Box 3. Nontimber Forest Products

Bulgaria's forests have traditionally been managed to provide mainly timber and watershed protection. As efforts to protect and restore biological diversity on forestlands proceed, much greater attention will need to be devoted to nontimber forest resources and products. These resources include most of the species of medicinal plants; many of the edible fungi, fruit trees, and berry-producing shrubs; and plants used for teas, oils, dyes, and other products. Forest fungi and plants are widely (and increasingly) exploited for both domestic use and export. Many of these species are suitable for cultivation and can, if developed properly, benefit local economies while relieving some of the pressure on wild populations. Forests also provide habitat for game animals, nongame fish, birds, and mammals, as well as other less conspicuous components of the ecosystem. Bulgaria's mature montane forests, which are among the oldest and most extensive in Europe, are the stronghold for many forest species (including large predators) that have disappeared from other parts of the continent. These forests also provide significant recreation and tourism opportunities for hikers, bird watchers, and other outdoor enthusiasts. Finally, the forests serve as important areas for environmental education and research.

While many of these nontimber forest values have been recognized and promoted in the past, they will require even greater emphasis in the future. These resources, if carefully managed, can provide direct economic benefits at the local level for forest conservation activities. However, great care must be taken to assure that use does not lead to overexploitation, which is a threat especially for edible fungi and medicinal plants. For these species, the potential for cultivation needs to be explored and promoted as efforts to protect native genetic resources and the habitats in which they occur proceed.

- Black Sea coastal communities and habitats, including the Black Sea lakes; sand dunes, wetlands, and coastal limestone communities; and staging areas and other lands along the western Black Sea migratory bird route (also known as the Via Pontica), which passes through Bulgaria and is one of the two most important European bird migration routes.

- The pelagic, littoral, sublittoral, and benthic communities of the Black Sea itself.

Important Biological Resources

Bulgaria's biological diversity includes species and genetic resources that are widely used for both commercial and noncommercial purposes, and others that have the potential to provide important economic benefits. Biological diversity provides additional economic benefits by performing various environmental services, although the value of these services is not fully recognized or reflected in the market. These biological resources can be grouped into several categories.

Economically Valuable Species

Many of Bulgaria's native species provide products for local consumption, domestic trade, and export. In the past, these resources have been developed and exploited to varying degrees. Some, such as timber trees, game animals, and food fish, have long been important economically, and have been intensively exploited and managed. Others, such as edible fungi and medicinal plants, have traditionally been collected from the wild but have recently become subject to heavier exploitation, especially for commercial export.

The economically valuable biological resources of Bulgaria include the following

- More than 200 species of edible fungi;

- About 750 traditional medicinal plants (some 250 of which are considered economically important);

- Timber trees, especially oaks (*Quercus* spp.), beech (*Fagus orientalis* and *Fagus sylvatica*), Scotch pine (*Pinus sylvestris*), Austrian pine (*P. nigra*), Norway spruce (*Picea abies*), and fir (primarily *Abies alba*);

- A wide variety of nontimber forest species (see Box 3);

- Wild and domesticated native plants that provide fruits, berries, oils, and chemical compounds; are used as ornamentals; and are used in farm and forestry operations as livestock forage and fodder, cover crops, green manures, and tree stock for reforestation and erosion control;

- Two species of snails (*Helix pomade* and *H. lucorum*), the exotic Rapana sea snail (*Rapana tomasiana*), and the marsh frog (*Rana ridibunda*), all of which are edible;

- Large and small game animals, including 16 mammalian species (several of which are introduced or invasive) and 24 bird species (both waterfowl and upland species); and

- More than 20 Black Sea and freshwater fish species important for both commercial and recreational fishing.

Local Plant Varieties and Animal Breeds

Bulgaria's plant and animal genetic resources are of immense economic, cultural, and biological importance. Over the centuries, the environmental conditions and selection pressures in the Bulgarian system of agriculture allowed an enormous diversity of both native and introduced crops to develop. Bulgaria is a primary center of diversity for many field, vegetable, and orchard crops, especially cereals, legumes, fruit trees, and forage species. As a result of its geographical, climatic, and edaphic variability, and the hybridizing of local varieties with foreign strains, it is also a secondary center of diversity for many of the cultivated plants introduced from other centers of origin. The domesticated plant resources include distinctive local varieties of durum and other bread wheats; other grains, including rye, oats, barley, sorghum, and maize; garden and field legumes, seed legumes, and annual and perennial forage legumes; and a wide range of vegetables (including tomatoes, peppers, onions, cabbage, cucumbers, pumpkins, watermelons, and other melons). Tobacco, spices, seed and stone fruit trees, grapevines, and nut-bearing species are also represented by local varieties.

Bulgaria possesses a similarly diverse stable of indigenous domesticated animals. A survey of these indigenous forms prepared for the NBDCS workshop noted a total of 37 domestic mammals with distinctive Bulgarian breeds: 3 cattle, 1 ox, 20 sheep, 1 goat, 3 pigs, 6 horses, and 3 dogs.

In Bulgaria, as in other parts of the world, the diversity of local varieties and breeds has eroded in recent decades as a result of socioeconomic pressures (especially farm collectivization), other structural changes in agriculture, and the accelerated adoption of new crop varieties suited to large-scale processing. Now, as the economic, cultural, and environmental value of these neglected forms has become more evident, attention has again turned to opportunities for incorporating them into more sustainable land use systems.

Wild and Primitive Relatives of Cultivated Plants and Domestic Animal Breeds

The Bulgarian flora also contains wild and semiwild relatives of many cultivated plants. Many are endemic to Bulgaria. Virtually all the cultivated cereal grains and leguminous forage species have wild relatives in the Bulgarian flora. Among shrubs and fruit and nut trees -- raspberries, strawberries, apricots, pears, apples, plums, cherries, morellos, and walnuts -- the diversity of wild and semiwild relatives is great. Over the centuries, crossbreeding has produced a wide variety of local adaptations, including differences in the size, taste, and structure of the fruits; in maturity rates and disease resistance; and in

growth forms and other characteristics. As is the case with local varieties of cultivated plants, many of these primitive relatives have been neglected in recent decades as fruit production in Bulgaria was collectivized and organized into large orchards growing only a few varieties of a given species.

Many of the rare domestic animal breeds, such as the Rhodope Shorthorn Cattle, Bulgarian Mediterranean Buffalo, and Karakachan Sheep, are closely related to their wild forebears and retain ancestral features. These breeds, too, diminished under collectivized agriculture. Many survive only as small populations within state-owned livestock breeding facilities.

Ecological Services

In addition to species and genetic resources whose market value can be gauged through traditional economic methodologies, Bulgaria's biota also includes organisms that provide important ecological services, the benefits of which are not reflected in the market and, consequently, are more difficult to measure. Microbes, fungi, plants, invertebrates, and other animals all serve important functions in a wide range of processes that profoundly affect human economic activities, including decomposition and nutrient cycling, pest and pathogen control, pollination, soil enrichment, soil and water conservation, flood control, and the removal and recycling of industrial and organic wastes. Although artificial products and processes have been developed to serve some of these ecological functions, they are often prohibitively expensive. Biological diversity also plays a critical role in the regulation of climatic, hydrological, and biogeochemical cycles -- regional- and global-scale phenomena that both influence and are increasingly influenced by human economic activities.

Gaps in Scientific Knowledge

The solid foundation of scientific information on Bulgaria's biological diversity, as previously illustrated, is one of the nation's most significant strengths as it implements new conservation measures. Nevertheless, this scientific foundation has several weaknesses and gaps. These deficiencies range from those that are common to many areas of research on biological diversity and its conservation to those that are specific to certain regions, taxa, habitats, and threats. Many specific knowledge gaps are described in the papers presented and discussed at the NBDCS workshop. Three gaps were most widely identified:

- *Insufficient information on species richness, distribution, current populations, and population trends for many taxonomic groups.* This was most significant for the fungi, algae and other nonvascular plants, invertebrates, and aquatic organisms.

- *Insufficient information on species composition for various taxa and other aspects of biological diversity in specific geographic areas.* Map 5 provides a synthesized view of the areas identified by workshop participants and their collaborators as in need of further study. The map incorporates data regarding fungi, algae, all invertebrates, fish, amphibians, reptiles, and mammals. The map also incorporates data regarding plant communities. Although different taxonomic groups have been studied to varying degrees in different parts of the country, several regions stand out as needing further study. These include the Rhodope Mountains (especially the eastern portions), the Pirin Mountains, the southwestern border mountains, hill lands between the Danubian plain and the Stara Planina Mountains; and the Black Sea coast. Other areas recognized as in need of further study include Sredna Gora and the central Stara Planina; portions of the Arda, Kamchia, Maritsa, Mesta, Strouma, and Tundzha rivers; the Sakhar hilly region; Dobrudzha; and the Kraishte-Konyovo region.

- *Insufficient information on the impact of various anthropogenic threats to biological*

Map 5. Areas Needing Further Study

Categories of importance for areas needing further study reflect compoiste rankings based on assessments provided by NBDSC participants.

diversity, methods for mitigating these impacts, and restoration procedures. There has been, for example, little research of the biological impacts of the construction of railroads, factories, highways, resorts, and dams, or of mines, quarries, and other forms of industrial and urban development. This is especially a concern in biologically fragile areas where development has proceeded without expert environmental assessment.

Other gaps in knowledge that have been widely identified include the following:

- Lack of knowledge concerning the functioning of Bulgaria's aquatic and terrestrial ecosystems and methods of managing their resources on a sustainable basis (especially for edible fungi, other nontimber forest products, and inland and Black Sea fish populations);
- Lack of basic up-to-date information on the presence of rare and endangered species;
- Lack of long-term biological monitoring and ecological studies, especially of species listed within the Bulgarian *Red Data Books*;
- Outdated red data book information, and lack of coverage for fungi, invertebrates, and nonvascular plants in the existing *Red Data Books*;
- Incomplete or outdated inventories of the biological diversity in the protected areas network, and the lack of a comprehensive data base to manage information about the biological diversity within the network;
- Lack of long-term studies of environmental change, especially within the protected areas;
- Lack of coordination and clear criteria in planning research projects on biological diversity and its conservation;
- Inadequate exposure to emerging concepts in conservation biology and applied ecology (e.g., landscape ecology and restoration ecology); and
- Inadequate procedures for organizing and publishing scientific information and for communicating and incorporating biological principles in the policy process.

Box 4. Bulgaria's Protected Areas Network

The core of Bulgaria's efforts to conserve biological diversity, both in the past and in the future, is its network of protected areas. The network's origins can be traced to 1933, when the first nature reserves, at Silcosia and Parangalitsa, were declared. In the following year, protected areas at Baiovi dupki and Vitosha National Park were established at a time when only a few countries in Europe had created national parks. New protected areas were established intermittently over the next four decades. By 1977, about 100,000 hectares were included within protected areas. In 1978, the Committee on Environmental Protection (now the Ministry of Environment) assumed primary oversight responsibility for the protected areas, and the network as a whole entered a period of rapid expansion. As of 1993, the total area had increased to more than 380,000 hectares, or about 3.5 percent of Bulgaria's total land base. (The distribution of existing protected areas of 100 or more hectares is shown in Map 6 in Chapter 4).

The 1967 Law on Nature Protection, under which the current system of protected areas was established and is now administered, defined five categories of protected areas and described their use and status.

Nature Reserves are strictly protected areas containing representative natural ecosystems and habitats of rare species. They correspond to protected areas in Category I (Strict Nature Reserve/Wilderness Area -- a protected area managed mainly for science or wilderness protection) as designated by the World Conservation Union (IUCN). At present, 89 reserves, comprising 77,000 hectares (20 percent of the total area in the network), have been established. Most are situated in Bulgaria's forest ecosystems, and some are included within the national parks.

National Parks (or *People's Parks*) are large protected areas established to conserve lands where natural conditions and ecosystems predominate. The 11 existing parks contain about 293,000 hectares (including 30,000 hectares designated as nature reserves), or 76 percent of the total land area within the network. The characteristics of the parks vary. Some correspond to those included in IUCN Category II (National Park -- a protected area managed mainly for ecosystem protection and recreation). Others are more similar to those in IUCN Category IV (Habitat and Species Management Area -- an area protected mainly for conservation through management intervention) and Category V (Protected Landscape/Seascape -- a protected area managed mainly for landscape and seascape protection and recreation). National parks in the latter categories contain both agricultural lands and nature reserves, as well as hotels, ski resorts, and other recreational developments.

Natural Landmarks (or *Nature Sanctuaries*) and *Protected Sites* are smaller areas of 1 to 500 hectares that provide protection for special landscape features, such as waterfalls and caves, and for communities of rare and endangered species. They correspond largely to those in IUCN Category III (Natural Monument/Natural Landmark -- a protected area managed mainly for conserving a specific natural feature). More than 500 such sites have been established.

Bulgaria's 972 *Historic Sites* serve to protect lands surrounding historical and archeological monuments. Their value in terms of biodiversity conservation is limited, although many sites do contain important natural features.

Many of the protected areas in Bulgaria are of international importance. Two sites (Pirin National Park and the Srebarna Reserve) are recognized as World Natural Heritage Sites under the 1972 Convention for the Protection of the World Cultural and Natural Heritage. Seventeen areas are listed as biosphere reserves under the Man and the Biosphere Program of the United Nations Educational, Scientific, and Cultural Organization. Four sites are designated as important wetland areas under the Convention on Wetlands of International Importance (known as the RAMSAR Convention). In addition, 22 sites (some of which are not currently protected) have been designated by BirdLife International as Important Bird Areas in Europe. (See Appendix A for listings of these areas.)

Box 5. GIS and the National Biological Diversity Conservation Strategy

The maps used in this document have been produced using geographic information system (GIS) technology, which offers important tools for conserving biological diversity. This technology has already played a vital role in preparing this national strategy by allowing scientists from a wide variety of fields, as well as NGO representatives and agency officials, to work together and to see the results of their collaboration in graphic form. While GIS cannot and should not replace established cartographic and planning techniques designed to perform specific tasks, it can serve to coordinate data from many sources and to facilitate applications of this data to conservation problems.

The flexibility of GIS technology is evident in the many roles it can play in implementing various aspects of this national strategy:

- GIS can be used to establish baseline ecological condition maps against which changes in habitats can be measured spatially.
- It can model the influence and spread of both point and non-point source pollution, as well as other human impacts, and show the potential effect of these impacts on areas of high biological value.
- It can be used to gain an overview of the changing status of land tenure and patterns of land ownership and management.
- This technology can be used to monitor and manage the resources within national parks and other protected areas.
- It can be used by local and regional planning officials to resolve and rectify conflicting demands on private lands and other unprotected areas.
- It provides an important means of synthesizing biological and ecological data in restoration projects, and in monitoring the success of restoration and reintroduction programs.
- GIS, because of its integrative nature, allows for collaborative interdisciplinary research on environmental issues, including their social causes and impacts.
- It simplifies the publication of maps and related materials. This capability has many relevant applications to conservation. To cite only a few examples, GIS maps can be used to update and create red data books, to support environmental education projects, and to generate attractive ecotourism-related materials.

Conservation scientists and planners in Bulgaria have only recently begun to use GIS technology. As GIS is adapted to meet the country's conservation needs, it will be called on to perform many services. In the short term, emphasis should be placed on expanding training opportunities, coordinating GIS with existing geographic and cartographic information technologies, and providing computer hardware and software where it will be most useful. As specific elements of the National Biological Diversity Conservation Strategy are implemented, opportunities to incorporate the products of GIS, and to familiarize both professionals and the general public with its capabilities, should be sought.

Table 1. Number of Described, Endemic, Rare and Extinct Species (and Other Taxa) for Selected Groups in Bulgaria.

Kingdom and Subdivision	Described Species	Endemic Species	Rare Species	Known Extinctions
Protozoa	1,800 (est.)	na	422	na
Fungi	3,500 (est.)	na	na	na
Macromycetes[1]	2,100 (est.)	na	65 [2]	na
Plants				
Nonvascular plants				
Algae	2,998	na [3]	22 [4]	2 [5]
Mosses	668	0	19	na
Others[6]	187	0	38 [7]	4
Lichens	709	14 (est.)	25 (est.)	na
Vascular plants	3,550 - 3,750 [8]	na	728 [9]	31 [10]
Pteridophytes	58	0	15	0
Gymnosperms	16	0	2	0
Angiosperms	3,460	170 [11]	711	31
Animals[12]				
Invertebrates				
Noninsects[13]	2,577	387 [14]	567	na
Nematodes	517	24 (est.)	157	na
Oligochaetes	54	10 [15]	8	na
Mollusks	432	116 [16]	60 [17]	na
Crustaceans	1,200 (est.)	47 [18]	4 [19]	na
Arachnids	1,266	79	322	na
Myriapods	215	104	16	na
Insects[20]	19,500 [21] (est.)	744 [22]	1,558	7 [23]
Vertebrates	700 [24] (est.)			
Fish (total/Black Sea)	207/126 [25]	12 [26] /na	29/12	3 [27] /0
Amphibians	16	1 [28]	0	0
Reptiles	36	4 [29]	2	[30] 2
Birds	383 [31]	0	78 [32]	9 [33]
Mammals	94 [34]			
Bats	29	0 [35]	0 [36]	0
Small mammals[37]	42	2 [38]	0 [39]	0
Large mammals[40]	23	4 [41]	10 [42]	2

NOTE: The information in this table is derived from the papers prepared for the National Biological Diversity Conservation Strategy workshop. Participants in the workshop were asked to provide information (including but not limited to information from the two volumes of the *Red Data Book of the People's Republic of Bulgaria*) within their area of taxonomic expertise. Key; est., estimated, na, not available.

Notes for Table 1.

1. Includes species, subspecies, varieties, and forms from the classes Mymomycetes, Ascomycetes, and Basidiomycetes.
2. Proposed based on research undertaken for the NBDCS workshop.
3. There are four Black Sea macrophytes that are considered endemics.
4. These are all Black Sea species that are classified as rare or endangered.
5. Both are Black Sea species. Other extinctions are likely, but unconfirmed.
6. Hydatophytes, neustophytes, helophytes, and hydatoneustophytes.
7. Listed as endangered, rare, or extinct in the 1984 *Red Data Book of the People's Republic of Bulgaria. Vol. 1. Plants.*
8. The Bulgarian flora also contains approximately 847 subspecies and 2,000 varieties.
9. Threatened and rare species listed in appendixes of Peev et al., "Biodiversity of Higher Plants of Bulgaria," presented at the NBDCS workshop.
10. Extinctions occurring in the "last 50 years" according to the 1984 *Red Data Book of the People's Republic of Bulgaria. Vol. 1. Plants.*
11. Bulgarian endemics. An additional 100 subspecies are considered Bulgarian endemics. The Bulgarian higher flora contains 200 Balkan endemic species and subspecies.
12. The 1985 *Red Data Book of the People's Republic of Bulgaria. Vol. 2. Animals* assumes a total of "about 35,000 animal species within the country's limits, of which nearly 18,000 have been described."
13. Does not include protozoa.
14. Includes 68 species that are considered Balkan endemics.
15. Species and subspecies.
16. Includes taxa other than species.
17. Includes taxa other than species.
18. Refers only to isopods.
19. Refers only to isopods.
20. Includes the following orders: Odonata, Ephemeroptera, Plecoptera, Homoptera (Auchenorrhyncha), Heteroptera, Coleoptera, Blattodea, Mantodea, Isoptera, Orthoptera, Dermaptera, Embioptera, Raphidioptera, Neuroptera, Mecoptera, Hymenoptera, Trichoptera, Lepidoptera, and Diptera.
21. The total number of insect species in Bulgaria is estimated at 29,500.
22. Species and subspecies, including 166 that are also considered Balkan endemics.
23. All from the order Ephemeroptera.
24. Includes both indigenous and introduced species.
25. Both numbers include species and subspecies.
26. Freshwater fish endemic to the Balkan Peninsula.
27. Known extinctions among all taxa in Bulgarian fish fauna.
28. Subspecies.
29. Subspecies.
30. Nearly all herpetofauna that are classified as rare in Bulgaria are common or numerous through their entire ranges. The two snake species noted here -- *Coluber rubriceps* and *Vipera aspis balcanica* -- are extremely rare within Bulgaria.
31. Includes resident, migratory, and wintering birds.
32. Includes 16 globally threatened species as well as 61 that were listed as rare or threatened in the 1985 *Red Data Book of the People's Republic of Bulgaria. Vol. 2. Animals.*
33. Includes six species extirpated from the Bulgarian avifauna but which occur in Bulgaria during migrations.
34. Includes introduced species. The 1985 *Red Data Book of the People's Republic of Bulgaria. Vol. 2. Animals* noted 88 mammal species.
35. There are seven bat species that occur rarely in Bulgaria, but which are common or abundant in other areas.
36. Three bat subspecies that were first described as Bulgarian endemics in 1936 are no longer recognized.
37. Includes Insectivora, Lagomorpha, and Rodentia.

38. The ranges of these two species -- the hamster *Mesocricetus newtoni* and the dormouse *Myomimus roachi* -- are restricted; they occur mainly within Bulgarian territory.
39. Although no small mammal species are noted here as rare, a number of species can be considered rare depending on the definition of rarity. These include species with populations that are small and discontinuously distributed, limited in their distribution, or represented by small scattered populations at a limited number of locations.
40. Includes Carnivora, Pinnipedia, Cetacea, and Artiodactyla.
41. Refers to the two endemic subspecies of dolphin and the endemic subspecies of chamois and European marbled polecat.
42. Includes species, subspecies, and populations considered rare, vulnerable, or endangered within Bulgaria.