Hungarian Biodiversity Monitoring System

1998-2001

Ministry of Environment
Authority for Nature Conservation

THE HUNGARIAN BIODIVERSITY MONITORING SYSTEM

The Hungarian Biodiversity Monitoring System (HBMS) is a national programme for observing biological diversity in Hungary, supervised by the Authority for Nature Conservation of the Ministry of Environment. Since 1994, when the Convention on Biological Diversity was ratified in Hungary, and published in Act no. LXXXI of 1995, it is a legal obligation to monitor biological diversity for nature conservation purposes. After elaborating the methodology of the monitoring system, data collection has started and the programme has been running for four years. In the following pages an outline on the objectives and the structure of the programme, and its adaptation to European requirements is presented for a general readership, and particularly for experts in the field of nature conservation.

INTRODUCTION

The diversity of living organisms is a fundamental biological feature that in the long term sustains life. Biological diversity enables through natural selection the adaptation to the continuously changing environment, i.e. evolution itself that results in the relative stability of living systems.

Biological diversity varies in time and space. In evolutionary geological perspective, species have always evolved and become extinct, just as today. The number of species, based on the 1.7 million known today, is estimated anywhere between 10 and 100 million.

As a result of human activities (agriculture, forestry, fisheries, urbanisation, industry, transport, tourism, energy production and mining), and due to the explosion of human populations, wild life (the biosphere) has become endangered.

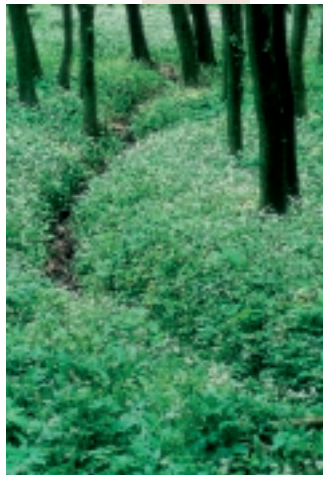
The rapid extinction of species has drawn attention to the vulnerability of the biosphere. The rate of extinction of species has been multiplied compared to the natural levels. The exploitation of natural resources has led to fragmentation and loss of habitats, expansion of invasive species, overexploitation of animal and plant species, pollution of water, soil and air, and furthermore, to global climate change. These all contribute to the loss of biological diversity. At the same time nature provides those renewable resources and services that are used daily by humans (e.g. soil formation, medicine, etc.). Finally, the loss of nature also threatens our own life support system.

An international convention was signed in 1992, named the Convention of Biological Diversity (CBD) in Rio de Janeiro, Brazil. Hungary was among the first countries to sign the CBD and ratified it in 1994. One of the basic commitments of the Parties is that a national strategy and supporting legislation have to be formed that enable the conservation of biological diversity and the sustainable use of its certain components. To fulfil these requirements, it is vital to know and monitor the state and changes of the biota, and that this knowledge should be based on continuous, repeated observations.

Beyond the diversity of species, biological diversity also includes the infraspecific variability of species and the diversity of associations of living organisms. Biodiversity monitoring implies the long-term observation of certain characteristics of selected species and communities. Observation of the natural state provides the basis for recognition and evaluation of responses different from the natural ones. The aim of monitoring can also be to study the effects of certain known or predictable environmental changes on ecosystem, lowering of water-table level, climate change, etc.

Taking into account the extremely large number of species and many habitats, it is simply not feasible to monitor everything everywhere, and this would make no sense either. The following principles were taken into consideration when designing the Hungarian monitoring activities:

- monitoring of the state of protected and threatened natural values,
- observation of indicators of the general state of the ecosystems in the country,
- study of direct or indirect effects of certain human intervention or environmental factor.



DEVELOPMENT OF THE HUNGARIAN BIODIVERSITY MONITORING SYSTEM

In compliance with the National Nature Conservation Concept (1994), and in line with the National Biodiversity Strategy under development, a monitoring programme was launched by the Authority for Nature Conservation in 1996 with the support of the PHARE programme of the European Union, involving several research institutes. As a result, a proposal for the Hungarian National Biodiversity Monitoring Program was developed that outlines the theoretical background and the methodology of monitoring of selected species and communities. The results were published in a series of 10 volumes in 1997, and an additional volume was produced in 2001. The manuals have been made available in pdf format on the Internet.

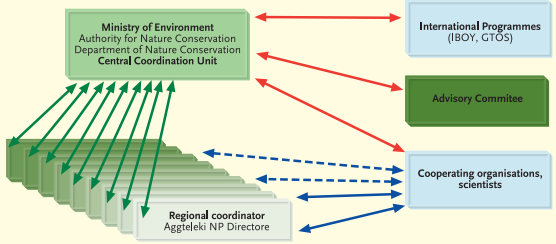
The system originally proposed in 1997 has been running with an increasing number of component projects, and it is named the Hungarian Biodiversity Monitoring System (HBMS).

THE STRUCTURE OF THE HBMS

The programme also proposed to establish a Biodiversity Monitoring Service that provides guidance and administrative management, and carries out sampling within the state nature conservation organisations.

The first year in the operation of the system was 1997, when a Central Coordination Unit was formed, mainly to fulfil the project management duties by employing two experts. Since 1998 one full-time post in each of the nine national park directorates has been devoted to implementing local tasks, to coordinate and supervise the monitoring activities within the area of jurisdiction of the given directorate.

Development and coordination of the national programmes are provided by the Central Coordination Unit, while local task are coordinated regionally by each national park directorate. Guidance is also provided by an independent Advisory Committee comprised of acknowledged experts of different taxa/disciplines (see Figure). The service also welcomes the contribution of institutes, universities or non-governmental organisation that can assist the Central Coordination Unit or the regional teams. Those tasks that do not require expert input, may be carried out by volunteers from nature conservation societies or schools. The service also plays an important role in raising the awareness of the general public. Conservation of the Hungarian natural heritage that is still outstanding at the European level, needs a concerted response from society. Without the support of the local communities and the public administration, the conservation goals cannot be achieved.



THE HBMS AND THE EUROPEAN UNION

Monitoring and long-term observation of biodiversity is not only a requirement of the Convention on Biological Diversity, but it is also a priority task in Europe. Upon accession of Hungary to the European Union, the nature conservation acquis communautaire of the EU, including the so-called Wild Birds and the Habitats Directives, will also be implemented in our country. These directives list birds and other animal and plant species, as well as natural habitats of community interests that are in need of conservation measures at the community level. When selecting species and communities for inclusion in the HBMS, these natural values, as well as those of national importance, have been taken into consideration.

Though there is no methodology prescribed by the above EU directives for measurements and sampling, efforts at the European level concentrate on reporting requirements and better a coordination of indicators to be employed. Hungary also contributes to this preparatory work. Consultations with experts working on devising monitoring systems have substantiated the sampling concept of the HBMS so far and it is expected that the information provided by the system will meet the requirements of the community legislation. As a new EU legal instrument, the Water Framework Directive requires the measurement of biological components in the case of water quality monitoring. The sampling of wetland communities under the HBMS is carried out in harmony with the guidelines of this directive, though they differ from each other in the objectives of the exercise.

HBMS PROJECTS AND PROTOCOLS

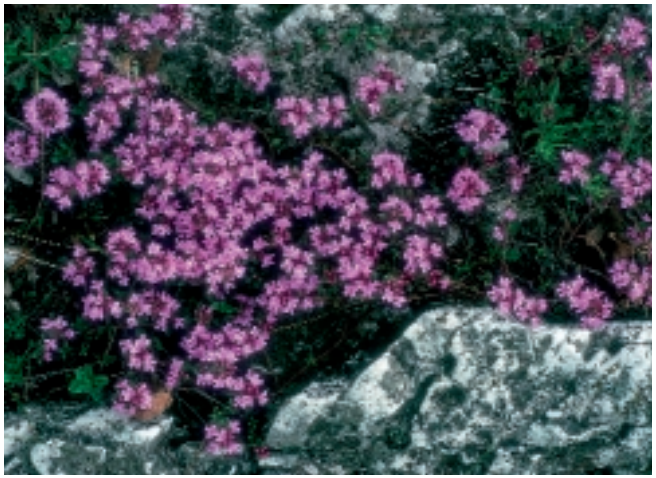
The monitoring programme was originally published in a series of 10 volumes in 1997. Based on the expert advice of many ecologists, these provide the theoretical background, the selection process and the sampling methods. As a novelty even for professionals, the programme has described all habitat types of Hungary and now this classification system (the Hungarian National Habitat Classification System) provides the basic units for habitat mapping.

Monitoring activities have been clustered into 10 groups (projects). The projects have been formulated by the definition of the objectives and the exact description of the tasks as follows:

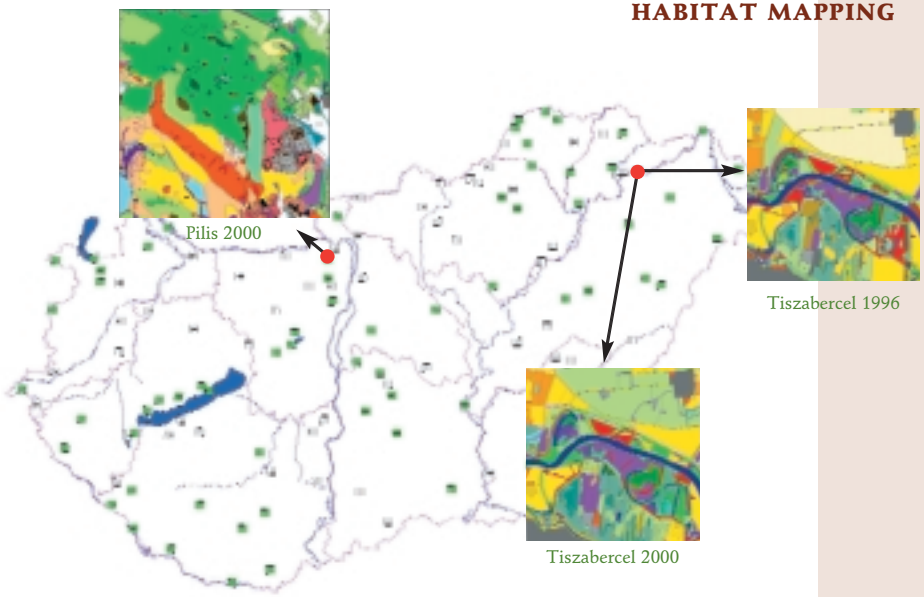
I. Monitoring of protected and threatened plant and animal species
II. Monitoring of aquatic and wetland habitats and their communities
III. Monitoring of habitat types in Hungary
IV. Monitoring of populations of invasive plant and animal species
V. Monitoring of selected sites of the Hungarian Forest Reserve Network
VI. Regional monitoring of the biota of the Kis-Balaton wetlands
VII. Regional monitoring of the Szigetköz wetlands
VIII. Monitoring of salt-affected habitat types
IX. Monitoring of dry grasslands
X. Monitoring of mountain hay meadows

To achieve the objectives defined in the projects, appropriate components (such as habitats, communities, populations of species) have been selected. For the sake of standardisation of monitoring activities, detailed guidance (so-called protocols) has been prepared for each component with the help of specialist teams. The protocols contain detailed guidelines for the selection of sample plots, the studied parameters, sampling methods, frequency of sampling and define derived parameters that are able to show correlations and trends.

Components monitored by the HBMS are habitats, plant associations, protected and invasive plant species, mosses, lichens, mushrooms, mammals (otter, beaver, small rodents, the root vole and bats), birds, amphibians, reptiles, fishes, snails, aquatic invertebrates, dragonflies, butterflies, larger moths, ground- dwelling arthropods, orthopterans, crustaceans, bee species).



HABITAT MAPPING



The HBMS monitors ecosystem diversity and its changes at the landscape level by mapping the habitats. The General National Habitat Classification System (G-NHCS) enables definition, classification and mapping of any habitat type in Hungary. Maps are produced at a scale of 1:25 000.

Repeated mapping makes it feasible to define and describe the changes of types and boundaries of habitats. Changes at the landscape level can indicate even directly the effect of human influences, e.g. changes in landscape use. These patterns help us to understand finer changes detected at the association or population levels in many cases. Therefore habitat mapping provides the background, or a framework for biodiversity monitoring since the HBMS concentrates data collections at the other levels of biological organisation in the quadrats selected for habitat mapping.

During the initial phases of the programme, altogether 124 5x5 km quadrats were designated taking into account nature conservation aspects, regional problems and considerations of general landscape representativity. Not only the general habitat classification system, but also the habitat mapping methods are basically novelties to the country, consequently an additional manual was published after having gained experience during the first years of the HBMS, and after having refined the methods. There is a great deal of interest in the maps at the international level, but evaluation of changes by GIS methods needs further development. Habitat mapping has been completed for over half of the quadrats by 2001 (see Figure, mapped quadrats in green). According to the protocol, habitat mapping should be repeated in each quadrat every 8 years.

BIRD MONITORING

The observation of bird species is one of the most popular nature conservation activities with the longest tradition and the largest scientific databases, especially in Europe. It is at the same time the most rapidly expanding nature conservation activity. Due to this fact, the number of bird species is relatively high amongst the threatened and protected species. The standard sampling methods used by the Hungarian Ornithological and Nature Conservation Society can also meet the requirements of the HBMS. The monitoring of birds is carried out at the population level of selected species, and also at the community level.

In the winter of 1999–2000, waterfowl censuses were carried out monthly in 24 regions, at standard sites throughout the country.

A programme of monitoring rare and colonially-nesting birds, including species of European Community interest, was started in 2001 by the Authority for Nature Conservation. In this project, the staff of national park directorates estimate the populations of selected bird species regularly. There is an overlap between this project and other ones (e.g. survey of sousliks around breeding areas of large raptors or small rodents through collection of pellets of barn owls).

MONITORING OF SOUSLIKS

As part of the HBMS, nation-wide assessment of souslik *(Spermophilus citellus)* populations has been organised with the active participation of volunteers since 2000.

The souslik occurs on the western border of its range in Hungary where it digs its burrows in open grasslands. These burrows generally have several entrances and often exceed 1 m in length. Hungarian souslik population has dramatically decreased as a consequence of the loss of potential habitats, therefore the species was declared protected in 1982. In addition to the national legal protection, the species is listed in Annexes II and IV of the Habitats Directive of the European Union, and appears on the list of strictly protected species of the Bern Convention.

Several of the rare and extremely valuable birds of prey feed on these animals, such as the saker *(Falco cherrug)* and the imperial eagle *(Aquila heliaca)*. Stabilising populations of these birds of prey could be achieved through restoration of the habitats of the sousliks.

Based on earlier experiences concerning the methodology of population estimation developed at the Department of Ethology of the Eötvös Loránd University, Budapest, the average number of burrows per individual was determined in selected sites, thus populations could be described by the number of used burrows. This method is suitable for the rapid, standardised and parallel estimation of the relative number of individuals of smaller souslik populations, and it does not require any special expertise.

The first survey of the Souslik Monitoring Project of the HBMS took place on the 22nd of April 2000, on Earth Day. The success of the project is shown by the large number and range of participants: schools groups led by teachers, nature conservation activists and experts of the national park directorates returned completed forms for a total of 93 sites (see Figure). Souslik habitats were also surveyed in the spring of 2001, and no significant changes were detected in the population indices. However, the organisation and execution of the survey, just as the accuracy of the received data have significantly improved.

OTTER MONITORING

The otter *(Lutra lutra)* is protected nearly over the whole range of its occurrence. Its populations have become extinct or fragmented throughout Europe, although a recent recovery is apparent. Survival of the species is threatened by habitat loss, water pollution and poaching. Permanent and increasing fresh-water populations can only be found in Central and Eastern European countries. The future of the species depends on the extent these countries can conserve the existing populations of the otter, and manage problems arising from socio-economic changes.

Hungary plays a key role in the conservation of the species, as the population in the Carpathian Basin can serve as one of the basic stocks for replenishing or replacing depleted Western European populations.

Monitoring of the species entails the regular and standardised repetition of nation-wide population surveys. The HBMS uses the indirect "minimum-standard" method developed by IUCN, which records the presence of otters based on the traces and marks left by them. Nation-wide surveys were conducted in 1995–96 and 1998–99 with the co-ordination of the Foundation for Otters. The results of these surveys were of great value in the assessment of the threatened otter populations of the Tisza River in 2000-2001. Fluctuating populations of five regions were surveyed with the assistance of the HBMS in 2000–2001.

MONITORING SMALL MAMMALS USING OWL PELLETS

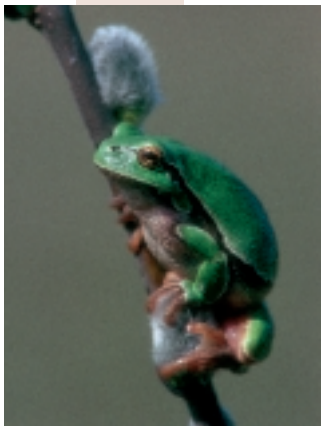
In ecological studies of small mammals, indirect sampling methods based on analyses of owl pellets are often used. Pellets of the barn owl (Tyto alba) are best for this purpose as this species possesses the widest prey spectrum among Hungarian owl species. Of course prey-preference and functional response of the predator ("switching" to more abundant prey) may affect the proportions of the small mammal species found in owl pellets. It is also to be identified which period is the most suitable for collecting representative samples for small-mammal monitoring, and if indices calculated from data of pellet analyses (species richness, diversity, biomass) are suitable for tracking abundance of small mammal populations and identifying their trends. Nation-wide monitoring is performed by the collection of pellets in the areas of jurisdiction of the existing 9 national park directorates. Ten sampling sites have been selected in every national park directorate, where pellets are collected twice annually: once in the spring and one sample in autumn.

On bases of these analyses an overall picture can be drawn of the spring and autumn diversity the prey of the feeding grounds (300–500 ha) of the owls, which can then be compared among sites and sampling dates.

As regards the ranges of small mammal species, important results have already been obtained, which will of course increase in value in a longer period as a part of a multiple-year database. This method will serve as an indirect indication of the abundance of certain species or genera of small mammals in different regions of the country. In the case of rare and protected species such as the root vole (Microtus oeconomus) in the area of the Fertő-Hanság National Park, new locality data are also extremely valuable.

AMPHIBIANS AND REPTILES

Altogether 14 amphibian and 12 reptile species are listed from the fauna of Hungary in the annexes of the Habitats Directive, which are all protected. In the HBMS all species are taken into account. Considering that monitoring is conducted on several species in parallel at the same time, the collected data are also suitable for characterising communities. The sampling frequency for amphibians is 4 or 5 occasions per year. For reptile monitoring five sampling days are necessary annually.



Sampling methods for monitoring amphibians

– Night search by torch light, bottle-trapping: methods suitable for sampling Caudata and larvae of Anura (eg. Pelobates fuscus) in the water;
– Egg counts: a method suitable for the assessment of the number of reproducing females of toads, tree-frogs and spade-footed toads;
– Count of adult animals along shorelines (spotted salamander assessment can be done on land as well).
– Acoustical surveys: a novel method for estimating the number of individuals of frogs.

Sampling methods for monitoring reptiles

One of the possible methods is transect sampling, during which the numbers of individuals of the observed species are recorded. It is recommended to spend the same time effort during each sampling. Another method is the quadrat sampling, which is used when features of the sample site do not allow transect sampling to be performed. On these occasions a regular sample quadrat is marked out in a close-to-homogeneous habitat patch, with a size of 1 ha. The sampling areas have to be defined in all cases of population estimation.

Evaluation

Evaluation of data can mean the estimation of population sizes of the species, and their spatial or time-dependent distribution, or can characterise the habitat with the presence of certain amphibian/reptile species. The site evaluation based on the estimation of the numbers of individuals is more suitable for the characterisation of smaller water bodies (5–10 ha). The said methods are suitable for comparing different sites and for comparing sites varying in time as well.

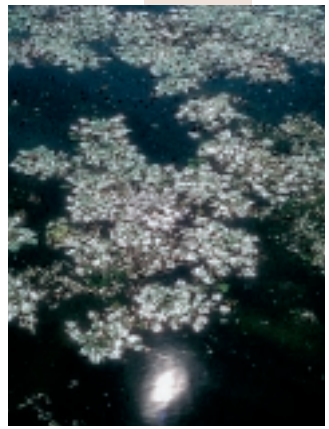
WETLAND ECOSYSTEMS

The investigation of communities that live in water bodies needs special expertise in hydrobiology. As water itself is highly variable as a habitat, the sampling method for aquatic species and communities have to be adapted to its main features as well. For this reason no standard sampling methodology can be given for small stagnant waters, streamlets or rivers. The lack of transparency of the water often hampers sampling. The monitoring of wetland communities has only partly started so far, and many corrections are needed in the protocols according to the experiences of the first year.

The protocol of monitoring aquatic macrovegetation is based on the methodology of terrestrial vegetation sampling. Estimation of the abundance of plant species is, however, difficult in this case, and often supplementary tools are needed, e.g. a rake or a boat. Joint training courses of the sampling techniques could help to standardise the sampling methods throughout the country.

Macroscopic invertebrates have been used in biological water qualification for many years in Hungary, which includes the investigation of several taxa, above all insects and molluscs. These groups can be collected with the same sampling methods: with netting from the sediment and quality of the water can be assessed from the composition of the obtained sample. The elaborated sampling protocol was tested for both rivers and standing waters in 2001. When designating sample sites, the recommendations of the Water Framework Directive have also been taken into account. The following groups of animals are identified from the samples: water molluscs, leeches, decapods, fairy shrimps *(Branchipodidae)*, amphipods, mayfly *(Ephemeroptera)* larvae, dragonfly larvae, Dryops spp., perlid stoneflies *(Perlidae)*, water spider and freshwater jellyfish.

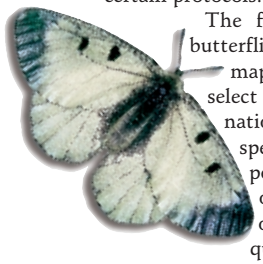
Quantitative assessment of the fish populations and communities also raises scientific problems. These species do not form natural communities in respect of species composition and proportion in waters under active fishery management, and continuous human intervention makes evaluation of changes in the community difficult. The requirements of obtaining permissions also hinders monitoring activities in many cases. Sampling itself needs professional skills and dedicated equipment, since it is based on electric fishing. Recommendations of the Water Framework Directive have also been taken into account as regards of fish monitoring. While testing the protocol several new records of fish species came to light. Further analysis is needed to identify the frequency of sampling, since features determining the survival of populations can only be assessed with highly intensive sampling, which can only be done for few sites.



DIURNAL LEPIDOPTERA

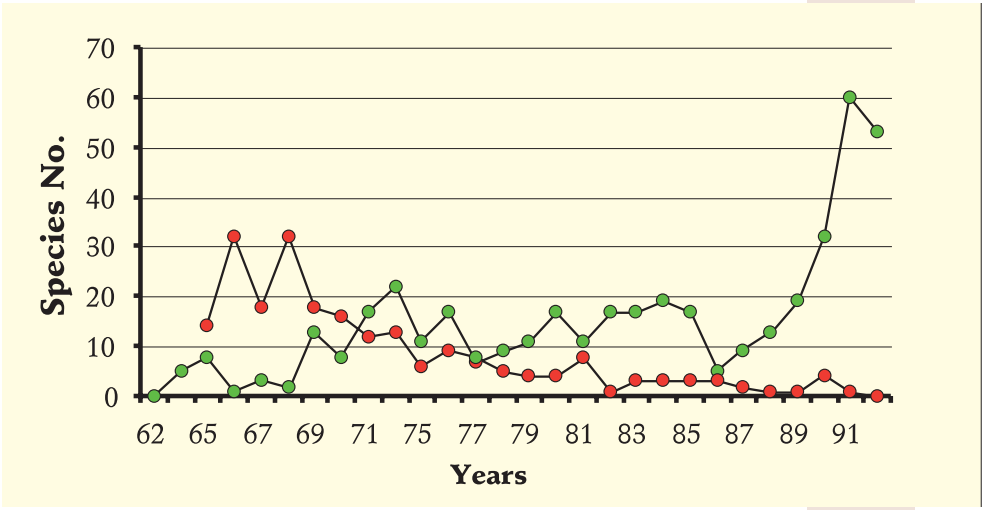
Butterflies, just as birds, are the symbols of undisturbed nature for the wide public. This is the group of insects which is successfully monitored in some Western European countries by voluntary organisations.

The HBMS also intended to develop such a system when preparing the protocol for monitoring certain selected butterfly species. The richness of the Hungarian butterfly fauna, however, makes it difficult to involve volunteers, since many species flying at the same time in the same locality can be easily misidentified. Thus most of the similar looking or threatened species can be monitored only by specialists, while some common species with a special food plant or habitat requirement can be monitored by volunteers as well, according to certain protocols.



The first step in collecting the distribution data of butterflies was to process archive capture data and to prepare maps. The next step was to compare these maps and to select the sampling sites. Monitoring these species of national or European importance is done by a group of specialists, along with the detailed analyses of the population dynamics of the species. Volunteers can only record the presence of certain species and occasionally can be involved in the estimation of the quantity of food plants and of larvae. To help them in this work, a short illustrated handout is produced.

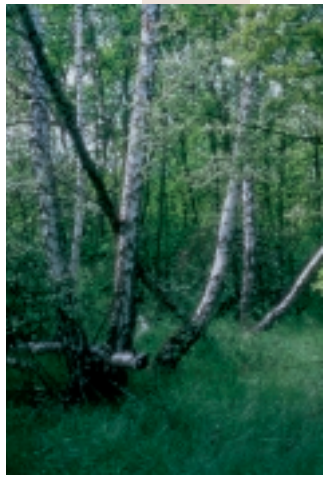
MONITORING OF NOCTURNAL LEPIDOPTERANS BY LIGHT-TRAPS



Change in the number of disappearing species (that were not trapped later on, green circles) and newly appearing species (red circles) at Várgesztes based on light trapped larger moth species.

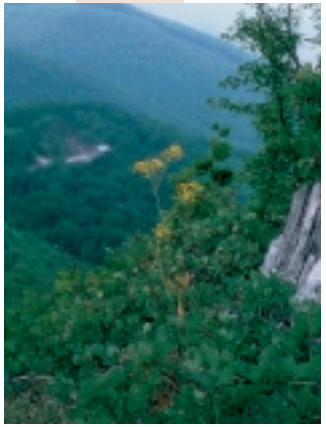
The light-trap network of the forestry service has been operating since 1962 for plant protection purposes. Along with the identification of "pest" species, lepidopterans have also been sorted out and identified by staff of the Scientific Institute for Forestry (ERTI). The HBMS relies upon the several-decade long experience, professional skills and database of ERTI. Evaluation, and thus usefulness of the data can be greatly improved by an ecological classification system which characterises every occurring lepidopteran species according to its distribution, habitat requirements and lifecycle. In a pilot study, the capture data of one of the traps were entered into a database and analysed in 2000. It can be seen from the data of the past 38 years that in the sampling area of Várgesztes (Vértes Hills), the number of species disappearing from time to time increased from the mid-1980s (see Figure). The sudden advance of Mediterranean species is also shown by the results.

Of course conclusions at the national scale cannot be derived from the data of a single sampling locality. The HBMS has therefore commissioned ERTI in 2001 to analyse the data of three further trap stations. For two of the three sampling localities similar results were obtained as for Várgesztes, while for the one, at Felsőtárkány – probably due to the habitat diversity of the surrounding area – the changes in number of species were not significant.



PLANT SPECIES

Hungarian botanists have stockpiled a huge amount of data since the 1800's. Based on this knowledge, populations of rare (and later protected) species have been identified. The monitoring of plant species in addition to the protected ones also focuses on some rapidly dispersing, invasive alien species. The populations are sampled every second, third or fourth year, depending on the rarity or other characteristics of the given population. The most commonly used method is the population size estimation, which can be done by counting or by estimating the cover. If necessary, the population may also be mapped. Mapping of the range of certain species with a scattered distribution pattern in the country tracks changes in the number of populations. This method is suitable for documenting the sudden advance of invasive species with the supplementary mapping of sample populations. The HBMS has pursued such sampling for four years with the assessment of populations of a total of about 70 plant species until 2001. Of these 70 species the invasive ones are monitored every year along with habitat mapping, while threatened and protected species are surveyed every second or third year.



MOSSES

Mosses have been included as a component of the HBMS for several reasons. Many of the moss species are not only rare, threatened and important at the national, but also at European or international level. Several habitats are to be protected for their special, valuable moss vegetation. Rare and threatened moss species often occur in habitats which are worthy of protection for their plant sociological characteristics or vegetation history. Mosses can be found in the annexes of international conventions and the EU Habitats Directive as well, and monitoring them is an obligation of the member states or contracting parties to the given conventions.

The elaboration and selection of the standard methods for moss monitoring has proven to be a new challenge for the experts. The monitoring project on mosses focuses on the species listed in the annexes of the Habitats Directive, which primarily means the retrieval of archive published data. Finding the species again often meets difficulties, since mosses can be located depending on the life-cycle strategy of the species, the degree of disturbance of the habitats and the weather conditions. Monitoring of moss communities is also part of the HBMS, therefore mosses are sampled in wetlands, forests, dry grasslands, and saline habitats in sites where plant community monitoring also takes place. Additional to this, there are some sites which are chosen for moss monitoring on bases of the concentrated occurrence of special, valuable and protected moss species (e.g. on shady rock faces). The elaborated methods are further developed according to the experiences gained in the pilot studies. Of the 35 localities identified in the protocol, 26 were surveyed in 2000–2001. The first round of surveying all the localities will be completed in 2002 along with repeated surveying of some of the sites.

MUSHROOMS

Mushrooms play a significant role in the circulation of organic substance in natural living communities. According to the present state of mycology, the number of mushroom species is estimated at 4500 on the basis of the approximately 1500 species known in Hungary. Due to their very important role in biotic communities, the group of macrofungi has been chosen as a component of the HBMS in spite of the difficulties that have arisen during their monitoring.

It is highly intricate to choose the right monitoring methods for mushrooms on account of their peculiar way of life and the accompanying taxonomic problems which also cause great debates among mycologists. The qualitative and quantitative methods of examinations of mushroom communities essentially differ from the methods used in both botany and zoology. The monitoring of mushrooms is first of all based on observing the fruit body, since collecting and identifying the vegetative mycelia and mycorrhizae living in the soil are very difficult. The close examination of the fruit body is also rendered more difficult by several factors, namely, by their short life span, by their considerably weather-dependent, periodic and fluctuating formation, by the great diversity of their ecological functions, and by the above-mentioned taxonomic problems.

Taking these problems into considerations, a group of experts has elaborated a method for monitoring mushrooms, according to which their occurrences are recorded over a period of several years using permanent sampling sites. They also put forward a proposal for numerous indices that would be sensitive to the habitat changes in the given area. The monitoring of mushrooms was carried out in forests in order to test the methods. The examinations at present are carried out in the core areas and buffer zones of three forest reserves and a planted forest nearby for each site. The results obtained so far have substantiated the standard sampling method, and after the first sampling cycle (4-5 years) the testing of this method can certainly be concluded.

PLANT ASSOCIATIONS

Native plant associations were first surveyed and described in Hungary in the first half of the 20th century, based on a classification system according to Zürich-Montpellier school of phytosociology. The concept, on the basis of which the plant associations of high conservation value unique for Hungary have been chosen for monitoring from the already known types, grew out of this rich tradition. After selecting the associations to be monitored, the populations have been chosen and the method to be used was described.

This highly developed state of vegetation science was accompanied by an advanced, widespread technique, the so-called coenological sampling method. This method based on estimating the cover of the species in the sampling squares did not meet the monitoring requirements in its original form because of its subjectivity, and it is also very difficult to return to the designated quadrats. The internationally widely used micro-quadrat sampling in permanent and larger plots proved to be much more effective, thus the group of experts proposed it to be included in the protocol. However, numerous problems arose at the beginning of the sampling process in 1999. It is difficult, among others, to delimit the stands designated for monitoring, to assign the typical localities, to deal with the transitional forms and the sudden advance of the degradation processes. So far samples have been taken from grassland associations, in 2002 forests will be sampled, and later the second sampling cycle will take place. Experience shows that the proposed number of samples may be reduced.

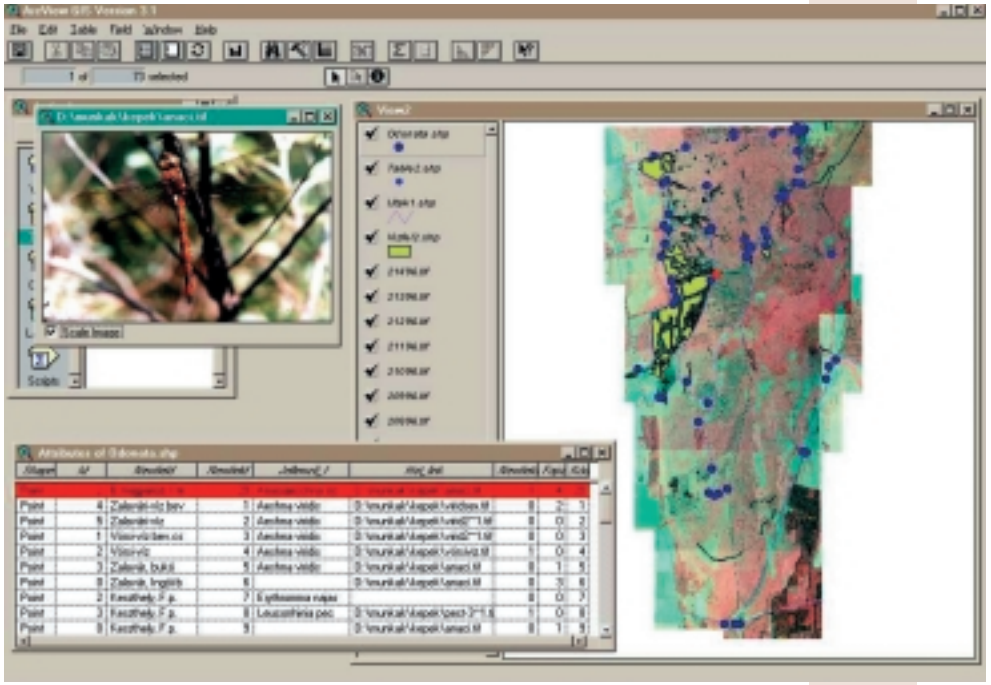
TISZA RIVER NATURE CONSERVATION MONITORING PROJECT

The establishment of this project became imperative after the Szamos and Tisza rivers were contaminated by a series of cyanide and heavy metal spills of Rumanian origin in February-March of 2000. The biological surveys aiming at assessing the environmental and natural damages due to the contamination are co-ordinated by the Authority for Nature Conservation and the Water Resource Research Centre. Plant and animal groups of high conservation value closely connected with the water-body (for reproduction or feeding) have been studied as part of the HBMS. The goal of the Nature Conservation Monitoring Project in connection with the Environmental Monitoring Project is the long-term and standardised examination of groups of living organisms of high conservation value, or which play a significant role in the food-chain in the selected habitats. These studies are implemented in harmony with the HBMS protocols. The draft plan of the development of the long-term Tisza-monitoring programme is going to be completed within a short time.

The following components were examined during 2000–2001: bats, birds (with the methods used by the Rare and Colonially-nesting Bird Species Monitoring Project), reptiles and amphibians, fish species and communities, aquatic macrovegetation (reed-grass, higher aquatic vegetation and wooded vegetation of shores and banks), aquatic macroscopic invertebrates.

In the course of the surveys in 2000–2001 the so-called 'Pilot Project' implemented in 1996 during development of the HBMS was repeated, during which the habitat map of a 5x5 km plot and the results of the examinations at both species and community levels were analysed. There is also a study in progress, which, besides the monitoring examinations, aims at modelling the changes in the food-chain as a result of the spills, and at forecasting the process of revitalisation. As a result of the examinations, it can be concluded that after the cyanide contamination the regeneration processes in the populations of aquatic groups of animals and the macrovegetation were extremely different, in some cases really significant, however, the fish populations suffered great losses. It is crucial to note that due to its long-lasting accumulation, the heavy metal pollution might have serious effects seen only later.

NATURE CONSERVATION MONITORING PROJECT IN THE KIS-BALATON



The Kis-Balaton, part of the Balaton Uplands National Park, is a large wetlands area with a unique fauna, and because of its international importance it has been designated as a Ramsar site. Besides its natural values, the Kis-Balaton also forms part of a water-quality improvement system of the Zala river.

The first section of the development of the system was the construction of an artificial lake to store the nutrient-loaded water of the Zala river for natural purification processes. The second part of the Water Improvement System started in 1992, when a 16 km2 large, so-called "model area" was flooded. At the same time a monitoring project was initiated by the water management authority to observe the effects of the system on the natural values. Since 1998 this project has been aligned with the requirements of the HBMS.

A GIS-based database of the results of the first five years of monitoring has also been compiled covering the following components: birds (rare and colonially-nesting species, reed and reed-nesting birds), small mammals (first of all the strictly protected root vole), fish, molluscs, leeches, biting mosquitoes, dragonflies, rotatorians and, among the plants, the algae (for an example of database query, see the Figure). In addition, the vegetation and the population of protected and invasive plant species, bats, amphibians, reptiles, carabid beetles and spiders that can be collected by soil traps, have also been frequently surveyed.

THE NATURE CONSERVATION MONITORING PROJECT OF THE RIVER DRÁVA

From a nature conservation point of view, the River Dráva with its inundation area is one of the most valuable regions in Hungary. A monitoring project has started in three sections along the river in response to a water barrage system proposed by Croatia. Within the scope of this programme, selected habitats and groups of living organisms are being continuously observed on the long run with standard methods. A considerable part of the monitoring efforts focus on the area of the Danube-Dráva National Park. During 1999 the project was established by a team of experts in harmony with the methodology of the HBMS, and in 2000 field monitoring commenced. The habitats are characterised by exceptional diversity and variability, which pose a challenge for the experts taking part in the monitoring.

The examined components are: plant associations, protected plant species, molluscs, zooplankton, dragonflies, mayflies, butterflies, large moths, fishes, amphibians, birds, bats, small mammals and small carnivores. The data collected during the first year have been entered into a GIS-based database.

SZIGETKÖZ NATURE CONSERVATION MONITORING PROJECT

The Szigetköz region of the River Danube has been impacted by Gabcikovo-Nagymaros water barrage system when the flow of the river was diverted in 1992. Since 1987 a monitoring project has been in place carried out by organisations other than the state nature conservation service, thus the data collected so far can be used to follow the increasing desiccation process due to the diversion of the course of the river. This monitoring project includes studies of the following components: fishes, birds, macroscopic aquatic invertebrates, algae, vascular plant species and vegetation. The HBMS contributes to the project by monitoring the dragonflies and small mammals.

Within the framework of the HBMS there are a few projects and there will be some initiated in the near future, which make it possible for volunteers (students, undergraduates, teachers, NGO-s etc.) to participate. These projects also render nation-wide monitoring possible by setting a large number of people in motion. Besides, they also play an educational role by contributing to the active social role in the protection of the natural values. Experience accrued over the period of two years has proven that the volunteers' monitoring activity needs cautious organisation and management. It has become clear that the sampling method should be described in details in a professionally written document (e.g. a brochure). Prior to the survey it is advisable to organise training and to arrange a field reconnaissance trip depending on the character of the task. Without these necessary steps data collection would be impossible or lead to poor data quality. It has proven to be remarkably difficult to arrange for sustained participation in the monitoring projects, and experience has shown that involving constant participants requires a lot of time and energy, therefore the preparations have to be repeated many times.

Survey of sousliks

The first action programme to assess the native population of sousliks started in 2000 and was based on the active participation of volunteers. That the programme was a great success is shown by the fact that numerous volunteers took part in the Second Souslik Monitoring Event arranged on the occasion of Earth Day in 2001 and nearly half of the data sheets were completed by volunteers. A key to the success is the application of a simple method with which the burrows of sousliks are counted in a standard way.

Monitoring amphibians

In the course of testing the monitoring methods for amphibians during 2001, volunteers played a significant role in collecting data from five regions of the country. Over 80% of their data were concordant with those of the experts who worked at the same time and in the same locality. A conclusion of the pilot project was that co-ordination can only be delegated to experts, and handouts must be prepared. Also, prior to commencing independent field work, the volunteers should participate in surveys together with the co-ordinator on several occasions.

Butterfly monitoring

In many western-European countries butterfly monitoring networks successfully function by involving different local groups in their work. Based on this experience, it has been initiated for volunteers to participate in the monitoring projects in Hungary. During 2000 a group of specialists tested the standard sampling methods, later a brochure will be complied for volunteers in order to help them in the observation of certain species living in wetland habitats. According to plan, a central and possibly several regional educational programmes will also help the work later.

FURTHER PLANS

The most essential parts of the HBMS have been developed by 2001. The staff and management capacity for building the system are ensured, the conditions for the proper functioning are refined during the development. A standard protocol has been completed for the majority of the components, the testing of which has taken place as well. Several archive data series have been incorporated into the HBMS, and the number of the examined components increased year by year. However, the HBMS cannot be considered as a fully-fledged programme because of the lack of a central information system as yet, which is a future task. In order to process the collected data stored in the form of reports at present, the number of the staff should be increased. The establishment of a GIS-based database, similar to those already existing for the Kis-Balaton and the Dráva river projects, is of crucial importance. Parallel to this, regulation of access to data and information stored in the databases must be elaborated in line with the nature conservation legal instruments. According to plan, access should be provided at three different levels: a) public data, b) regulated access for scientific and nature conservation purposes, c) classified data for internal use (e.g. basic data on strictly protected species).