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Development and implementation of a National Biodiversity Monitoring Programme in Hungary

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Abstract

Upon the initiative of the Authority for Nature Conservation of the Ministry of the Environment, a complex programme for long-term biodiversity monitoring in Hungary has been elaborated by a large group of experts during 1995–1997.

The 110 plant communities, 315 plant and about 250 animal species selected for monitoring represent the common and characteristic, the rare and therefore protected, the threatened and the invasive elements of the biota.

Ten volumes of manuals for monitoring biodiversity have been published, and they contain the characterization of the selected entities and attributes, the localisation and timing of monitoring and the exact but simple methodology for gaining broad but reliable data in the field.

As part of the programme, experts have elaborated a comprehensive national habitat classification system compatible with EUNISHAB[1], which serves as basis for landscape-level habitat mapping and monitoring. The first steps towards setting up a National Biodiversity Monitoring Service have been taken to implement the programme.

1 Introduction

The signing of the Convention on Biological Diversity (CBD)(GLOWKA 1994) by 155 states and the European Union gave enormous stimulus to the development of global, regional and national biodiversity programmes.

Article 7 of the CBD requires signatory parties to identify components of biodiversity important for conservation and sustainable use, to monitor the components of biological diversity, to identify and monitor processes and activities having or likely to have significant adverse effect on conservation and sustainable use, and finally to maintain and organize the data derived from the above activities.

Based on the principles stated by the CBD, an increasing number of excellent national strategies and action plans are already available. A Hungarian preparatory work (FEKETE et. al. 1994) was among the first such documents to be produced (e.g. FPT-BWG 1994, DoE 1994); the fully-fledged National Biodiversity Strategy and Action Programme is being developed using Global Environmental Facilities (GEF) support.

In Hungary with the joint efforts of the state nature conservation bodies and biological research institutions, a complex nature inventory programme was launched in 1991 using a standard methodology (TARDY 1994), which served as precedent for starting to develop a biodiversity monitoring programme.

[1] EUNISHAB = EUropean Nature Information System, HABitats

Hungary's successful participation in the CORINE Biotopes programme has also been a corner stone in preparatory work (KOVÁCS-LÁNG & HORVÁTH 1997).

From the point of view of environmental policy, at a time when Hungary is preparing for accession to the European Union, and when privatisation and other incredibly rapid social and economical changes take place at an unprecedented rate (TARDY 1998, VARGA 1998), information on the impacts of these processes on nature is particularly badly needed.

Act No. LIII of 1996 on Nature Conservation entered into force in January 1997, and in September of that year the Hungarian Parliament endorsed the National Nature Plan as a separate annex of the National Environmental Protection Programme. The Act and both of the above documents emphasize the obligation of the government to conserve biological diversity and to pursue monitoring.

Using funds from the PHARE[2] programme of the European Union, the National Biodiversity Monitoring Programme (NBMP) has been developed by a consortium of four research institutions upon the initiative and under the coordination and supervision of the Authority for Nature Conservation of the Ministry of Environment and Regional Policy. The Institute of Ecology and Botany of Hungarian Academy of Sciences in Vácrátót was leader of the consortium, other participating institutes were the Hungarian Natural History Museum, Budapest, the Ecological Department of Kossuth Lajos University, Debrecen and the Computation and Automation Research Institute of the Hungarian Academy of Sciences, Budapest. The consortium could rely on a wide range of expertise in taxonomy, floristics, faunistics, plant sociology, forestry, hydrobiology, plant and animal ecology, as well as conservation biology and nature conservation management (KOVÁCS-LÁNG 1997). During the design of the system, special attention was paid to the possible links and integration between the already existing observation and monitoring systems (such as the National Meteorological Service, ornithological, forestry, soil observation networks, insect light trap network etc.)

Financial resources were secured in 1997 to take the first steps in setting up the national programme. After various preliminary projects, the actual monitoring activity started in 1998.

2 Some principles in monitoring biodiversity

A growing number of publications dealing with biodiversity monitoring (GOLDSMITH 1991; SOLBRIG 1991; DI CASTRI et al. 1992; WCMC 1992; HEYER et al. 1994; HEYWOOD & WATSON 1995; JERMY et al. 1995) consider as key issues the problems of scaling in space and time, the selection of the proper entities and their attributes to be monitored, and standardization of sampling protocols.

- The concept of biodiversity may and must be interpreted for all levels of the hierarchically organized system of the living world, and for all characteristics of the systems that can be defined at the specific levels of organization (NOSS 1990; SVENSSON 1997).
- A sharp distinction must be made between biodiversity monitoring aimed at studying the attributes of living organisms, and biomonitoring, which is used in environmental monitoring systems. In the latter case the living organism is only a tool and not the target of the monitoring activity.
- Biodiversity monitoring is a long-term activity which must always have a well-defined objective, which applies to a specific attribute of a specific level of organization, and which accurately defines the spatio-temporal scale of the phenomena and processes to be observed (SPELLERBERG 1991).

[2] PHARE = Poland and Hungary Assistance for the Restruction of the Economy

- According to the aims, trend monitoring and hypothesis testing (HEAL 1991) can be differentiated.
  While trend monitoring follows the "normal" fluctuations and trends (noise) in patterns and dynamics of populations and communities giving a baseline for comparisons, in the case of hypothesis testing hypotheses are postulated to study the impacts of different threatening factors (pollution, overgrazing etc.) or conservation measures. In this case critical values different from the baseline serve as signal for taking preventive or remedial actions.
- Successful biodiversity monitoring activity is inconceivable without a sound scientific and technical background.
- The basic underlying methodological and theoretical principle of biodiversity monitoring is the "general indicator" theory, which states that all living organisms and all attributes, occurrence, abundance and interrelationships of living organisms thereof possess an indicator value with regard to the limiting factors (JUHÁSZ-NAGY 1986).
- A national monitoring programme should adequately represent the biodiversity of the given country and be indicative of the impacts of factors that might endanger the preservation of biodiversity. It is impossible to monitor all living objects and all their attributes. When setting up a monitoring programme, one is always forced to select (i.e. to sample).
- The comparative evaluation of data obtained in the course of monitoring and their successful analysis in space and time are possible only if an internationally compatible standard methodology is available for sampling, as well as for thorough and unambiguous documentation and data processing.

3 The Hungarian programme for biodiversity monitoring

A preliminary study (KOVÁCS-LÁNG et al. 1995) played an important role in the elaboration of the Hungarian Biodiversity Monitoring Programme. Based upon international expectations, initiatives and experience formulated by and available at that time, the study outlined the basic principles, objectives, tasks and methodology of the development of the National Biodiversity Monitoring Programme, taking into consideration the needs of the nature conservation authorities, as well as the available capacity of the existing Hungarian taxonomic and ecological expertise.

The principal tasks in designing and setting up the monitoring programme and system in Hungary were as follows:

3.1 Recording system and information network

The first task was the establishment of a comprehensive biological data-recording system and information network, which is compatible, or at least may communicate with similar systems existing in the country and abroad, and which integrates the already existing biological and nature conservation databases.

The monitoring process is organized into operative activity units, the so-called projects, which have clearly defined aims, objects and methodologies. The effective coordination of projects is ensured by a centrally managed meta-database TERMET (HORVÁTH et al. 1997a). Standard documentation of the projects, their products and their links has been elaborated. This involves the biotic, coenological and mapping data entry sheets; preparation and maintenance of taxonomic code-tables; methodology of data entry and evaluation process; as well as the regulation of copyright and data accessibility issues (HORVÁTH et al. 1997b).

3.2 Selection of entities

The second task was the selection and justification of the proper entities (populations, biotic communities and their mosaics, habitats and their mosaics at landscape level), attributes, scale, localities, and timing of monitoring, and the establishment of an exact but simple methodology for gaining broad but reliable data in the field. Numerous factors had to be taken into consideration. The programme was designed on the basis of the hierarchy of biological organization. Of the approximately 2300 vascular plant species and about 53000 animal species existing in Hungary, the populations of 300 plant and 245 animal species, and 110 out of the about 400 plant communities have been selected for monitoring (TÖRÖK 1997). In order to sample the landscape-level habitat patterns, 125 plots of 5 x 5 km size have also been selected (KOVÁCS-LÁNG & TÖRÖK 1997). The above-mentioned number of objects and sites constitutes a maximum programme for biodiversity monitoring. However, subject to availability of funding and other restrictions, an optimal, and a minimal and limited programme have also been proposed.

The selected objects represent

a) the commonly occurring species and communities generally typical of the biota and the habitats of Hungary;
b) those rare and especially valuable species and communities whose selection has been influenced by international conventions and by European and Hungarian red books and lists;
c) species and their communities which are directly endangered by some human activities or environmental factors;
d) those invasive elements of the biota that endanger natural populations and communities;
e) economically important species;
f) key species of communities;
g) characteristic habitat patterns of different regions of the country;
h) habitat patterns of areas of outstanding nature conservation importance.

Practical aspects have also been taken into account during the selection, e.g.: easy accessibility of the selected sites, security of long-term observations and data collection, hierarchical allocation of the populations and community stands, availability of trained specialists for the individual taxa, availability of preliminary data sets etc.

The attributes recommended for monitoring are:

- for populations: presence-absence, population size or density, spatial distribution of individuals, demographic characteristics, genetic variability (morphological, chromosomal, enzymatic) in certain special cases;
- for communities: species composition, relative abundance, physiognomic structure, borders and location of the stands (mapping).

3.3 Charaterization of habitat types

The third task was hte inventory, description and characterization of the main habitat types, and the elaboration of a comprehensive national habitat classification system and identification key.

This gap-filling work defines a hierarchical system of 116 units which fully covers all main types of the Hungarian habitats. It also includes habitats showing various degrees of degradation, as well as cultivated land, and habitats subjected to other types of human management (FEKETE et al. 1997).

The descriptions and characterizations of habitats follow the criteria and categories used by the European habitat classification system (EUNISHAB) under development.

To facilitate identification, two user-friendly non-hierarchical keys have been constructed. One is based on the definitions of habitats, while the other is a multidimensional key for distinguishing the 20 main groups based on four features: altitudinal distribution, formation type (physiognomy), hydrological status, and the state of naturalness.

As part of the monitoring programme, a total of 125 quadrats of 5 x 5 km size have been designated to represent the habitat patterns of the country. Supported by aerial photographs, it is planned to carry out land-surveying at the 1: 25,000 scale at regular intervals. The total area of the sampling quadrats is 3000 km^2, which represents 3.2 % of the country's surface area.

35 % of the selected sample quadrats represent protected areas valuable from the point of view of nature conservation, 44 % contain habitat patterns generally typical for Hungary's different regions, and 21 % represent habitat patterns of areas exposed to the effect of some regional risk factors (sinking ground water table, urbanization, river diversion etc.). The allocation of the sampling quadrats also follows the UTM grid system.

It must be stressed that although the Hungarian Biodiversity Monitoring Programme elaborated so far is a relatively comprehensive nation-wide programme, it does not yet cover all important groups of organisms and objects and thus can and must be further developed later on as an open system.

3.4 Publication

The proposed programme was published in Hungarian as a series of ten manuals entitled "National Biodiversity Monitoring Programme" (HORVÁTH et al. 1997). The volumes contain the basic principles of biodiversity monitoring, the characterization of the selected entities, the sites recommended for monitoring, and the standard methodology of data collection and handling in Hungarian.

The volumes of the series are as follows:

I. Information management.
II. Description and definition of Hungarian habitats and the National Habitat Classification System.
III. Plant communities, community complexes and habitat mosaics.
IV. Plant species.
V. Crustaceans, Dragonflies and orthopteroid insects.
VI. Coleoptera.
VII. Lepidoptera.
VIII. Amphibians and Reptiles.
IX. Birds.
X. Mammals and the monitoring of genetic diversity.

The series is soon to be supplemented by two new volumes: a single-volume summary of the above manuals in English and a training manual for habitat mapping.

4 Organization of biodiversity monitoring

In the long run data collection and processing based on adequately designed, nationally coordinated, comprehensive and regular sampling can only be accomplished through the establishment of a "purpose-built", dedicated Biodiversity Monitoring Service (BMS) organized specifically for that objective.

The main elements of the structure of the Biodiversity Monitoring Service are as follows:

A) A Central Coordination Unit, within the Authority for Nature Conservation at the Ministry of Environment and a Scientific Advisory Committee supporting the work of the former;
B) Implementing regional organizations (nation-wide network of one Central and nine Regional Monitoring Groups)
C) Cooperating Organizations

The Central Coordination Unit should exercise nation-wide supervision of the relevant activities, identify the priorities, authorise and coordinate monitoring projects at different levels and hosts, and provide the manpower and financial conditions necessary for the operation of the Service and the Programme. In addition, based upon professional analyses, the unit should draft a report on the state of the biota as part of the environmental status report to be submitted to the Hungarian Parliament every second year.

The implementing organization of the BMS consists of a Central Monitoring Unit which carries out special tasks, and of Regional Monitoring Units. The units must be staffed by professionals with adequate information technological, biological and ecological qualifications, and their work should be supported by assistants. They organize, supervise and perform monitoring activities at the regional level (e.g. the area of jurisdiction of a national park directorate), in the framework of national and regional projects launched by the Central Coordination Unit of the BMS, as well as local projects that enjoy priority in the given area.

4.1 Relations with the monitoring programmes of other government sectors

As far as possible, the measurement and observation site networks established by the services of other sectors (e.g. National Meteorological Service, National Hydrological Service, National Forest Service, Plant Protection Service, Centre for Geodesy, Cartography and Remote Sensing) should be taken into account when selecting the localities of biodiversity monitoring, so that the combined analyses can yield a more complete and comprehensive interpretation through the comparison of the resulting information.

4.2 Education and training

The launching and successful operation of the BMS require a staff of specially trained professionals and assistants.

The monitoring programme recommended as a start-up includes about 600 species belonging to 5 invertebrate and 4 vertebrate animal groups, vascular plants, peat mosses and siliceous algae. Further professional tasks include the monitoring of the selected phytocoenoses and community complexes, as well as the mapping of the 5 x 5 km sample quadrats representing the entire country in order to detect habitat mosaic patterns.

The specialists (both university graduates and skilled assistants) necessary for the successful operation of the National Biodiversity Monitoring Service could be trained partly in the framework of the existing forms of higher education, partly by dedicated courses established specifically for the purposes of biodiversity monitoring.

4.3 Participation of non-professionals (Schools, NGOs) and the general public in biodiversity monitoring

It is considered essential that non-governmental groups and organizations (NGOs) should be drawn into the monitoring activity, and that the general public be kept informed of the relevant goals and the ongoing activities.

Certain easy and routine monitoring tasks defined in the NBMP (e.g. the sustained observation of certain plant or animal populations in a given location, at a given time, or at specified intervals) can be accurately performed and reliable data may thus be generated by amateur naturalists, teachers and their students properly prepared for those tasks. In 1997 the Authority for Nature Conservation launched a programme for teacher training and commissioned the preparation of a teachers' manual in order to get schools involved in monitoring.

The work of knowledgeable amateurs would complement the activities of the Regional Monitoring Units. In addition, their contribution increases social awareness of the necessity of monitoring and nature conservation, and facilitates the development of social attitudes committed to the knowledge and protection of nature.

For wider information of decision makers and the general public, we consider it important to produce short and attractive colour publications for school children about the importance and role of biodiversity monitoring, and the possible participation of schools in the exploration and preservation of local natural values.

It is also important to produce executive summaries for decision-makers about the basic objectives and tasks of monitoring, in the context of the tasks to be performed in the framework of the country's biodiversity preservation strategy and action plan according to the international expectations. The first piece of this series, a colour leaflet was published in January 1998. An English language version of this brochure was distributed at the 4th Conference of the Parties to the CBD in Bratislava, Slovakia, in May 1998.

5 The present state of implementation of the National Biodiversity Monitoring Programme in Hungary

During the very first stages of the implementation, it was found necessary to identify the possible users, and above all, to secure funding for the necessary long-term operation of the programme.

Putting a system into operation always involves a long and hard learning process, but the first steps have already been taken. Biodiversity monitoring is identified as a priority task in the six-year long National Environmental Programme of Hungary, and thus there is a commitment to sustain future government financial support. Funding for the programme is provided almost exclusively from the state budget. The Ministry of the Environment chapter in the annual state budget has a separate budget line as programme funding for environmental protection and nature conservation monitoring. The latter subcomponent is largely devoted to implementing the National Biodiversity Monitoring System. In 1998 a total of 20 million Hungarian Forint was spent on the programme from the state budget, with about 5 million Hungarian Forint additional funding from the Central Environmental Protection Fund (mainly to cooperating partners). In the 1999 budget the approved expropriation is 32 million Hungarian Forint, a substantial increase over the previous year's figure.

The setting up of the National Biodiversity Monitoring Service started in 1997. The Central Coordination Unit first consisting of a full-time, and now of two part-time staff members started to function in 1997. The staff are employed by the Nature Conservation Service of the Institute of Environmental Management of the ministry, but are seconded to the Authority for Nature Conservation of the Ministry of the Environment. A Scientific Advisory Committee of highly respected experts from academia and NGOs was constituted in 1998 to advise the government as regards the monitoring activities.

The cores of Regional Monitoring Units have been set up by employing a regional coordinator at each of the nine national park directorates of the country, who first participated in special in-service training courses in habitat mapping and phytocoenological surveying.

In 1998 the regional coordinators carried out regional and national "pilot projects" specified by the Central Coordination Unit at population and landscape levels.

By the end of 1998 the Central Coordination Unit of the BMS elaborated a project plan for launching the first nation-wide monitoring projects. Because of the still rather limited governmental financial resources, careful selection was necessary. The joint decision of the Central Coordination Unit and the Scientific Advisory Committee was basically motivated by international obligations, national interests, local problems and practical considerations.

Preference was given to the following projects:

- Nation-wide monitoring of protected and threatened plant and animal populations (their allocation is often linked to CORINE Biotopes or/and planned NATURA 2000 sites). The groups to be monitored: mammals, bats, certain bird species, amphibians, reptiles, fish, vascular plants, mushrooms, certain invertebrates (trend monitoring).
- Nation-wide monitoring of the biocoenoses of surface waters and wetlands (adaptation of the normatives of the EU for freshwater qualification, monitoring of Ramsar sites).
- Nation-wide monitoring of the habitat patterns of Hungary, by mapping the selected 125 quadrats of 5x5 km.
- Nation-wide monitoring of invasive plant and animal species and phytocoenoses threatened by invasion.
- Nation-wide monitoring of selected sites within the proposed Hungarian Forest Reserve Network.
- Regional monitoring of the biota of the Kis-Balaton II. water quality improvement system under construction (part of the Balaton Uplands N. P.) (based on earlier datasets).
- Regional monitoring of the Szigetköz area, exposed to the effects of the Gabčikovo water barrage system on the Danube (integration of the earlier datasets into the National Biodiversity Monitoring System).
- Regional monitoring of salt-effected habitats unique in Europe.
- Regional monitoring of dry grasslands exposed to global warming.

The above projects are listed in priority order.

The system plan for the database of project information is under development, although some modifications according to user requirements can be expected in the future. Standardised species lists have also been completed for certain "problematic" animal and plant species groups (taxonomic look-up tables).

An ad-hoc working group appointed by the Central Coordination Unit is elaborating the detailed project plan for each project.

Each project plan contains the title of the project, name and address of the responsible leading person or organization (institution), the character of the project (preparatory, survey, trend monitoring, hypothesis testing), the geographical scale, planned duration, financial sources. The detailed description includes the aim and justification of the project (what and why to monitor), the ownership, the history and earlier management and research of the site, as well as the characterization of the objects and their attributes to be monitored, the sampling strategy to be followed, the methods of sampling and data evaluation, and the expected results (data sets, maps, photos, tables to be produced).

A detailed work plan sets out the requirements in terms of expertise, personnel, logistics and finances.

The recommended frequency of sampling is 8 years for habitat mapping, 3-5 years for plant communities, 1-5 years for most species but 2 years for threatened species (e.g. OECD/EUROSTAT reporting).

Hungary has expressed interest to join the European Environment Agency, which will allow us to take up an active role in developing the European Nature Information System (EUNIS) by capitalizing on the experiences of the Hungarian NBMP.

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A homepage of the NBMP can be found at http://www.gridbp.meh.hu/BIODIVER/INDEX.HTM. At the time of writing, the English version of the homepage was under construction. Inquiries by e-mail can be addressed to biodivmon@ktmdom2.ktm.hu.

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