly.

(c) Air pollution, which apart from immediate damage to forests, accelerates the corrosion of buildings, acidifies soils, causes the eutrophisation of surface waters, and areas immediately adjacent to large industrial plants cannot be used for food production.

(d) The increasing production of waste materials means areas of arable and forested land have to be used for storage, causing the devastation of the countryside and more pollution of surface waters.

(e) Shortcomings in the management of raw mineral deposits accelerates exploitation of their reserves, and leads to excessive costs connected with the management of their waste materials.

In the event of the simultaneous occurrence in a certain area of the harmful effects of several kinds of environmental degradation, the accumulated (synergistic) effects lead to the emergence of localities termed ecological disaster zones. In Poland, 27 such zones have been identified, encompassing 11% of the country's surface area. These include the regions around Belchaty, Bydgoscz-Torun, Chelmno, Czestochowa, Gdansk, Upper Silesia and Rybnik, Inowroclaw, Jelenia Gora, Kielce, Konin, Krakow, Legnica-Glogow, Lodz, Myszkowo-Zawiercie, Opole, Plock, Poznan, Pulawy, Szczecin, Tarnobrzeg, Tarnow, Tomaszow, Turoszow, Walbrzych, Wloclawek and Wroclaw.

Estimates of the economic and social losses stemming from the degradation of the natural environment in Poland have indicated that at the turn of the 1970s they amounted to at least 10% of the national income. Since the minimum expenditure needed to decrease the losses incurred is smaller than the sum total of these losses in the long term, the undertaking of specific ventures in the environmental protection field is not only necessary on social grounds but, in the majority of cases, it is economically justifiable. The current expenditure on environmental protection, however, is many times smaller than the losses incurred. A very large obstacle to socio-economic development is the water deficit, which is expected to increase from 7.7% in 1985 to 28% in 2010.

The recommendations (plans) laid down for Poland's socio-economic development up until the year 2000 anticipate a rise in the population to about 40 million and a growth in average consumption by 2.7% per annum. This will cause an increase in housing construction with a planned minimum of 4 million apartments being built by the year 2000, raise the quality of foodstuff (with regard to the so-called wholesome foods), and lead to a 72% growth of energy demand by the year 2000. In preparing this plan, the National Development Forecast Committee - "Poland 2000" - which works under the aegis of the Presidium of the Polish Academy of Sciences [PAN] - presented three likely scenarios for the country's development:

(1) A raw material-energy priority scenario that constitutes the continuation of the kind of economic policies implementated during recent decades. The outcome of this will be an increase in energy requirements as well as investment in and imports of fuel on

a massive scale. The consequence of such a scenario would be the further intensification of environmental pollution, particularly in areas where extraction industries are based.

(2) A basic needs priority scenario which limits the investment available to heavy industry at 15%, favours the construction of residential housing, and the development of infrastructure, communications, the water resources and environmental protection.

(3) A civilisation development priority scenario, which is the most beneficial from the environmental protection viewpoint. It will demand the allocation of 17-21% of the budget to implement scientifically demanding industries, 7-10% for activities aimed at increasing exports and opening up trade with the West, and 9-11% for science and education.

Currently (December 1988), it appears that scenarios 2 and 3 will dominate Poland's socio-economic development. The three main aims that have been indicated by Premier Rakowski's government are: (a) the development of agriculture and the manufacturing industries, (b) housing construction intensification, and (c) the consistent implementation of activities aimed at environmental protection, which will create the chance of checking the rate at which the natural environment is deteriorating and provide the opportunity for its improvement in accordance with the proposals of the NPOSP 2010 plan.

3.2 Ecological Aims to the Year 2010

The National Programme for Environmental Planning to the Year 2010 (NPOSP 2010) calls for the achievement of certain strategic aims in order to minimise the effects environmental deterioration in Poland. Thus, the following plans have been made with respect to atmospheric protection:

(a) Reduce by the year 2000 the emission of sulphur into the atmosphere by 30% compared to the level for 1980, and by 2010 to reduce this emission by a further 35%, that is, to 2 million tons per year.

(b) To check by 1995 the trend for the growth in the emission of nitrogenous acids, hydrocarbons, heavy metals, benzopyrenes and other aromatic substances, and then to bring emissions within acceptable limits on a nationwide scale by 2010 at the latest.

(c) By 2000 to equip all industrial and municipal power plants with appropriately efficient dust collection equipment.

(d) To convert all motor vehicles to the use of lead-free petrol by 2000, as well as to make the appropriate changes in the construction automobiles.

For the protection of water from pollution, plans have been made to:

(a) Eliminate by 2010 the pollution of water leading to its classification as being unsuitable for economic purposes, and to obtain a class I-III cleanliness level nationwide. This will require the cleaning of all sewers as well as the resolution of the

very difficult problem of treating the saline mine effluent that is currently discharged into the upper reaches of the Vistula river.

(b) Obtaining by 2010 class I-III water in all lakes. This will require the purification of all effluents which are currently fed into lakes, especially removing phosphorus and potassium from them, as well as completely banning the discharge of sewage into lakes in protected areas.

Similar aims have been devised for coastal and inshore waters and it is planned to open the majority of coastal bathing spots to the public by 1995. For the protection of soils and the management of waste materials, plans have been made to:

(a) Restore land degraded by industrial activity.

(b) Decrease the amount of waste created that requires storage by 30% in 2000 and by 60% in 2010.

(c) Minimise urban and industrial development in biologically valuable areas, especially of highly productive arable and forest soils.

(d) Restrict soil erosion.

For the protection of living natural resources, plans have been drawn up to:

(a) Ensure the maintainence of ecological processes and the genetic variety of species.

(b) Preserve existing fauna and flora species, wetlands and special geomorphological features and outstanding landscapes.

(c) Extend the coverage of national parks and nature reserves.

(d) Prepare and implement a multi-regional nature protection system, so that through the protection of suitably selected areas, aquatic, forested and arable ecosystems can be protected to a level that would ensure national subsistence;

(e) Check by 2000, forest degradation processes occurring due to air pollution , as well as gradually to reconstruct ruined forested areas.

(f) To increase the country's timber reserves by 30% by 2010.

In order to improve the quality of water supplied to people, agriculture and industry, plans have been made to:

(a) Supply all towns with waterworks and sewerage systems.

(b) Equip the majority of villages with collective waterworks while, at the same time, building waste purification plants.

(c) Implement a system of small storage reservoirs complete with irrigation equipment for agricultural requirements.

(d) Continue the construction of a storage reservoir network that will facilitate an adequate supply of water to cities.

In order to contain flood damage, plans have been made to:

(a) Embank all the important rivers and build more reservoirs to hold floodwaters.

(b) Increase the natural retention capacity of basins and river valleys and carry out anti-erosion measures in 10-15% of the arable land area.

(c) Restrict construction in areas potentially threatened by flooding.

3.3 Problems and Prospects for the Protection of the Natural Environment

The NPOSP 2010 document contains certain ideas for the resolution of the problems facing environmental protection. The implementation of these ideas will depend on the state of the country's economy, on the accepted and implemented ideas for the country's socio-economic development, and on the introduction of the appropriate regulations, particularly the introduction of financial penalties for industrial plants that pollute the environment.

3.3.1 Protection of the atmosphere

The Helsinki Protocol to the Geneva Convention of 1975 commited its signatories to restrict the emission of sulphur dioxide by the year 1993 to 30% of the 1980 level. Poland did not sign this protocol. However, Poland did ratify the Geneva Convention, which commited it to restrict emissions of sulphur into the atmosphere but without any target as to the level of this restriction. A two-stage resolution to the problem of the excessive emission of sulphur dioxide is being planned, given Poland's critical economic situation. The first stage involves the reduction of these emissions to a level approaching 2.9 million tons by 2000, that is, restricting them by 30% seven years later than the 21 European countries that signed the Helsinki Protocol. The second stage involves achieving a sulphur dioxide emission level of approximately 2 million tons by the year 2010, that is, restricting it by a further 30%, which will allow the achievement of an internationally acceptable standard of air quality across Poland. However, a forthcoming problem is the halving of the international standard of average sulphur dioxide concentration from 0.064 g/m^3 to 0.032 g/m^3 from 1991. The great difficulty of restricting the emission of sulphur dioxide and the impossibility of adapting to the demands of the Helsinki Protocol result from the following causes. Poland lacks the appropriate domestic technology necessary to desulphurise gases: this technology is only now under development. Although the potential for resolving the excessive emission of sulphur into the atmosphere based on Polish does exist, there is still a very long way to go. An alternative is to license this technology from abroad, but this is a very expensive option.

Another difficulty facing the implementation of the NPOSP 2101 document is the creation of adequate economic mechanisms that would discourage the emission of sulphur dioxide by industrial plants. Plans have been made not to operate new industrial plants unless they install effective equipment to restrict gaseous emissions. It has also been planned to double the emission fines imposed on industrial plants set up after 1990

compared with plants existing prior to that date. This is why, in order to implement the programme devised to restrict these emissions, there is an urgent need to modernise and develop the country's purification equipment industry, to organise an installation service for this equipment and to improve the coal distribution system (by earmarking low-sulphur fuels for use in regions facing the greatest level of ecological threat).

3.3.2 Protection of water against pollution

Measures are needed to increase the availability and quality of Poland's water resources through the construction of waste purification plants and a storage reservoir network, as well as increased efficiency in the use of water. The achievement of this goal is possible through the regulation of discharges from industrial plants and urban areas, but depends on introducing new legislation and the availability of finance. Priority is being given to the construction of waste purification plants, waterworks and sewerage networks.

3.3.3 Protection of living natural resources

The implementation of plans for the protection of the air, and surface and subterranean water, against pollution is an essential prerequisite for planning the protection of liveing natural resources. Failure, or even only partial success in the restriction of pollution would jeopardise the protection programme for living natural resources. An important objective is to convince decision makers at all levels that it is necessary to protect not only the outward appearance of the natural environment, but also the proper functioning of biological processes. Living natural resources have been and remain the basis for the country's economic development, and they determine quality and level of survival of Poland's people. Under the conditions prevailing in Poland, the main priority of the nature protection strategy is to implement the principle of sustainable development. Thus, a departure has been made from a system of protection for the sole sake of protection. Various ideas on protection for economic development have been promoted instead: all types of spatial protection (national parks, nature reserves, landscape parks and protected landscape areas) are treated as a linked system that serves the implementation of the main aims of the nature protection strategy, which include the following (based on the World Conservation Strategy):

(a) the maintenance of basic ecological processes and systems that are the mainstay of life;

(b) the preservation of genetic diversity; and

(c) ensuring the continued use of species and ecosystems that determine the satisfaction of social needs together with human subsistence.

A problem of exceptional importance in Poland in view of the above interpretation of the goals of the nature protection strategy is the accelerating threat to the forests, which has taken on the form of an ecological disaster in the south-western part of the country.

This disaster has in many diverse forms already affected over half the surface area of Poland's forests. One conflict that must be resolved is that between the rational use of mineral resources and the establishment of new protected areas, as well as the extraction of deposits from existing protected areas.

3.3.4 Protection of soils and the management of waste

A major issue facing the Polish economy is the dependence of a constantly increasing population on home-based agricultural products. For this reason, the protection and restoration of arable soils is one of the most important environmental problems. Moreover, soils that are in the immediate vicinity of large industrial plants pose a threat to human health if used for the production of foodstuff and fodder. It has been planned that by 2000, all directly devastated soils will be restored, while by 2010 soils that have been indirectly degraded, for example by syncline subsistence or crater depressions, and zones of chemical soil pollution, as well as others, will also be restored. However, despite the planned progress in the restoration of soils, it is likely that the total area of polluted soils and land used for waste storage will actually increase. It is anticipated that after 1990 the annual amount of spoil resulting from the exploitation of increasingly impoverished mineral resources at deeper levels or extracted from new mines will rise. The amount of solid waste from the power generation industry will also increase because of the dust collected by newly installed or more efficient dust-collection equipment, and the calcination of burnt coal. In order to help overcome this threat, industrial recycling of all slag from certain steelwork products is anticipated by 1995.

There will be an accelerated growth of domestic and industrial waste materials in rural areas. The entire mass of waste materials of this type which require management will increase from about 45 million m^3 in 1986 to 113 million m^3 in 2000 and 135 million m^3 in 2010. It has therefore been planned to initiate if not complete, by 1995, the construction of waste recycling plants in large urban centres like Warsaw, Krakow, Katowice and Lodz. After 1995, construction of recycling plants will be started in all major towns. The effective management of waste in rural areas requires the establishment of dumps in every parish community [*gmina*]. It has been estimated that some 5,000 such dumps will be required. It is also essential to make provision for the treatment of wastes from pesticides, refineries, coking plants and varnish factories. It has been estimated that some 3 million tons of these toxic wastes are currently in storage dumps.

CHAPTER 4: PRIORITY INITIATIVES

Poland's geographical location in Europe and certain features of her natural environment, together with the direction of her economic development, have created a very unfavourable environmental situation. The predominance of westerly winds in this part of Europe has resulted in the atmospheric pollution emanating from Czechoslovak and GDR industrial centres, as well as those of other countries lying further west, to flow into Poland. As has been indicated earlier, atmospheric pollution constitutes over 40% of all gaseous pollution occurring in Poland.

The catchment areas of the sources of Poland's two largest rivers, the Odra and Vistula, lie in the south of the country in Upper Silesia, a region which boasts the country's main resources of coal, zinc and lead ore, as well as of other mineral resources. From the 19th century, intensive mining began of these minerals, as well as establishment of the manufacturing industries associated with them, including steelworks and coking plants. Large towns arose around the mines and factories. The often wasteful exploitation of the raw minerals and the uncontrolled development of heavy industry, combined with a lack of investment in waste treatment equipment, has caused excessive pollution of the upper reahes of both the Odra and Vistula rivers. These pollutants migrate along these river courses through central and northern Poland as far as the Baltic.

4.1 Reducing Pollution of the Environment

The combating of excessive pollution of the atmosphere and the unprecedented pollution of water constitute the basic tasks for the protection of Poland's natural environment. This difficult situation is exacerbated by the fact that Poland is now suffering a great economic crisis which will necessitate, at least initially, increased exploitation of mines and more production from manufacturing industries in Upper Silesia. Meanwhile, Poland cannot afford to purchase or produce sophisticated pollution abatement technology. However, the main objectives for improving the quality of air and water in Poland have been accepted as being the following:

- improving the quality of the power plant fuels by desulphurising coal;
- equipping power stations with scrubbers to reduce sulphur and toxic emissions;
- introducing better combustion technology to restrict emissions further;
- fitting domestically produced dust-collection equipment to all industrial plants;
- fitting vehicles, particularly buses and trucks, with catalytic converters, introducing lead-free petrol to the market, and converting the engines of newly built vehicles.
- constructing waste purification plants near at all industrial plants and prohibiting new plants from operating without having efficient waste purification facilties;

- halting of the discharge of saline mine effluent into the tributaries of the Vistula and Odra rivers, even at the cost of restricting extraction rates.

4.2 Conservation of Living Natural Resources

After pollution, the second most important issue facing the protection of the natural environment in Poland is conservation of living natural resources. The key problem here is to prevent the loss of plant cover as a result of atmospheric pollution and acidic precipitation which causes the destruction of forests, particularly coniferous forests. Forest degeneration is rapid, while the time needed to restore damaged forest communities is reckoned in decades. However, putting a check on this phenomenon, which has in certain places taken on the proportions of an ecological catastrophe, is extremely difficult. It will take a long time to reduce air pollution, especially that flowing into Poland from the west.

National parks are also endangered, particularly in the mountains of southern Poland. The borders of these parks constitute no barriers to the flow of air pollution. The wetland reserves of northern Poland are less threatened by atmospheric pollution, but nevertheless damaged or destroyed by drainage, water storage and irrigation schemes.

One consequence of soil acidification has been the increased use of mineral fertilisers on areas of arable land as a measure to combat the loss of productivity. A considerable quantitiy of these fertilisers seeps into the ground waters, and from there eventually pollutes rivers and lakes.

The Planning Commission of the Council of Ministers have drawn up priorities for preventative measures that should be applied to the ecologically threatened areas which are affected by the impacts of several types of environmental polution (Table 2).

4.3 Environmental Education

It is essential that the education authorities embark upon activities that will further the promotion of studies about environmental protection and the improvement of the content and methods employed in this field of education. The education authorities should aim to introduce the "Environmental Protection and Development" subject as one that is compulsory and not optional in the classes of all primary, comprehensive and secondary career/profession schools, as well as in all areas of further education. This demands the preparation of suitable programmes, handbooks that have been adapted to the pupils' varying levels of standards and to university study courses. Much significance can be attached to informal education, especially to the development of citizens' attitudes to the issues facing environmental protection, which have been carried out by the mass media, youth organisations and other social organisations. This can, for example, be achieved by increasing the number of television programmes on nature and increasing the numbers of other data on the environment at a national and worldwide level by developing school and propaganda activities through youth and social organisations. Discussions on the programme for the protection of the natural environment can also constitute an important part in informal education schemes.

Table 2: Main activity areas in certain ecological disaster zones.

Ecological Disaster Zone	Main activity areas
Belchatow	A reduction in air pollution; facilitating the supply of drinking water to people living within the radius of the basin by building storage reservoirs and a system of linked waterworks; an increase in the exploitation of raw materials using coking coal; recycling ash from electricity generating stations for use in construction and land restoration.
Bydgoszcz -Torun	A reduction in the pollution of surface waters, particularly the Vistula river and the Bydgoszcz Canal as well as the Brda and Drweca rivers.
Chelm	A reduction in the dust falling in the Chelm and Rejowiec area as a result of the technological improvements in cement production; resolving the sewage purification problem in Rejowiec and Chelm.
Czestochowa	Improved cleanliness of the waters of the Vistula river by modernisation of the chemical and lime works in Rudniki; a reduction in the emission of dust and gaseous pollutants from the B. Bierut Steelworks in Czestochowa, which will also contribute to an improvement in the state of the forests.
Gdansk	Improved cleanliness of the waters of the Bay of Gdansk, in particular the elimination of the present catastrophic bacteriological state of the entire coastal zone; a reduction in the emission of harmful compounds into the atmosphere, especially those produced by phosphoric fertilizer factories and petroleum refineries.
Gornoslaski	The initiation of activities aimed at protecting waters against salinisation and accelerating land restoration in areas that have been exploited for raw materials; a reduction in the surface areas of waste dumps especially in the Upper Silesian Industrial Region (GOP); increased economic exploitation of waste; an acceleration of activities aimed at reducing the damage caused by mining; increasing the number of forest plantations; a reduction in emissions of dust and gas using new pollution abatement technology.
Inowroclaw	Improved cleanliness of the waters of the Notec river, to increase the possibility of abstraction for agricultural irrigation.
Jelenia Gora	A reduction in the pollution of surface waters, particularly of the Bobr and Kaienna rivers; increased air quality to reduce the threat to Jelenia Gora, Szklavska Poreba, the spa at Cieplice Zdroj and also the Karkonowski National Park; prevention of soil degradation caused by the storage of harmful waste from industrial purification plants.
Kielce	A significant reduction in the amount of dust fall in the "Biale Zaglebie" region as a result technological improvements in cement production, which will reduce the threat to the Swietokrzyski National Park and the forests in the Nowina and Malogoszca areas.

Table 2 (cont.): Main activity areas in certain ecological disaster zones.

Konin	Restoration of areas devastated by former coal exploitation.
Krakow	Improved air quality particularly by reducing the concentrations of sulphur dioxide, fluorine and lead, as well as the gradual elimination of local heat sources; the restoration and management of industrial waste dumps; a pilot trial of an incinerator, which will resolve the problem of managing municipal waste in Krakow; an improvement in the quality of the river Vistula's waters just below Krakow as a result of the construction of a large sewage treatment purification plant.
Legnica -Glogow	Reduced air pollution by heavy metals, sulphur dioxide and carbon monoxide which are produced in the "Glogow" and "Legnica" copper smelters; greater flood retention in the basin of the Kaczwa river, which will decrease the flood threat to Legnica; a reduction in the losses incurred in forest plantations; halting soil degradation by the dumping of toxic wastes produced from copper smelters and the "Wizow" chemical plants.
Lodz	An improvement in air quality in Lodz, Zgierz and Pabianice, mainly by reducing the concentration of heavy metals; an improved water quality in the basins of the Bzura and Ner rivers by building a sewage treatment plant in Lodz.
Myszkow -Zawiercie	Improved cleanliness of the Vistula river from Zawiercie, which will facilitate the renewed use of the reservoir in Poraj for recreational purposes; increased recycling of waste.
Opole	Improved air quality as a result of the reconstruction, modernisation and installation of flue scrubbing equipment in industrial plants in Zdzieszowice, Kedzierzyn-Kozle and Strzelce Opolskie; a reduction in the amount of polluted effluent to the Oder, Klodnica and Bierwaka rivers; an improvement in the state of the forests; increasing recycling of industrial waste as well as treating it.
Plock	A reduction in the discharge of toxic effluent by modernising refineries and petrochemical plants; improved cleanliness of the Bzura river.
Poznan	A reduction in the amount of untreated sewage discharged into the Vistula river, particularly from the mouth of the river Ner.
Walbrzych	A reduction in surface and underwater pollution as a result of the modernisation of existing purification plants as well as the construction of new ones and the introduction of closed water cycles in the Walbrzyck and Nowa Ruda coal mines; the raising of air quality; recycling of waste, particularly ashes, slag and shipping bilges; an intensification of land restoration work and the management of waste dumps and settling tanks.
Wloclawek	Improved air quality from technical and technological changes in nitrogen, cellulose paper and sugar refining industria plants.
Wroclaw	Improved water quality of the Oder, Olawa, Bystrzyca and Widawa rivers; a reduction in air pollution by the modernisation of abatement equipment in the industrial plants of Wroclaw, Brzeg Dolny and Olawa; an increased level of recycling industrial wastes.

CHAPTER 5: OPPORTUNITIES FOR REGIONAL AND INTERNATIONAL COOPERATION

Poland is a member state of the United Nations. Various Polish governmental bodies, Scientific Committees of the Polish Academy of Sciences and its Commissions are members of international organisations connected with environmental protection, including IUCN, UNEP, Unesco-MAB and others. Thus contacts can be made and maintained at meetings, congresses, commission meetings, seminars, workshop sessions, bilateral meetings, and so on. The only obstacle here is the shortage of funds for distant foreign trips which generally excludes many voluntary activists and organisations from close international cooperation.

Professional people connected with environmental protection are chiefly assembled in the scientific institutes of the Polish Academy of Sciences [PAN], higher education colleges or institutes within various ministeries, for example, the Institute of Meteorology and Water Economy, the Institute for Environmental Development, the Geological Institute, and the Forestry Research Institute. These scientific institutes, and especially PAN itself, possess a well-developed network of bilateral agreements with other scientific institutes, chiefly in Europe, but also in Asian, American and African countries. Many of these accords concern research on various aspects of the natural environment in general, while some are focused directly on nature protection or on the protection and use of natural environment resources. The system of non-foreign currency accords, which is particularly well developed in the PAN institutes, gives more scope for foreign travel and undertaking joint environmental research schemes. The network of agreements established with the USSR, Bulgaria, Czechoslovakia, Romania, Hungary and other East European countries to promote scientific cooperation is particularly well developed. Many of PAN's scientific institutes have direct contacts with the equivalent institutes of these countries. Research connected with issues facing the protection of the natural environment in cooperation with other countries under PAN's aegis are being conducted by, among others, the Nature Protection and Natural Resources Research Centre [ZOP i ZN], the Botany Institute, the Geography and Spatial Planning Institute, and the Geological Studies Institute.

These institutes also organise joint external projects on issues facing the protection of the natural environment. An example of this is research being carried out into the rational exploitation of the natural environment in selected regions of Mongolia by the Institute of Geography and Spatial Management and the Nature Protection and Natural Resources Research Centre in collaboration with the Institute of Geography and Polar Studies of the Academy of Sciences of the Mongolian People's Republic. Similarly, joint research is being conducted into the functioning of biosphere reserves in the Stara Planina mountains in Bulgaria by the Nature Protection and Natural Resources Research Centre in conjunction with the Scientific Coordination Centre for Ecology and Nature Protection of the Bulgar-

ian Academy of Sciences [BAN]. Among PAN's more significant undertakings are the research surveys being carried out in polar regions, for instance, the permanent Polish Scientific Station based in Antarctica, where the Institute of Geophysics has scientific research programmes in the fields of geology, geophysics and fauna and flora. PAN has also been active in Spitzbergen for many decades. The results of this research are usually published in foreign languages and are widely disseminated.

Another form of cooperation is the availability of specialist advisers from PAN's institutes, colleges and departmental research centres. This body of experts, although relatively large, is not widely recognised and so far only a few of them have been called upon by various international organisations. These specialists have two major assets: (a) most them have a relatively good knowledge of Russian plus a West European language, usually English, so they can easily transfer certain scientific concepts or ideas from Western to Eastern Europe and vice versa, they can also be used in many Third World countries where there are eastern and western influences; and (b) they generally cost less than specialists contracted from the highly developed countries of Western Europe and North America.

Other volumes will include:

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