SOME FACTS ON THE STATE OF ENVIRONMENT IN FR YUGOSLAVIA BEFORE AND AFTER NATO BOMBING

Bozidar Stojanovic, Ph.D.

This paper reviews key characteristics of the environmental situation in Yugoslavia before, during and after the NATO bombing against this country. Some principal environmental problems and their sources are described. The "quality" of soil, water and air, as well as some other environmental parameters is documented by available data collected during the last decade. An analysis of main environmental issues was made. A short review of key environmental policies, instruments and institutions are also presented.

Key words: environmental protection, state of environment, Yugoslavia

INTRODUCTION

Former Yugoslavia has made great progress in transforming its economy and society. Whilst disregarding the environmental criteria in this period, a dynamic economic, traffic and urban development led to present environmental conditions. This created a situation of highly polluting factories, the lack of proper waste facilities for municipal, industrial and hazardous effluents, insufficient air, water and soil pollution monitoring. Without an established market economy as yet, and with budget restrictions, the maintenance and development of the urban infrastructure, as well as industrial facilities, remain inadequate, and the natural resources, fuel and energy use uneconomical. These are all contributing factors in the environmental degradation. In the past ten years, FR Yugoslavia has had a stagnant economic performance due to economic sanctions and political conflicts in the area. Despite declined industrial activities the environmental situation did not changed in positive direction.

Additional environmental degradation of Yugoslavia was the consequence of NATO aggression and destruction of chemical plants, oil storage installations and other hazardous objects. Although there was no evidence of a large-scale ecological catastrophe, pollution was very severe in the vicinity of targeted industrial complexes and many valuable ecosystems were disturbed. Just because there have been no acute large-scale visible impacts on flora and fauna or on human health at the moment, does not mean that there will be no long-term effects.

This paper contains some basic data and comments on the environmental state of Yugoslavia before, during and after the NATO bombing. The main goal of this paper is to initiate a more serious and comprehensive research on the environmental situation in Yugoslavia as a basis for environmental recovery of threatened areas and the improvement of the ecomanagement in the country.

PRINCIPAL ENVIRONMENTAL PROBLEMS AND THEIR SOURCES

Environmental situation in Yugoslavia before the NATO bombing can be analyzed using the data from the last official report on the status of the environment in FRY (1). Although the report includes data until 1994, the results of the analysis today are still actual, because of the low level of economic activities as a consequence of the economic sanctions since 1992.

Soil

Destruction or degradation of soil is caused by erosion, open-pit mining, dumping of waste and ash, and diversion to the other uses (settlements, transport and other infrastructure, water collection, etc.). Overall percentage of distracted land is 0,25% of the total surface of Yugoslavia (0,24% located in Serbia). The percentage of various types of distracted land in overall surface of destructed land was as follows: open-pit mining 30%, water-reservoirs 20%, various dumps 15%, settlements 10%, factories, transport and other 25%. The main environmental impacts from non-ferrous metal mining and metallurgy are present in Bor, Majdanpek, Kosovska Mitrovica and Podgorica, and open-pit coal mining in Kolubara, Kostolac, Kosovo and Pljevlja.

Various gases, liquid and solid pollutants and toxic substances contaminate soil. The source of the main environmental impact is the use of the chemical fertilizers and pesticides in the agriculture. Although Yugoslavia belongs to the countries with low-level agro-chemicals con-

sumption, some areas are contaminated due to extensive use of chemicals. This can be illustrated by the results of soil analysis collected in Vojvodina.

Table 1 - Contents of heavy metals in the soil of Vojvodina

Contaminant	Concentration (mg/kg)	Contaminant	Concentration (mg/kg)
Cadmium	0.06-1.68	Lead	3.6 - 82,5
Copper	1,3 - 252,5	Phosphorus	0,2 - 16,0
Mercury	0,01 - 0,054	Zinc	1,25 - 182,5
Contaminant	Concentration (mg/kg)	Contaminant	Concentration (mg/kg)

Acidification and inadequate disposal of solid and hazardous wastes from farms and industrial facilities also degrade the soil.

Air and atmosphere

In Yugoslavia, the emissions of polluting substances into the air are considerable, despite the fact that the industrialization, traffic and urbanization level is low compared to European countries. The air is polluted from firing places in households and factories, heating plants, thermal power stations and other thermal facilities, by motor vehicles, industrial processes and installations.

The annual emission variation is closely related to the economic activity. The noticeable decline of emissions in the year 1992 is the result of UN economic sanctions introduced that year against Yugoslavia (Table 2).

The levels of SO_2 emissions derive mainly from the consumption of coal in the thermal power stations, with an average emissions share of 88% of total sulfur emissions. Major emission sources are thermal power plants in Obrenovac, Kostolac, Lazarevac (Central Serbia), Obilic (Kosovo) and Pljevlja (Montenegro). Industry shares only 3-4% of total SO_2, although the installed metallurgy capacities are relevant. Among other emission sources of air pollutants the most important is traffic in the cities and on main highways and roads.

Yugoslavia actively participates in the international system of monitoring transborder pollutants transport through atmosphere (EMEP). According to the results obtained from EMEP- program in the period 1985-1993, Yugoslavia "imported" from other European countries 256 000 tons of sulfurs, and "exported" 147 000 tons in average. The total amount of deposited sulfur in Yugoslavia was 561 000 tons. The total deposition of nitrogen, in the same period, was 132 000 tons, while the "import" amounted to 97 000 tons, and the "export" to 34 000 tons.

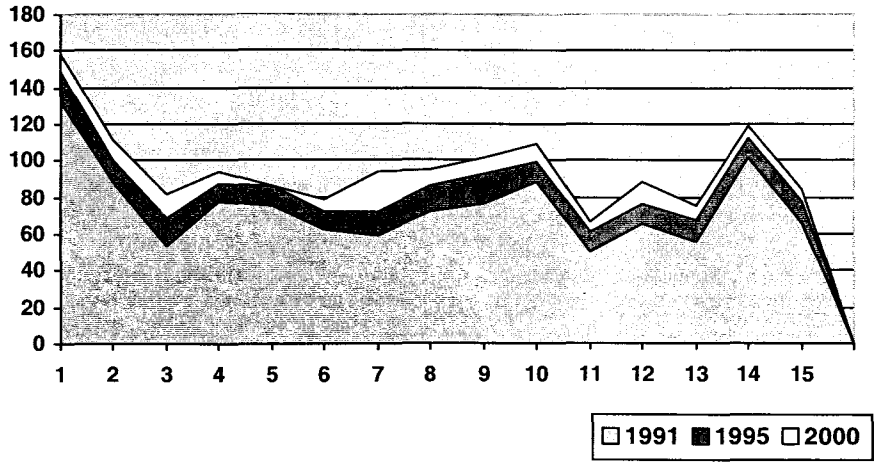
Some major polluting substances in urban areas include: sulfur dioxide, soot, carbon dioxide, nitric oxides, formaldehyde and other organic substances, lead and specific pollutants from industrial sources. The quality of air is regularly monitored according to the annual program by the network of meteorological stations, and by the network of health institutions in settlements. According to data obtained from health institutions many settlements are overpopulated. During last decade, the highest contents of SO_2, soot, sediment or specific industrial pollutants were found in Belgrade, Uzice, Bor, Pancevo, Krusevac, Sabac, Pljevlja, Niksic, Bar, etc. (2).

Table 2 - Emissions of SO_2 and NOx in Yugoslavia 1990-1994 (in '000 tons/year)

Year	Pollutant	Total emission	Thermal power station	Industry	Other
1990	SO_2	254.0	223.3	9.9	20.8
	NOx	66.0	59.2	4.6	2.2
1991	SO_2	224.0	195.6	6.5	20.9
	NOx	57.0	50.9	4.0	2.1
1992	SO_2	198.0	167.5	5.2	25.3
	NOx	49	44.1	2.4	2.5
1993	SO_2	200.5	179.0	7.0	14.5
	NOx	54	47.6	5.0	1.5
1994	SO_2	212.0	186.6	6.3	19.1
	NOx	52.4	47.8	2.1	2.1

Fig.1 - Average yearly concentrations of SO_2 in Belgrade

(Imission limit = 50 mg/m^3)



Waters

General appraisals of the status of the majority of waters in Yugoslavia, including the coastal see water, points to quality deterioration.

City and industrial wastewater pollute the waters of many rivers, particularly in the basins of the Danube and the Sava. Only a small number of cities have wastewater treatment equipment. In certain areas, waters are also contaminated by polluted air, especially in the vicinity of power and industrial plants.

Water flows and the see are polluted by nutrients found in wastewater, as well as metals and synthetic organic compounds which accumulate in sediments. Underground waters are polluted, too, as a result of acidification and diffusive wells pollution by wastewater from public utilities, nitric fertilizers and pesticides, industrial wastes, etc.

The quality of water in the majority of Yugoslav rivers, lakes and coastal waters should belong to class II, and only exceptionally to class III, or out of standard. Unfortunately, it is the other way around and the most of waters do not fit in the classification at all. In the most rivers lower concentrations of oxygen have been found, and higher concentrations of BOD and COD, as well as ammonia, nitrates, and occasionally in some rivers higher quantities of Fe, Pb, Hg, etc. Such results indicate to urban wastewater as the main sources of pollution.

According to the official data (3), examples of extremely clean, waters, which belong to class I, are very rare, e.g. Raska River, Lim, Studenica and Lepenac. The worst situation as regards the water quality has been registrated in Zlatica River, Begej, Mlava and the Channel Danube-Tisa-Danube.

The quality of coastal waters in the Adriatic is still relatively good, except in some parts of the Kotor Bay and the port of Bar.

Natural heritage

Yugoslavia has a wealth of natural regions and values, both in terms of quantity and quality. According to the inventory of all protected natural goods which covers the period until 1994 inclusive, our country has 1700 valuable natural goods, on an area of 400 000 ha, or 4% of total area. In Yugoslavia, under formal protection are 9 national parks, 20 regional parks, 19 protected coastal areas, 122 reservations of nature, and about 1000 protected species of flora and fauna, etc.

Yugoslavia's natural heritage which is on the List of World Heritage, includes the National Park Durmitor (with the Tara Canyon as biosphere reservation included) and the Kotor-Risan Bay, as the natural and cultural-historical area. Obed Marsh and Ludog Lake have been included in the list of marshes of international importance, while "Carska bara" is locality of the greatest importance.

Although natural heritage has formal legal protection and certain organizational and financial support, the real protection system of nature is not satisfactory. Strong anthropogenic impacts on the natural systems, particularly in the national parks, have been the consequence of unsustainable wood and mineral exploitation, tourism development, infrastructure network building, construction of weekend settlements and houses, and the use of chemicals in the agriculture.

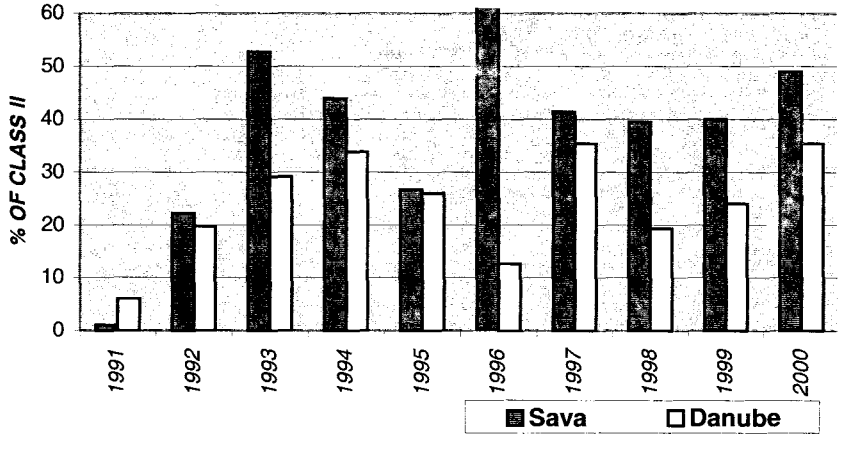
Other environmental problems

Noise in Yugoslavia, albeit not measured systematically at the most threatened locations, is definitely increasing. Critical areas in terms of noise are cities and settlements in vicinity of thoroughfares, industrial complexes and plants, multi-purpose zones, airports, etc. The results of noise measured at 16 locations in Belgrade in the period of 1991-1999 show high levels of noise at all locations including central zones, settlements, industrial zones and main traffic routes (4).

Systematic monitoring of radioactivity has been conducted in various types of samples from the air, waters, soils, vegetation and food. Results of monitoring have shown low levels of radioactivity in all type of samples.

Collection and treatment of urban as well hazardous wastes in Yugoslavia are largely neglected. The percent of urban wastes covered by recycling is still low.

Fig.2 - Water quality in the Sava and the Danube 1991-2000



ENVIRONMENTAL EFFECTS OF NATO BOMBING

After more then two years it is still difficult to perceive and evaluate the entire humanitarian, economic, environmental, health and other consequences of the NATO air strikes against Yugoslavia. However, it is amply documented that the bombing of Yugoslavia was not strictly aimed at military and strategic targets as claimed by NATO. Civilian infrastructure, many industrial facilities, civil institutions as well as many protected natural areas and cultural monuments have been damaged too.

From 24 March to 10 June 1999. NATO carried out more than 35 000 assaults against Yugoslavia. Between 22.000 and 79 000 tons of explosives were dropped, including aerial bombs, cruise missiles, cluster bombs, depleted uranium weapons, etc. (5). The air strikes have so far destroyed or damaged several thousand of objects in the built and natural environment throughout the territory of FR Yugoslavia. The list of shooted objects is long. It includes objects of the transportation infrastructure (bridges, railways, roads and airports), factories, chemical industries, refineries and warehouses, electric power stations and infrastructure, water supply infrastructure, cultural and historical monuments, housing units, protected natural areas, biodiversity, and other.

The destruction of industrial facilities, refineries, warehouses storing liquid raw materials and chemicals, thermal power stations and the electrical transformer installations and facilities has caused the release of numerous toxic substances, as well as several hundreds other chemical compounds with potentially harmful effects on the environment and human health.

Contamination of soil

Due to the bombing of industrial facilities, a huge quantities of hazardous chemicals and oil products were spilled contaminating the soil, and polluting the air and water that settled into the soil in the wider areas. Identified threats to the regions' soil are:

- More then 200 000 tons of oil products have burned or were spilled into the soil at locations of Novi Sad refinery, Pancevo refinery, as well as at oil storage installations in Smederevo, Prahovo, Beograd, Bor, Nis and others (5,6,7).
- By bombing the electrical transformers in Kragujevac, Bor, Resnik and Veliki Crljeni mineral oil (PCB) was spilled, thus strongly contaminating soil and groundwater.
- Nearly 8 tons of mercury were spilled from the electrolyze plant.

Water pollution

As the result of leakage from damaged industrial plants, the surface and ground waters have suffered largely. Specific impacts include following:

- Oil products leaked into the Danube River from Pancevo's industrial zone and the refinery at Novi Sad.
- More than 20 transformers were damaged or destroyed, all around Yugoslavia stations (Belgrade, Kragujevac, Nis, Bor, etc.), producing soils and underground waters contamination by PCB.
- From the Pancevo's petrochemical complex 1 000 tones of ethylene dichloride leaked into the industrial channel and additional 1 100 tones spilled into soil and groundwater (5).
- Over a hundred tones of sodium hydroxide were spilled from Pancevo's petrochemical complex.
- The Iron Gate Danube Reservoir is in special danger since the process of sedimentation increased due to the riverflow slow-down. Therefore, the Iron Gate's reservoirs act as collectors of all upstream pollution.
- Heavy metals: copper, cadmium, chromium and lead, at double maximum rates of the allowed concentration, were registered in Romania's Danube.

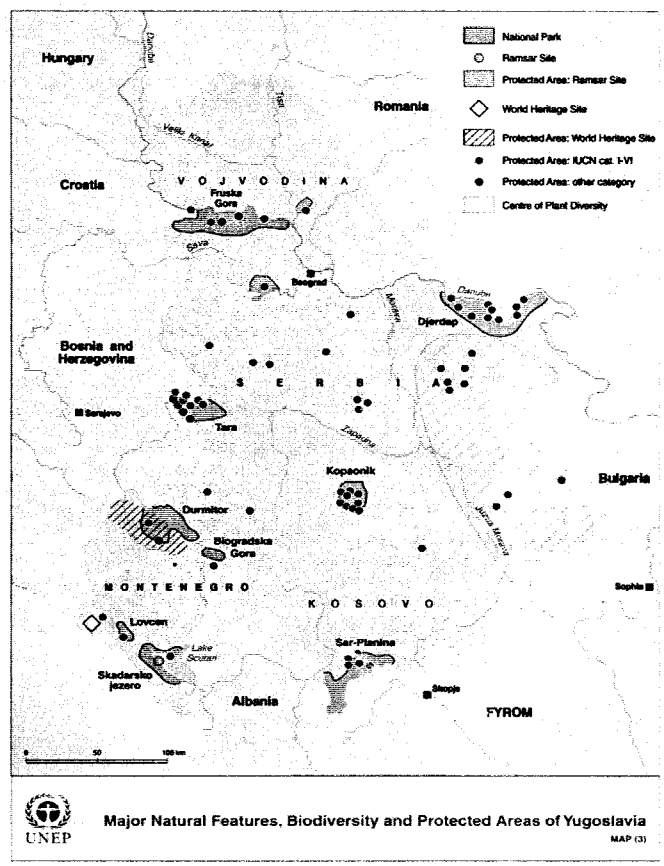
Spilling of dangerous substances from Pancevo's industrial zone during the heaviest bombing attacks at 18. April 1999. provoked heavy contamination of the Danube River water, killing fish and degrading vegetation in the industrial channel and in the Danube, several kilometers downstream of the channel (8). The results from samples of the river water taken on 18. May and later did not show the presence of pollutants spilled from industrial zone.

Air pollution

Air pollution, in case of the chemical plants bombing tends to be a short-term phenomena. Following cases were registered:

- Vinyl chloride monomer (VCM) was released from the Pancevo petrochemical plant. Polluted clouds carried the products of combusted VCMs: phosgene, chlorine, chlorine oxides and nitrogen oxides. It should be mentioned that poisonous air pollution in the town of Pancevo and in some parts of Belgrade was avoided because of meteorological conditions over the Pancevo's industrial zone at moments of bombing (9).
- Products from incomplete hydrocarbon combustion were released as the result of strikes on oil refineries.
- During the Pancevo and Novi Sad attacks, large oil depots were burned. This resulted in the production of soot and other particulates.
- Nitrogen oxides have been released from jet aircraft and through burning industrial installations.
- Radioactive pollution from depleted uranium weapons was suspected in Kosovo and in South Serbia.
- Destruction of metal industry plants released heavy metals into the atmosphere: mercury, cadmium, chromium, copper and zinc.
- Acid rain was measured in a number of areas, including Romania and Bulgaria.
- In Timis County, Romania (North-East of Belgrade), from April 18-26, 1999, the maximum allowed concentration for sulfur dioxide, nitrogen oxide and ammonia was exceeded by 5-10 times.

Fig. 3 - Biodiversity and protected areas



Biodiversity/Nature

The direct consequences on biodiversity and nature can be summarized as follows:

- Locally, the physical destruction of habitats, plant and animal populations by air attacks.
- Degradation of habitats, plant and animal populations from chemical contaminants (borne in air, water and in soil).

Protected areas directly affected by the bombing include: Kopaonik Mt. National Park, Fruska Gora Mt. National Park, Tara Mt. National Park, Sar planina Mts. National Park, Vrsacke Planine Mts. Natural Reserve.

ENVIRONMENTAL POLICY AND MANAGEMENT

In Yugoslavia, the environmental protection policy has been defined by federal and republic constitutions and laws, by the federal government resolution and some other documents.

Policy and legislation

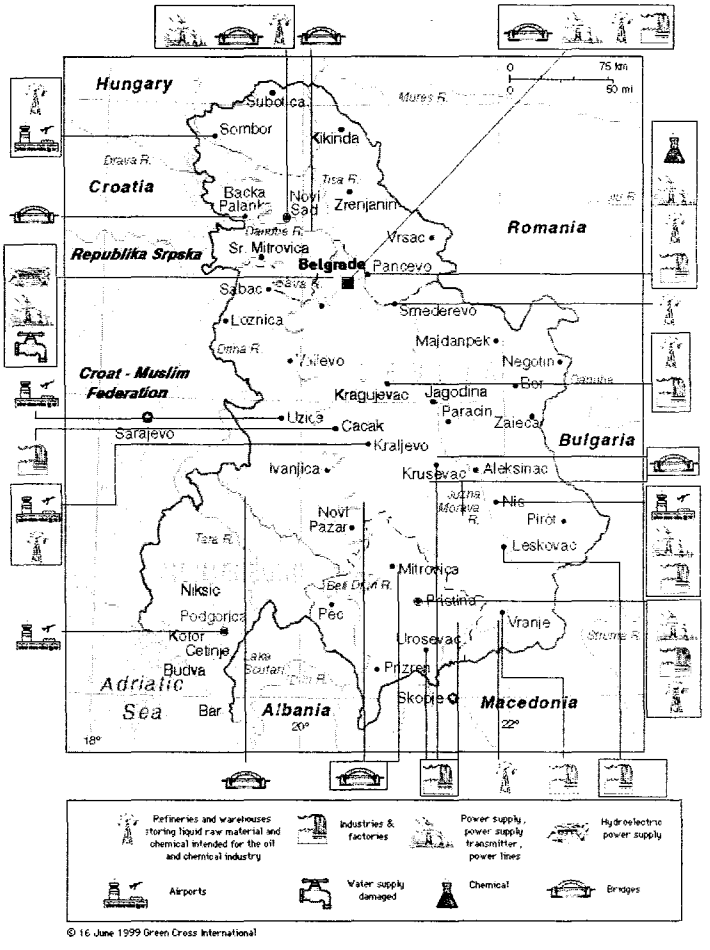
Basic goals, principles and programs of the environmental policy in Yugoslavia were formulated by the "Resolution on the policy of environmental protection in FRY" (adopted by Federal Government, 1993). The key policy elements are: integration of environment and development, hierarchy of interests and goals, quality control, efficiency, market neutrality, information, program directed, prevention principle, relaying on the polluter-pays principle and solidarity in financing the environmental protection programs. Montenegro has a special document with defined policies that orients the republic towards the ecological idea (Declaration on the Montenegro as Ecological State).

The policy was backed up by a set of instruments, which included the institutional organization, legal provisions, monitoring, education, etc.

Key actors in the environmental management in Yugoslavia are organized in a three-level system. There is the Sector for Environment as part of the Federal Ministry for Development, Science and Environment. Both Yugoslav Republics have their own Ministries for Environmental Protection, and certain larger cities have their local authorities for the environment.

Basic legislative acts are: the federal "Law on the fundamentals of environmental protection" (1998), Law on the environmental protection (Serbia, 1991) and Law on the environment (Montenegro, 1996). There are a great number of laws in the other sectors, which cover

Fig. 4 - Locations of main damages during the NATO-bombing of Yugoslavia



specific requirements for environmental protection, such as: territorial and urban planning, agricultural land, forests, waters, health care, design and construction of buildings, protection of national parks, etc.

Environmental impact assessment systems (EIA) as the most important precautionary instrument in the environmental protection were established in the both republics. In Serbia, the EIA system was established by the "Regulation on the analysis of impacts of objects and works on environment"(1992) and in Montenegro by "The Decree on the environmental impact assessment" (1997). In general, the contents of these documents are based on EC Directive 85/337 on EIA, but our EIA systems do not include public participation in decision-making.

Monitoring and data-base system

There are two basic institutional systems for regular monitoring of the state of environment in Yugoslavia. The first is the Federal Hydometheorogical Institute (with two republic branches), which consists of a network of hydrometheorogical stations. The responsibility for monitoring the quality of surface waters is given to 8 stations, for precipitation waters to 11 stations and for monitoring the air to 30 stations. The second system is organized through the Federal Institute for Health Care and the Health Care Institutes of the Republic of Serbia and the Republic of Montenegro, who have corresponding networks of local ecotoxicological, chemical and microbiological laboratories. This system conducts the monitoring of some environmental factors quality in urban areas: surface, underground and potable water, soil contamination, air and noise, etc. The third part of the Yugoslav

monitoring system includes a number of specialized institutes of technical sciences, cultural heritage and nature.

Primary data on the environment are collected and processed by the network of bureaus of the Federal Statistical Office (FSOY) at all territorial levels, from communes to the federal level. A comparison of the coverage of the environmental data included in the OECD and ECE catalog by Yugoslav statistic (1990) reveals that our statistics contains more data from the OECD catalog then from the ECE catalog.

Table 3. - Percentage of coverage of OECD and ECE environmental data by Yugoslav statistics (1990)

Field of environment	Soil	Air	Flora & Fauna	Coastal & marine environment	Surface waters	Forests	Waste	Noise
OECD	83	46	57	33	55	100	-	-
ECE	32	60	20	-	50	-	13	-

The Statistical Yearbook of FR Yugoslavia is the principal publication of FSOY, which comprehensively and systematically offers a choice of the most significant data from all fields of social and economic life, as well as from the environment. The main environmental data areas in this publication are:

- air quality
- quality of surface waters
- chemical composition of precipitation
- waste water and purified waste water from settlements
- waste waters from manufacturing
- quantity of purified waste waters from manufacturing
- consumption of plant protection preparations
- consumption of mineral fertilizers
- number of protected natural areas by type
- list of national parks
- list of natural-cultural patrimony.

The lack of raw data, i.e., the actual structural features of Yugoslav environmental statistics, represents a critical information gap. Above all, the weak point is the interpretation of this data in the context of ecological and socio-economic functional relationships.

CONCLUSIONS

Yugoslavia has witnessed a dynamic economic and societal development, which created a situation of highly polluting factories which have been characterized by inefficient use of raw materials and energy, lack of proper waste facilities for municipal, industrial and hazardous effluents, and by weakness of the environmental protection management system in this country. As result of such development all parts of environment (soil, water and air) became polluted. Pollution in the vicinity of mines, energetic and industrial sites, in urban areas and along highways has various harmful effects on the environment and human health.

During NATO bombing the destruction of industrial facilities, refineries, warehouses storing liquid raw materials and chemicals, thermal power stations and the electrical transformer installations caused releasing of several highly toxic substances, as well as several hundreds other chemical compounds which contributed to further degradation of environment in Yugoslavia. Although there was no evidence of a large-scale ecological catastrophe, pollution was very severe in the vicinity of targeted industrial complexes and many valuable ecosystems were disturbed. Just because there have been no acute large-scale visible impacts on flora and fauna or health after two years since bombing at the moment does not mean that there will be no long-term effects.

Despite Yugoslavia have had policy; institutions and instruments for environmental protection efficiency of implementation of protective measures have not been adequately implemented in the past as well as today. There are four main problems: (1) lack of money for recovery of identified hot-spots, (2) lack of comprehensive information on the state of environment including environmental analysis and reporting, (3) inadequate implementation of preventive instruments and measures, and (4) lack of public participation in the process of decision making on environmental issues.

References

1. Report on status of the environment in FRY, Federal Ministry for Development, Science and Environment, Belgrade, 1995
2. Statistical Yearbook of Yugoslavia, 1991-2000, Federal Statistical Office, Belgrade
3. Report on the status of the environment, Federal Hydro-Meteorological Institution, Belgrade,1995-1997
4. Concept of Master Plan of Belgrade, Belgrade Urban Institution, 2001
5. Environmental consequences of NATO bombing in FR Yugoslavia, Official report of Federal Ministry for development, science and environmental, Belgrade, 1999
6. Kosovo Conflict-Consequences for environment and human settlements, UNEP/ UNCHS, Nairobi, 1999
7. FOCUS Assessment Mission 2 to the Federal Republic of Yugoslavia-Ecology, 18. July – 13. August, 1999, www.focus-initiative.org
8. M.Tanaskovic et al., The impact of bombing of southern industrial zone on water quality of the river Danube and channel "HIP", Environment and health -Consequences of NATO aggression on Yugoslavia, Institute of Public Health of Belgrade, 1999
9. B.Stojanovic et al., A contribution to environmental planning of development of Pancevo industrial zone, Monograph "Two cities: Perspectives of renewal and Krasnogorsk, Institute of Architecture and Urbanism of Serbia, Belgrade, 2000.