THREATS TO BIOLOGICAL DIVERSITY IN BULGARIA

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Bulgaria's biological diversity faces a broad spectrum of anthropogenic threats. The varied threats affect different taxa and regions to different degrees. In some cases -- the damage to commercial fish breeding areas in the Black Sea littoral zone as a result of trawling, for example -- the threats are discrete, readily identifiable, and of short-term economic consequence. In any given ecosystem, however, a combination of interrelated threats is usually present, affecting the general health of the system in often subtle ways. Poor pasture management and overgrazing in the mid-elevation hills, for example, has led not only to a loss of floral and soil biotic diversity in the pastures themselves, but also to soil erosion, siltation, and eutrophication in downstream waters and wetlands.

The threats to biological diversity fall into several general categories: habitat loss and degradation, pollution, overexploitation (of ecosystems, habitats, and species), exotic and hybrid species, changing land tenure, global change, and lack of knowledge and effective policy.

HABITAT LOSS AND DEGRADATION

The degradation and outright destruction of both aquatic and terrestrial habitats are the most significant threats to biological diversity in Bulgaria. The deterioration of habitats affects all ecosystems, from the high mountain forests and lakes to the open waters of the Black Sea. In some cases the threats are site-specific and the effects acute. In other cases, the threats issue from general patterns of land use, and the effects are widespread across the landscape.

Bulgaria's aquatic systems -- the Black Sea; the seaside lakes (Bourgas, Varna, Beloslav, Mandra); the Danube and other major rivers; inland lakes and streams; groundwater; and wetlands associated with the Black Sea coast, the Danube, and other inland waters -- are subject to many forms of habitat loss and degradation:

- Pollution from household, agricultural, industrial, and nuclear wastes;

- Eutrophication as a result of intensified land uses, sedimentation, wastewater influx, and overloading with other organic inputs;

- Illegal bottom trawling in the Black Sea, which damages fish breeding areas;

- Channelization of riverbeds, affecting both the biota of the streams and rates of water and sediment flow into the Black Sea;

- Other alterations of stream hydrology, habitats, and processes, including diking, embankment, diversion for irrigation, and damming; and

- Drainage of wetlands along the Black Sea coast, in the Danubian plain, and in inland basins.

These factors have led to substantial alterations and, in some cases, the complete disappearance of fish populations and other fauna in many aquatic environments.

Bulgaria's terrestrial ecosystems face a different set of threats:

- Clearing of the few remaining natural lowland forests for agricultural purposes and of older forests in the higher elevations for timber. Timber harvesting not only degrades habitats directly, but requires the construction of roads and other support structures, further degrading and fragmenting forest ecosystems.

- Widespread alterations of mid-elevation forests due to clearing, fires, heavy pressure from livestock grazing, and artificial planting and afforestation (especially the replacement of broad-leaved forests with conifer plantations).

- Problems associated with agricultural land uses: plowing of meadows, including formerly uncultivated lands; overgrazing in high mountain meadows, pasturelands, and foothills; expansion of monocultures and input-intensive agriculture, especially the intensified use of fertilizers and pesticides; loss of the genetic diversity of crop plants, orchard trees, wild and primitive relatives of domesticated crops, and domestic animal breeds; and soil erosion and siltation of lakes, wetlands, and waterways.

- Poorly planned construction and development projects, including tourist resorts and facilities, highways and other transportation projects, dams, mines, and quarries, as well as urban expansion in general. Especially vulnerable are those areas, often biologically fragile, that are developed for increased tourism -- the Black Sea coastal dunes and beaches, caves, and high mountain forests and meadows. Such projects have not been undertaken with expert evaluation of their environmental impacts.

- Genetic isolation as a result of habitat fragmentation. This is known to affect the chamois and brown bear populations in the Stara Planina Mountains, which are separated from those in the Rhodope, Rila, and Pirin mountains. Other plant and animal species, not only in the montane forests but in remnant lowland communities, may also be affected.

Pollution

Bulgaria's biological diversity is threatened to varying degrees by virtually all forms of point and non-point source pollution, including household, industrial, agricultural, petroleum and petrochemical, and nuclear. Several forms are of particular concern:

- Household wastewater (especially in the high mountains) and other toxic and organic household wastes;
- Runoff of agricultural organic wastes and chemicals (pesticides and fertilizers)
- Contamination of agricultural lands with heavy metals;
- Localized air pollution in parks near large urban or industrial areas (especially Vitosha National Park);
- Localized pollution of soil (especially agricultural lands) and water with heavy metals, chlorine compounds, and other industrial wastes;
- Oil pollution from drilling and shipment on the Black Sea;
- Thermal pollution of the Danube River, other inland waters, and (more sporadically) the Black Sea waters (this has not been well studied in Bulgaria, but should be considered a threat based on studies performed in other areas);
- Transboundary air pollution from other European countries; and
- Transboundary water pollution of the Danube River and Black Sea.

Environmental reforms in Bulgaria, and throughout Central and Eastern Europe, have been driven largely by concerns over the severity and extent of industrial pollution and its associated effects on human health (see Box 6). This remains an overriding concern, but greater consideration should be given to other types of pollutants, and to their effects on biological diversity.

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Overexploitation

Direct exploitation and especially the overexploitation of economically valuable species affect many different ecosystems, habitats, and taxa. Included in this category are such threats as

- Illegal gathering, sale, and export of medicinal plants, edible fungi, the two commercial species of snail, vipers, and protected reptiles, especially reptile species from the Mediterranean zones.
- Overharvesting of commercial fish species in the Black Sea coastal and open waters. Overexploitation of the Bulgarian Black Sea fisheries was most intensive in the period from 1960 to 1980. Despite the adoption of

Box 6. Addressing Pollution Problems

Although the human health and environmental effects of pollution are not the primary focus of this strategy, the issues of biodiversity conservation and pollution control are inseparable. Pollution of the air, soil, groundwater, freshwater, and coastal waters in Bulgaria has intensified over the last five decades and constitutes a major threat to both biological diversity and human health.

Air quality suffers from high levels of particulate matter, sulfur dioxide, and nitrous oxides. Most are emitted from automobiles; coal-burning power plants; and chemical, cement, and other industrial plants. The effects of these pollutants are evident in the occurrence of regional concentrations of human respiratory problems and incidence of acid precipitation. Air pollution is also cited as a contributing factor in the reduced resistance of forest stands to disease and insect infestations.

Of Bulgaria's 13 major rivers, only one (the Mesta) now meets recreational quality standards along its full length. Most are polluted in their lower stretches. Two (the Danube and Beli Lom) fail to meet pollution standards at any point and 10 are seriously polluted along more than half their length. These rivers receive inputs of barely or untreated sewage, feedlot effluent, fertilizer runoff, and unregulated industrial wastewater containing chemicals and heavy metals. The consequences for biological diversity have been profound. A 1987 evaluation of the major rivers revealed significant declines in species diversity. Rivers with the poorest river bottom communities are the Arda, Iskar, Yantra, Russensky Lom, and Maritsa. Stretches of the Vit, Osam, and Ogosta have also been seriously degraded.

Although pollution of the Black Sea is a problem that transcends national boundaries, Bulgaria contributes a significant portion of the wastes. At present, pollution constitutes the main threat to marine resources, and marine biodiversity in general, along the Black Sea coast. Oil and petrochemical industrial wastes comprise nearly half of the discharge into Bourgas Bay. Adjacent Bourgas Lake is the most heavily polluted of the seaside lakes. Concentrations of untreated sewage and industrial wastewater have also caused advanced eutrophication in Varna Bay.

Soil and groundwater pollution are significant problems. Rapid, large-scale industrialization over the last several decades has left a legacy of high concentrations of heavy metals, fly ash, organic chemicals, and acids. Mining and smelting operations, coal-burning power plants, and oil processing and chemical production facilities were (and in many cases remain) the main sources. Wastes from these

(CONTINUED ON PAGE 31)

fishing regulations and prohibitions in Bulgaria over the last decade, stocks of most commercial species within Bulgaria's waters have continued to decline, in some cases dramatically. Species affected include the sprat (*Sprattus sprattus phalericus*), mullets (Mugilidae), turbot (*Psetta maxima moeotica*), sand smelt (*Atherina boyeri*), gobies (Gobiidae), European flounder (*Platichtys flesus luscus*), Black Sea mackerel (*Scomber scombrus*), bonito (*Sarda sarda*), bluefish (*Pomatomus saltator*), and anchovy (*Engraulis encrasicolus*).

- Poaching and sport hunting pressures on large mammals, birds (especially waterfowl and birds of prey), and other groups. Among the species affected are several regionally and globally threatened species, including the brown bear (*Ursus arctos*), chamois (*Rupicapra rupicapra balcanica*), capercaillie (*Tetrao urogallus*), rock partridge (*Alectoris graeca*), red-breasted goose (*Branta ruficollis*), white-headed duck (*Oxyura leucocephala*), pygmy cormorant (*Halietor pygmeus*), and pheasant (*Phasianus colchicus colchicus*).

- Control of predators, especially those (such as the wolf and cormorant) that subsist on game animals and commercially valuable fish species. In the past, strychnine, barbi-

Box 6. Addressing Pollution Problems (CONTINUED FROM PAGE 30)

sources were dispersed through the air, through irrigation with wastewater, and through direct dumping. Although pollution control laws were enacted, they went largely unenforced. At the same time, advanced pollution control technologies were unavailable due to political constraints. The pollution of soils with heavy metals -- primarily copper, zinc, lead, and cadmium -- remains an especially serious concern. Some 456,000 hectares that were to be returned to private ownership under Bulgaria's land restitution laws cannot legally be turned over until they have been cleaned up. Although these pollution problems have received greater attention in the last few years, scientific information on the extent of the environmental impacts remains limited. Groundwater pollution, for example, has rarely been monitored.

The political reforms now occurring have begun to address these long-neglected problems. Nongovernmental organizations (NGOs), in particular, have provided the stimulus and many detailed analyses and recommendations for improved national environmental policies. However, the lack of effective laws, financial resources, and incentives remain serious obstacles. New legislation to bolster the authority of regulatory bodies and to encourage the adoption of "greener" technologies is being formulated. International interest has also aided the effort. Shortly after the change in Bulgaria's government, the World Bank, the U.S. Environmental Protection Agency, and the U.S. Agency for International Development (USAID), in cooperation with the Bulgarian Ministry of Environment, undertook a comprehensive study of the country's environmental problems. This was a critical step in communicating to the world the pollution problems facing Bulgaria and in setting priorities for responding to them.

Such analyses have begun to provide guidance to private investors and assistance agencies interested in environmental cleanup and restoration projects. Although these projects are often expensive and still in the experimental phase, several have already been initiated. For example, Battelle Laboratories (with the assistance of the USAID) has helped to support a new NGO that will promote energy efficiency through policy reform, joint venture development, training, and education. Inefficient energy use, particularly in the industrial sector, has been a key contributor to Bulgaria's air pollution problems. The Bulgarian Energy Efficiency Foundation was established in August 1993, staffed with in-country experts able to provide advice and assistance for improving efficiency.

turates, and other substances have been used against wolves, affecting not only the wolf population, but populations of vultures and other scavengers that feed on the carcasses. Similarly, the control of rodents and other pest species through mass poisoning has had indirect effects on their natural predators. This has been a contributing factor behind recent declines in the population of several steppe species, including the marbled polecat (*Vormela peregusna peregusna*), steppe polecat (*Mustela eversmanni*), golden hamster (*Mesocricetus newtoni*), and several species of waterfowl and birds of prey.

Invasive and Introduced Species

As a European country long occupied by human beings and their domesticated plants and animals, Bulgaria is not as vulnerable as other biogeographic areas to the problems associated with invasions by exotic species. However, it is not invulnerable. For example, the raccoon dog (*Nyctereutes procyonoides*) and the muskrat (*Ondatra zibethica*) have spread successfully through Bulgaria following their artificial introduction into other parts of Eastern Europe. Bulgaria's aquatic ecosystems in particular are susceptible to disruptive invasions. In the last

few years, the ctenophore *Mnemia maccradyi* has significantly affected the stability and diversity of the Black Sea coastal plankton community.

The intentional introduction of nonnative species and subspecies has also had negative impacts on biological diversity. Nonnative timber trees have been widely used in forest plantations, appropriating and altering natural habitats and narrowing the genetic base of forest trees. Exotic stocks of fish and game animals have been introduced, sometimes to the detriment of native species and subspecies. The Mongolian pheasant (*Phasianus colchicus mongolicus)* has interbred with the local indigenous form (*Phasianus colchicus colchicus*). Similarly, browns bears (*Ursus arctos)* from the Russian-Carpathian population were introduced in 1983-1984 into the Bulgarian range of the Balkan brown bear, which is morphologically and behaviorally distinct from its northern relative.

Agricultural Intensification

As noted previously, Bulgaria's unique genetic resources -- local crop varieties, wild relatives of domesticated plants, and local and primitive domestic animal breeds -- have been diminishing as a result of changes in land use and the agricultural economy. Local crop varieties began to be lost with the advent of intensive agriculture and the development of new crop varieties. Land consolidation and the collectivization of agricultural production accelerated the process. Now, the greater availability and productivity of foreign forms may result in further pressure on local varieties. The same forces have also led to the loss or decline of local animal breeds. Of the 37 domestic animal breeds indigenous to Bulgaria, all face some degree of threat; 6 are already extinct, 12 are nearly extinct, 16 are threatened, and 3 are potentially threatened. Potentially important genetic resources of wild plant and animals, including rare species and Bulgarian endemics, are also decreasing. Habitat loss, illegal gathering, hybridization between wild and domestic species, and a lack of incentives and other measures to assure propagation and preservation are the main factors behind their decline.

Changing Land Tenure

Land restitution -- the return of state-controlled lands to private or municipal ownership -- is a complex process now unfolding in Bulgaria and other countries of Central and Eastern Europe (see Box 7). In Bulgaria, it is expected to affect about 4.6 million hectares, or 40 percent of the nation's land base. Most of these lands are situated in the lowlands and submontane foothills (as opposed to high mountain regions).

Restitution does not, in and of itself, constitute a threat to biological diversity. In fact, in areas of the country where extensive monocultural regimes have been in place, it may have significant positive impacts by encouraging new land use patterns favorable to biological diversity. In all cases it holds great potential for involving citizens more directly in conservation activities.

However, there is real concern that, as the restitution process accelerates, and as citizens and communities regain control over lands, they will not be fully informed or encouraged -- through education, local planning, or economic incentives -- to adopt conservative or restorative land use practices. Many who are coming into land ownership are still uncertain about their options. In a recent survey of people living in small towns and villages near protected areas, 25 percent had not decided what they will do with their lands. Restitution, therefore, entails a number of *potential* threats to biological diversity:

- Impaired ability to protect the public interest in private lands, especially lands in or near protected areas;

- Increased difficulty (and possibly expense) in adding to the system of protected areas;

Box 7. Land Restitution and Conservation

Land restitution presents both important opportunities and potential problems for conservation. The long-term effects depend on the degree to which conservation provisions are built into the restitution process. That process is complicated due to the diversity of historic land tenure patterns. Land in Bulgaria has traditionally been owned or managed by private individuals, cooperatives, municipalities, and the church, and holdings have usually been situated in close proximity to one another. Sorting out these patterns is a time-consuming task, often involving extensive research and conflicting claims. It also has broad implications for future conservation planning, especially planning at the landscape scale.

Bulgaria's Law on Restitution is clear on the fate of farmlands within the nation's protected areas: no lands will be returned that are now within protected areas of national and international importance (primarily the national parks and natural reserves). The government will compensate former or potential owners of these lands with other lands. In other types of protected areas -- natural landmarks, protected sites, and historic sites -- landowners will be required to use their lands in a manner defined by law.

Land restitution, however, will have its greatest impact on agricultural lands outside protected areas. These lands form the matrix within which protected areas exist, and themselves support (or can support with restoration) important populations, habitats, and communities. It is on these lands that conservation -- of soil and water resources, forests, wetlands, other wildlife habitats, plant genetic resources, and aesthetic values -- will be most in need of commitment on the part of individual and municipal landholders. More perhaps than any other one factor, the actions of these landholders over the next few years, acting singly and cooperatively, will determine the character of the Bulgarian landscape and the fate of its biological diversity.

The restitution of forestlands presents even greater complications. Naturally, in a recessionary period the economic expectations that accompany forest ownership are great. The Ministry of Environment, other government entities, and nongovernmental organizations are now assessing carefully all projects in an effort to guarantee the sustainable use, maintenance, and enrichment of the biological resources and diversity within private forest lands. At present, however, there are no legal or policy provisions that offer guidance or incentives for biodiversity conservation on restituted forestlands, nor is there a coherent program to inform landowners of conservation issues and techniques.

Providing a stronger legal basis for conservation on all restituted lands, not just those within existing protected areas, is absolutely necessary. However, such legal provisions will automatically solve neither the economic problems of the people in these areas nor the environmental problems of the affected lands. As a sobering case in point, the restitution of heavily polluted agricultural lands has been delayed until they are adequately restored (see Box 8). Furthermore, the ability of the government to stimulate the adoption of sustainable agriculture and forestry methods by local farmers and other landowners is limited under existing economic conditions. Successful conservation will require that landowners possess the desire, the ability, and the knowledge to manage their lands in a manner that combines their own interests and the public interest. Toward this end, an effective program of incentives and dissemination of information about sustainable agriculture methods and systems will be critical in supporting any new laws.

- Direct destruction of economic resources and rare or unique habitats on returned lands through logging, agricultural expansion, draining of wetlands, and other activities;
- Increased susceptibility to indiscriminate urbanization and tourism-related development;
- Exacerbation of the illegal gathering and export of medicinal plants, fungi, and other commercially valuable species subject to exploitation in the wild;
- Increased need to compensate for wildlife damage;

Box 8. Sustainable Agriculture in Bulgaria

As the dominant land use in Bulgaria, agriculture has a critical influence on the fate of biological diversity within the country. Agriculture, like all areas of Bulgarian life, is in a state of profound transition as a result of the political and economic changes that have occurred in the last several years. As these changes continue, conservationists, agricultural experts, officials, farmers, and other landowners will need to work together in moving toward a system of agriculture that is socially, economically, and environmentally sustainable.

Of Bulgaria's land base, 62 percent -- about 6.85 million hectares -- is devoted to agricultural production. The 4.6 million hectares of cultivated land are divided among grains, vegetables, and other crops (3.85 million hectares); grasslands (.49 million hectares); vineyards and orchards (.3 million hectares). Pastures account for 1.5 million hectares, and other agricultural uses account for the remainder. Although most food is produced for domestic use, Bulgaria does export grains, fresh fruits, and vegetables. Agriculture accounted for 25 percent of the nation's income in 1989. Agricultural output and income have since declined due to unstable political and economic conditions.

Agriculture in Bulgaria dates back, of course, several millennia. Plant geneticists believe that Bulgaria may in fact have provided important genetic source material for many important crops, including many cereal grains and fruit trees. Traditional agriculture in Bulgaria was based on small private landholdings. In 1946, prior to the forced collectivization of farmlands, these small parcels numbered about 12.2 million, averaging about .3 to .5 hectares in size. The 1946 Law on Land Property initiated the process of land collectivization and effectively abolished private ownership of land. By 1958, virtually all farmland had been incorporated into large collective farms or lost to industrial expansion, mining operations, and other forms of development.

As collectivization changed the nature of farming, many of the localized pest and nutrient management practices, crop and livestock genetic strains, and seed sources were abandoned. Larger-scale agriculture required increased dependence on purchased inputs of machinery, artificial fertilizers, pesticides, and seeds. The heavy emphasis on productivity resulted in increased outputs, but incurred widespread social and environmental costs. Of the latter, soil erosion is perhaps the most severe. As a result of deforestation, overgrazing, and other factors, 68 percent of Bulgaria's arable land is either seriously eroded or at risk of erosion. Other environmental problems associated with agricultural land use include chemical pollution of soil, pollution of surface waters from livestock operations, toxic contamination of soils with heavy metals, and the loss of genetic diversity. Little research, however, has been undertaken to ascertain the full extent of these effects. Groundwater pollution, for example, has rarely been monitored in Bulgaria.

Since passage of the Law on Ownership and Use of Farmland in October 1991, additional laws have been enacted to move the process of land restitution forward, and others are now being drafted. While several of these new laws contain provisions related to environmental protection, they place no explicit emphasis on protecting sensitive habitats and species. Furthermore, they address only peripherally the need to encourage adoption of environmentally sound agricultural practices.

As the restitution process continues, lawmakers need to be more aware of the important connections between sustainable agriculture and biodiversity conservation. Agricultural land use will have far-reaching consequences for soil and water quality, habitat protection and restoration, the management of protected areas and buffer zones, protection of plant and animal genetic resources, landscape- and watershed-level planning, and other critical aspects of biodiversity conservation. But conservation is only one of many important reasons for moving toward sustainable agriculture in Bulgaria. Perhaps most important, work at this interface can serve to bring together agricultural, environmental, and natural scientists, as well as farmers, landowners, educators, food wholesalers and retailers, consumers, and representatives from nongovernmental organizations.

- Increased difficulty in conducting research on private lands;
- Increased use of agricultural chemicals and other pollutants;
- Decreased incentives for long-term investments in forestry, sustainable agriculture, and other conservative land use practices; and
- Lack of adequate legislation or education to support zoning and the adoption of appropriate land management practices.

Global Change

Accelerated rates of global change could significantly affect Bulgaria's biological diversity. Bulgaria, like all countries, faces overarching threats related to the depletion of the Earth's ozone layer and the accumulation of greenhouse gases in the atmosphere. As a mid-latitude country, Bulgaria will likely be less affected by the most immediate effects of ozone depletion. If current predictions of global warming hold true, the effects on Bulgaria's transitional climatic conditions could be far-reaching. Because Bulgaria is situated at the point where three major bioclimatic regions meet, even slight shifts in climatic conditions could have substantial effects on temperature, precipitation distribution and timing, and weather patterns, and thus on biological diversity. If a general warming trend emerges, the survival of the many rare and endemic populations and species in Bulgaria's alpine habitats (especially those populations that have become isolated as a result of habitat fragmentation) could be threatened. If global warming should result in a rise in sea levels, the effects along the Black Sea coast would also be substantial.

It will be several years before current global warming scenarios can be evaluated with greater certainty, and the potential effects on biological diversity better understood. In the meantime, some sense of the possible impacts can be gained by assessing the effects of the drought conditions that have prevailed in Bulgaria and other parts of Central and Eastern Europe over the last 10 years. During this period, average temperatures in Bulgaria have risen, while rainfall levels have fallen 43 percent below that which is considered normal. The most direct impacts have been felt on wetlands, streams (especially those that provide water for irrigation), and reservoirs (many of which are at or near record low levels). These regional impacts should be fully considered in discussions of the effects of global change on biological diversity in the Balkan Peninsula.

Lack of Knowledge and Effective Policy

The lack of knowledge and effective public policy is a less direct but no less critical threat to biological diversity. This complex category of threats includes several general areas of special concern:

- Insufficient scientific information on the status of and threats to biological diversity (see "Gaps in Scientific Knowledge" in the previous chapter).
- Inadequate management and administration of protected areas.
- Uncoordinated and poorly enforced conservation laws and environmental regulations.
- Ineffective or nonexistent penalties and sanctions.
- Insufficient registration and monitoring of harvested biological resources.
- Lack of public understanding of biological diversity and the threats to it, and a lack of information available to the public to achieve a higher level of awareness.