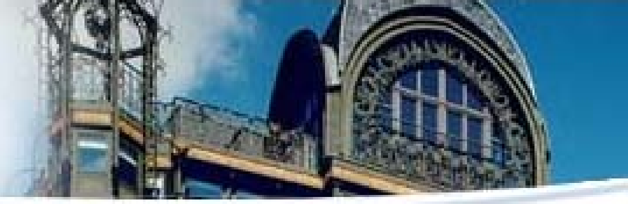
EPBRS meeting



Belgian Biodiversity Platform

Proceedings of the 5th meeting of the

European Platform for Biodiversity Research Strategy

2-4 December 2001 – Brussels

SCIENTIFIC TOOLS FOR BIODIVERSITY CONSERVATION: MONITORING, MODELLING AND EXPERIMENTS

WEB VERSION – PART 2

Federal science policy

Meeting under the Belgian EU Presidency

Edited by

H. Segers, E. Branquart, A. Caudron & J. Tack

BIOplatform EUROPEAN PLATFORM FOR BIODIVERSITY

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Proceedings

4 Electronic conference

4.1 Session 1. Biodiversity conservation in practice: Successes and failures of biodiversity conservation projects

(Moderators: G. Raeymaekers & E. Branquart)

4.1.1 Summary of session 1: The use of biodiversity research for on-site nature protection.

Geert Raeymaekers &Mats O.G. Eriksson

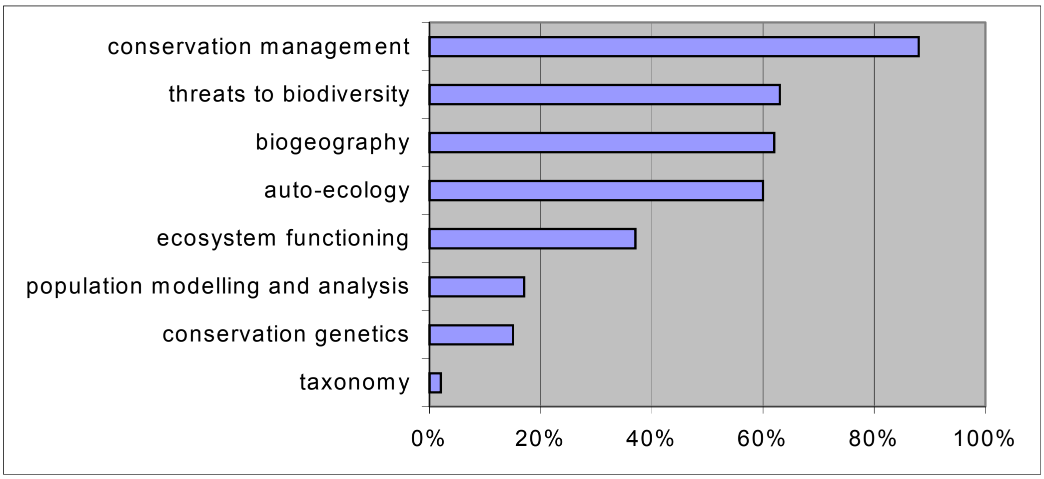
Ecosystems LTD, Brussels

Introduction

The following is a summary of the first session of the e-conference "Scientific tools for *in-situ* biodiversity conservation". The objective of this session was to focus on concrete nature conservation and to obtain information from 'field practitioners' on the use of biodiversity research data for practical conservation. An additional aim of this session was to document biodiversity research issues, which should receive more attention or should be more adequately addressed in the research programmes.

The LIFE-Nature projects as a case study

The LIFE-Nature projects were chosen as a case study to assess the importance of biodiversity research in practical conservation. Of the circa 500 ongoing LIFE-Nature projects, a selection was made of ca 50 representative projects, which addressed specific scientific questions or where it was apparent that specific scientific research preceded the LIFE-Nature project. The following table indicates some scientific disciplines in the sample of LIFE-Nature projects. Additionally and on the basis of the selected projects, it seemed that research questions are more explicitly addressed in LIFE-Nature projects, which focused on species than on projects, which focused on habitat management. Research issues dealing with monitoring biotic and abiotic parameters were important in most projects.



A successful participation to the e-conference.

Of the 600 participants (those who registered), *more than 110 people* participated in to the e-conference, of which circa 80 contributed to this session 1. Overall most participants to the e-conference were closely associated with nature conservation projects or policies. Among the contributors, most came from the scientific world and less (ca 60%) were, at least partly, involved in concrete conservation measures (including only 15 LIFE-Nature beneficiaries). Finally, about half of the contributors were also active *policy makers*. Generally, the participation seems to indicate for many on-site practitioners "biodiversity research" is not the priority issue of importance. Other, more concrete problems require most of their attention.

This session was successful because of the *high quality of many presentations* and comments and of the wide range of discussed items: from presentations which emphasised the importance of detailed ecological research on a certain butterfly, to those that emphasised the need to address the cultural issues in biodiversity conservation.

Finally, the *discussions were even emotional*. Scientists, policy makers and field practitioners alike have witnessed the decline of species and habitat types and are often deeply involved in on-site conservation actions. Consequently, many presentations stressed ethical issues or lobbied for more concrete actions.

Given the wide range of participants and contributions, it is nevertheless possible to draw some conclusions from this session of the e-conference. These are:

Independent and rigorous research is the basis for successful biodiversity conservation.

In conservation research, science and politics do meet. This dualism between policy and research was apparent in many contributions, in particular in the cases, which discussed monitoring and indicator species. It also epitomises the relationship between policy makers, scientists and field practitioners

Whether at the regional, national or European level, political choices decide which species and habitat types should be protected. However, sound scientific (biodiversity) data are needed to prepare these choices, to implement the conservation policies and to monitor the success of these conservation programmes and projects. This implies rigorous ***and*** *independent scientific research.*

Additional research projects must address the socio-economical context in which on site conservation takes place.

Success or failure of concrete, on-site conservation actions (e.g. LIFE-Nature projects but also other conservation programmes) is influenced by *socio-economical problems*. For the practitioner, problems such as local opposition to conservation measures and the change in land-use, financial constraints and lack of project management are much greater challenges to over-come than how to link the project actions to the relevant scientific experiences. Scientists and policy makers tend to overlook the fact that for practitioners it is the political and socio-economic constraints that are main difficulties to solve when launching a project. At least field practitioners have to give less attention the scientific problems.

Most field practitioners have a good understanding of the biodiversity issues before they start a biotope conservation project. Knowledge about biodiversity is often regarded as minor constraint that has to be compensated by experience, intuition and common sense, although almost no one questions the necessity of sound scientific bases. The majority of the LIFE Nature projects are "experience-based" rather than "evidence-based".

In this context, it must be emphasised that several participants stressed the need to pay more attention to the sociological implications of an on-site conservation measure. Although they recognise the need to implement their projects in a sound scientific context, they find various socio-economic constraints the most urgent ones to tackle in order to ensure a successful result.

There is a need to set up research projects, which address the socio-economical context in which conservation actions take place. Optimally, these research projects should be integrated with other sectors and should aim the development of management routines through which the various socio-economic constraints can be tackled more smoothly than is often the case in conservation projects at this moment.

Several participants pointed to the use of "flagship species" as a means to gain public support for the protection of threatened species or threatened biotopes. However, the use of 'flagship species' yields the best results if conservation programmes around flagship species maintain an ecosystems approach and include local developmental aspects.

Also, the contributions on the agri-environmental support mechanisms *touched upon the socio-economics of biological conservation. In the first place, participants to the e-conference indicated that most agri-environmental measures do not improve the conservation stage of the more sensitive threatened species. Secondly, research is needed to integrate the agri-environmental measures into sustainable farming practices (instead of merely providing some extra income).*

A need for "expert systems"

It might be trivial to say that "knowing what to protect" and "understanding the impacts" are essential for successful on-site conservation that "sound scientific information and data" are needed. However, policy makers, scientists and field practitioners use information in a different context and therefore differ in the value they give to scientific data. Some participants opposed the information value of data against the scientific value of these data. This became clear in the e-conference when the use of "indicator species" was discussed (but also applies when other types of information, e.g. management practices, are disseminated). It was emphasised that compilation and transfer of scientific information must be carried out with much scientific care. Too often during transfer of information, data sets are simplified to such an extent that the message may seem clear but that the context in which the data were gathered has been entirely lost.

There is a clear demand of expert systems to consult. But to be effective, these systems must provide the right kind of information for various target groups (e.g. scientists, practitioners, policy markers) and often be adjusted to the demands of the individual projects and persons.

In this context, it remains useful to flag up the need of a common build-up of basic knowledge, although it is hardly a new and innovative thought. There are however many demands, which the participants expressed; for instance, access to the wealth of information that is stored in databases without public access. Scientists and practitioners want to have a better understanding of distribution data, good classifications, best guidelines for restoration measures etc.

Need for fundamental research and a European-wide monitoring.

Taxonomy, vegetation sciences, autecology, population dynamics, ecosystems research, etc. all these research fields allow us to build up a “basic knowledge” for on-site conservation action. Despite the recognised importance of these research fields, many on-site practitioners no longer see these themes as having a direct effect on (or even relation with) their work.

Looking at the European space, many contributors stressed the shallow knowledge of fauna and flora and the need to monitor distribution, population trends, ecology of species and habitats and so on. Additionally, in too many cases, we can only witness the rarity or decline of a species, but have no understanding the ecological roots of the problem.

Fundamental research remains essential to understand biodiversity and to prepare the framework for conservation programmes. It is necessary to support research projects with a European-wide perspective and to allow the support of long-term projects (up to a decade or more).

Long-term research (> 10 yrs) is particularly needed in monitoring research but also in general ecological research. This is urgently needed since it is often not possible to expect any effect of restoration projects until many years or some decades after the restoration projects. Long-term monitoring is necessary if to document trends in long-lived species with long generation times and low annual recruitment. Participants to this session warned of the possible pitfalls, risks and erroneous conclusions if one relies on too short monitoring periods.

Support the involvement of volunteer networks.

Volunteers play a very important role in the collection of basic data on species and habitat types. The involvement of volunteers in the past and the present allowed the development of conservation policies and measures. The amount of time devoted by these volunteers to document the distribution and ecology of species and habitat types represents a budget, which cannot be paid by taxpayers' money alone. However socio-economic pressures make it more difficult for young people to get involved in these volunteer organisations. We need more than just awareness-raising campaigns to support these volunteer organisations; also structural changes in the professional lives of many (young) people are needed to support volunteer work.

At the national and European level, there is an increasing need to support these organisations, to integrate these organisations into biodiversity research and policy making and to create networks amongst these organisations.

Examples of networks do exist: e.g. Planta Europa, BirdLife International, the European Committee for the Conservation of Bryophytes, etc. However, more networking and international collaboration is needed and data collected locally should be made available to assess biodiversity trends at larger scales.

[1] LIFE-Nature is the financial instrument of the European Commission DG ENV to co-finance conservation project in view of the implementation of the Birds and Habitats Directives (see the website of DG ENV for additional information: http://www.europa.eu.int/comm/environment/hnature/home.htm

4.1.2 Messages posted to the electronic conference

4.1.2.1 Case studies

4.1.2.1.1 Regeneration of limestone grassland on cliffs of the Baltic Sea near Oldenburg, Schleswig-Holstein, Germany.

Author: Hauke Drews **Date: 7 November 2001**

I would like to present you a case study related to a LIFE-nature project I'm involved in. Here are my answers to the questions addressed in the welcome message of the fist session of this e-conference:

(1) What are the objectives of the project?

Our LIFE-Project focuses on the Regeneration of limestone grassland on cliffs of the Baltic Sea near Oldenburg, Schleswig-Holstein, Germany.

(2) What kind of literature information was used to design the project?

Regional Information from historical data, Prahl (1880): Kritische Flora von Schleswig-Holstein, actual data from the biotope mapping of Schleswig-Holstein 1978-1998, actual soil mapping-data of the region.

Literature:
Grime, J. P., Hodgson, J. G., R. (1988): Comparative plant ecology, Allen & Unwin, London, Great Britain.
Bakker, J. P.(1989): Nature Management by grazing and cutting, Kluwer academic Publishers, Dordrecht, The Netherlands.
WallisdeVries M. F., Bakker, J. P., Van Wieren, S.E.(1998): Grazing and nature conservation, Kluwer academic Publishers, Dordrecht, The Netherlands
Finck, P. Klein, M., Riecken, U., Schröder, E. (Bearbeiter) (1998): Förderung dynamischer Prozesse in der Landschaft, Schriftenreihe des BFN, Hft. 56, Bonn Bad-Godesberg, Germany.

We have experience from different grazing projects in Schleswig-Holstein i.e. in areas of the nature conservation foundation of Schleswig-Holstein: www.stiftung-naturschutz-sh.de, (E+E project "Höltigbaum")

(3) Which scientific tools have been used to guide management actions? (With special attention to experimental design and monitoring schemes)

We are just starting the LIFE-project. The aim is to regenerate lime grassland on former agricultural areas. The areas are still in agricultural use. The most important part is to organise the change of land use in the area and to establish a grazing system for a long-term regeneration process. The actual situation in the beginning will be described with a detailed vegetation mapping of the area and additional investigations about special insect groups.

A long-term monitoring is yet not planned, but could be done on the base of the vegetation mapping. Eventually a aerial photo sequence will be taken.

(4) What kind of obstacles were encountered during the project?

The most important obstacle at the start of the project is the competition with the farmers about the land. Schleswig-Holstein is an agricultural land. About 75% of the hole land is used for agricultural purposes. In the project area are very rich soils. The structural change within the agriculture force the farmers to enlarge their farmland. Due to the agricultural subsidisation-system of the EU, the farmers receive between 300 and 650 Euro per hectare and year in Schleswig-Holstein. The subsidies and the intensive production on the rich soils gave the farmers the ability to pay for agricultural land in these area between 20.000 and 25.000 Euro/hectare. So we need for our Project in this area a lot of money to buy the land.

Comparing the financial volume of the LIFE-Programme (640 Mio Euro for 4 years within the hole EU) and the volume of the agricultural subsidies (roundabout 2200 Mio EURO each year, only Germany) makes sure why we have problems with the biodiversity within the western EU-countries.

(5) What are the main expectations towards conservation biology?

The conservation biology must close the gap between ecology and economy and between science and public relation. For conservation interests we need more public awareness about this themes.

Conservation biology should focus investigations on:

(1) The development of expert systems and internet data systems for easy and fast access to the actual knowledge for conservation practice purposes.

(2) The ecology of rare or endangered species and their communities, especially investigations in population biology.

(3) The relation between land use and biodiversity.

Could science be useful to improve management success?

Yes, when science keeps contact with practise. The questions in practise often seem to be easy but "unscientific" but are not easy to be answered: 1. What are the reasons for the dramatical increase of *Arnica montana* (mountain tobacco) in heathlands? 2. Why does *Juniperus communis* fail to restock the heathlands of Germany? etc. 3. Under which conditions can we expect *Spaghnum imbricatum* as an important peat builder again in regenerating bogs?

Many questions of this type could only be answered seriously with a huge amount of autecologic information. This information if already available is widespread within scientific work and should be brought together in a special designed data-system. The same is needed for ecosystems.

4.1.2.1.2 **Reintroduction of the Golden Eagle into the Republic of Ireland**

Author: Lorcan O Toole **Date: 8 November 2001**

Reintroduction of the Golden Eagle into the Republic of Ireland (LIFE00/NAT/IRL/007145).

1 - What are the Objectives of the programme?
Our primary aim is to re-establish a viable Golden Eagle population in Donegal in North-west corner of Ireland. We will release 60-75 birds (collected under licence from Scotland) in Glenveagh National Park between 2001-2005.

We also hope to raise public awareness of Irish birds of prey in general. Ireland has one of the lowest ranges of breeding raptors in Europe due to historical persecution and habitat loss (e.g. deforestation).

2 - What kind of literature was used?

The project actions were based on a thorough understanding of raptor reintroduction programmes and of the Golden Eagle, which is comparatively well known.

Guidelines for Re-introductions, prepared by the IUCN/SSC Re-introduction Specialist Group in 1998 (IUCN, Cambridge) were the key reference document for the project proposal. The project team already had first hand experience of managing the Red Kite Reintroduction programme in Scotland. A Golden Eagle monograph, 'The Golden Eagle' by Watson, J. 1997. T & AD Poyser, London was also invaluable.

Literature:
Key conservation concerns regarding *Aquila* Eagles were gleaned from:

Action Plan for Spanish Imperial Eagle, compiled by Luis Mariano Gonzalez, Birdlife International.
International Action Plan for the Imperial Eagle, compiled by Borja Heredia, Birdlife International.
The draft Species Action Plan for Golden Eagle in Britain compiled by the Royal Society for the Protection of Birds.
Two reviews of reintroduction programmes in general were very useful namely; Fischer, J., Lindenmayer, D. B., 2000.
An assessment of the published results of animal relocations. Biological Conservation 96, 1-11. Cade, T. J., 2000.
Progress in translocation of diurnal raptors. In Raptors at Risk, eds R. D. Chancellor, B.-U. Meyburg, pp343-372. WWGBP/Hancock House.
Reintroduction plans for Red Kite, Osprey and Beaver in Britain were also used.

Apart from the literature review the comments and views of several conservation managers and reintroduction and bird of prey specialists in Ireland, Scotland and England were sought.

3 - Which scientific tools were used?
The Scottish donor licensing authority posed two key questions, would the removal of donor stock have a detrimental effect on the Scottish population? And do the planned releases have the potential to produce a self-sustaining Irish Population?

We approached Dr Alan Fielding, Manchester Metropolitan University who kindly developed two Monte Carlo models to answer these concerns. The Golden Eagle Productivity Model demonstrates that the removal of chicks from Scotland should not have a detrimental effect on the Scottish population. The second model was a MINITAB Release Model using multiple simulations to derive the expected population structure and is based on four assumptions.

Because actual Golden Eagle survival rates are unclear three levels are tested: 0.25, 0.50 and 0.75. It is expected that between 3-13 home ranges will be occupied by 2007, if only 12 birds are released each year. This imprecise estimate is a consequence of uncertainty about juvenile survival rates.

4 - What obstacles were encountered during the project?
The project began in March 2000 and the first Golden Eagles were imported and released in the summer of 2001. Opposition from local hill sheep farmers were thought to be the primary obstacle to the project. Even before the project commenced we started consulting the local farming bodies and they have joined our project steering group, which is of enormous benefit to the project. Liaison with hill sheep farmers and gun clubs has gone extremely well to date but difficulties could easily arise due to perceived threats to newborn lambs as the project progresses.

To date most of our opposition has come from within sections of the conservation movement. Whilst our small but focused group was able to raise funding for this high profile project, other cash strapped conservation groups tackling more intractable and broader problems felt these monies should have be used elsewhere.

5 - What are the main expectations towards conservation biology?

We have deliberately engaged three key audiences (the farming community, the tourist sector and the Irish speaking Gaeltacht community) in the project and have placed a strong emphasis on seeking support from the Donegal general public and school children. Because our potential Golden Eagle home ranges will be relatively accessible we need to mindful of the socio-economic aspirations of the wider community.

In the near future there will be varying levels of sheep destocking on the Republic of Ireland's upland commonages. In the long term this could mean lower Golden Eagle densities, due to decrease in winter carrion, but greater breeding productivity, due to increased live prey availability. The populations of Irish Hare and Red Grouse, the availability of Red Deer and Sheep carrion and the densities of predator populations such as Fox, Raven and Hooded Crow need to be monitored. A better understanding of Ireland's upland predator/prey relationships would benefit the project and help identify the optimum grazing densities.

Could science be useful in improving management success?

Yes, we will carry out a thorough review of the project during the third year of the five-year programme. We will evaluate the survival rates of the first three released cohorts and carry out further modelling in order to assess whether releasing 60-75 birds will be sufficient in order to establish a viable population.

The debate in Ireland has thrown up the question, at what stage of our ecological past should conservationists aspire to under our biodiversity commitments? Golden Eagles became extinct in Ireland in 1912. Other birds of prey became extinct here 200-300 years ago. Obviously we believe we have satisfied the IUCN Reintroduction criteria but some discussion regarding this point would be useful.

4.1.2.1.3 **Chalk Grasslands in the Seine Valley**

Author: Didier Alard **Date: 8 November 2001**

I would like to present you also a case study of chalk grassland conservation and restoration as part of a Life-Nature program. The project itself is headed by the "conservatoire naturels des sites de Normandie" which is a regional wildlife trust and we are responsible in my university lab of the scientific monitoring. The interest of this project is that it considers within a broad regional scale (about the 100 km of the lower seine valley and adjacent rivers) a set of habitat (screes with an endemic species, chalk grasslands, scrubs and former crops (vineyards) with rare weeds) that we aim at managing for different purposes. Most of the chalk grasslands in this area are actually out of the agricultural influence (We are in a densely populated area) and their are, in practical, managed by the conservatoire with its own flock of sheep or cattle (rustic breeds) or other means.

What have done we at the university for the monitoring of habitat quality? A long term monitoring is performed since 1999 by two means:

1 - permanent quadrats were arranged in a hierarchical scheme in order to nest small samples (quadrats from 1 to 16 square meters) in larger ones (transects of 100 m) within different sites. As a whole, this represent a data base of 4000 permanent quadrats distributed in 35 transects and five sites distributed along the valley in which vegetation (and other groups like insects and earthworms in the future) is surveyed. Statistical tools were used to perform empirical modelling and identify regional gradients (climate) and local factors (succession). The sampling design allows us also the use of geostatistical tools.

This data set can help us to understand how management create or remove heterogeneity and at which scale (square meters or hectares). Conserving species can be achieved by different ways on one site of several hectares: by creating spatial segregation (with different plots and different management regimes) or encouraging species rich communities at very local scale on the whole area.

Under these very practical questions of conservation management, we have developed scientific research in the field of (1) ecological restoration (what kind of ecosystem of reference should we aim at restoring, is there a single reference and if not are they compatible?) and (2) community ecology (what kind of communities do we create with different types of management i.e. the mechanism of species coexistence induced by disturbance (isolated) or disturbance regime (repeated management practices); do we want communities in equilibrium with a stable regime of management or do we want changing and non equilibrium communities?...)

2- a second tool for monitoring was the use of GIS and aerial photograph, which were analysed and clustered by image analysis in order to map vegetation vertical structure (scrub, tallgrasslands, short grasslands, screes) and to monitor habitat grassland fragmentation. Our permanent quadrats were used in this context to validate the interpretation of the aerial photographs. This was performed also on former photographs (1965 to nowadays) The research here considers mostly landscape ecological aspects (fragmentation, heterogeneity at different scales, identifying changing or stable plots etc) but aims at answering the same type of questions: what are we doing one site of 10 hectares? Do we create the maximum of heterogeneity in order to reach different ecosystems of reference (which have never been coexisting from an historical point of view) or do we manage each site in a dynamic equilibrium where different stages of the succession can be reached but in a changing mosaic from year to year?

As Hauke Drews recently said in his own case study, the gap between science and practitioners is a problem of communication but I think also that science could help practitioners to identify the real purposes behind conservation management. What kind of biodiversity do we want for our species rich ecosystems and is species richness, originality or rarity a good criteria to monitor ecosystem quality or functioning?

In advance, many thanks for your comments.
I can propose a set of published papers or in press for people who might be interested.

4.1.2.1.4 Conservation of areas with threatened species of the flora in the island of Minorca

Author: Pere Fraga i Arguimbau **Date: 9 November 2001**

Here we've started, since only a few months, a LIFE-nature project to which are related some case-studies, we will try to answer the questions you introduce

(1) What are the objectives of the project?

The main objective of the project, as his name suggests, is the preservation and conservation of the endangered flora of the island. To reach this main objective the project sets several ways:

- Management and/or recovery programmes for the endemic and most endangered taxa.
- Set the basis for a plant micro-reserve network to protect all the taxa and plant communities endangered or with a restricted distribution area (endemic or not).
- Control and elimination of the threats that act on the island flora (specially some alien introduced plants).

So it can be said that this projects includes several case-studies.

(2) What kind of literature information was used to design the project?

The sources to design the project were mainly works on chorology, floristic and vegetation of the island. From these works have been got information to select the taxa and area that were worthy to the objectives of the project. Another good source have been the experience and information given by other projects with similar objectives, both, in the protection and management of endangered flora itself, as well as in the control and eradication of threats of invasive alien plants.

(3) Which scientific tools have been use to guide the management actions?

As is said, the project is just started, so we can talk more on the tools to use that on the used tools.

A basic tool will be the cartography. With this tool we at first will know the actual situation of the elements to work with. Later as the project goes on, and with a good cartography supported by a GIS and a related database, we could track the evolution of those elements in response to the planned actions (management programmes, area protection, invasive alien plant removal, etc.). This primary tool will be a complement for a more complex ones like the management or recovery programmes and different studies on methodology to establish a method to eradicate invasive alien plants with a minimum injure to the environment or to set way to re-introduce some very endangered plants (i.e. *Apium bermejoi* L. Llorens).

(4) What kind of obstacles was encountered during the project?

As the main part of the island lands are of private property to involve the land property in the importance of flora, and biodiversity, preservation will be the main obstacle to clear. But also this involvement must be extended to the local population as most of the threats to the flora come from the human activities. For this reason the project address an action series to the local population consciousness and participation, thus the success and continuity of the project works will be more secure.

(5) What are the main expectations towards conservation biology?

On one side conservation biology must deepen on scientific studies like population dynamics, ecology of rare and endemic taxa etc. But as is said before the main part of threats on the environment and biodiversity have their origin in the human activity, so the conservation biology must direct part of his efforts to bring these problems to the people and catch that the population get conscience on the importance of biodiversity preservation. In some way must be possible to put all these works at the people reach so they can understand his value and transcendence for the future.

4.1.2.1.5 Opportunities in the Hortobagy National Park (Hungary) to allow natural processes to take place: Conservation of processes instead of habitats

Author: Zsolt Vigvari **Date: 16 November 2001**

The principal role of the Hortobagy National Park (470 30' N, 210 10' E) is to conserve the largest unbroken alkaline steppe of Europe together with its special characteristics of landscape, elements of fauna and flora as well as a special tradition of grazing domestic Hungarian breeds. Two very important processes took place in the past causing habitat alterations in the region:

1. Up to the second half of the 19th century the Hortobagy was the floodland area of the River Tisza. After that the river was strongly regulated therefore most of the marshes lost their waterways supplying them with water from the Tisza. Perhaps to try to counterbalance the dryness of the region fishponds (75 on 6000 hectares), rice-fields and irrigation canals were built in the first half of the 20th century. The fishponds gradually became partly or totally

overgrown by reedmace *Typha* and reed that resulted in the appearance of large mixed heron colonies including Great White Egrets, Little Egrets, Squacco-, Night-, Grey- and Purple Herons, Pygmy Cormorants and Glossy Ibises.
2. Decreasing of the number of grazing animals in the past three decades that led to the undergrazedness of the whole area. Thus marshes with barren shorelines are now overgrown by tall alkaline marshy meadow vegetation. This resulted in the loss of some breeding bird species preferring barren alkaline habitats, e.g. Collared Pratincole *Glareola glareola* and Kentish Plover *Charadrius alexandrinus*. On the other hands new breeding species - preferring tall marshy meadows - appeared or showed population increases, e.g. Aquatic Warbler *Acrocephalus paludicola*, Montague's Harrier *Circus pygargus*.

Thus these habitat changes led to a situation where conservationally important species settled in artificial, or highly altered habitats. In order to preserve 'original' and 'new' habitats of different succession phases and connected species the National Park management is trying to work out a dynamic, mosaic-like system, where all different types of habitats coexist in the whole area (ca. 80,000 hectares), although in different proportions. Now it is possible to supply artificially the largest marshes with water in droughty seasons, as well as part of the grazing livestock is managed in accordance with the needs of the conservation management. The management of fishponds (i.e. varying the water-level to provide habitats for heron colonies as well as for feeding and roosting flocks of geese, ducks, cranes, waders and gulls) is also now greatly coordinated by the National Park. The habitat succession in natural grasslands with marshes is planned to be set free for some years (the amount of it is still unclear, some studies investigate it), then by altering the water-level and grazing activities the succession phase can be transformed into a earlier phase, as was shown in involuntary cases and small sample areas. Besides lots of experiences regarding habitat alterations were gained in 1999 and 2000 when extremely large flooding have greatly changed the habitat composition of an 8,000 hectares large natural grassland area. Fishponds are thought to be managed in a way that mudflats, shallow and deep water bodies are provided simultaneously in the region, with lots of experiences behind it.

In summary, we would like to conserve processes in a mosaic like turn-over system, where all types of habitats are to be found at the same time. The most important tools are the management of water-level and grazing activities.

4.1.2.1.6 **Action for birds of reedbeds in the River Haine Basin**

Author: Gaëtan Bottin **Date: 19 November 2001**

Here is a short contribution from a practical case in Belgium. The LIFE-Nature Project 'Actions for Birds of Reedbeds in the River Haine Basin' started in July 2001, so this contribution only represents our views after a few months work. We will present the main questions we are facing in our work regarding management of reedbeds. The wetlands of the River Haine Basin are located in Belgium, between the City of Mons and the French border. Within the area concerned by the project, one can found three sub-sites consisting of large reedbeds and associated wetlands. These sites present a high ornithological interest, but are also very important botanically and entomologically. The following bird species are particularly targeted through this programme: bittern, little bittern, marsh harrier, bluethroat, great reed warbler, etc.

One of the main objectives of the project is to undertake conservation work in existing designated sites. In these sites, the technical, human and financial resources allocated to conservation work have been rather limited in the past, and the degradation of these sites could not be avoided. A new system of water levels management has recently be put in place for the largest site. However, many reedbeds have developed into carr, mainly through encroachment by willow. Thanks to the LIFE-Nature Project, a big effort will be given to remove trees in reedbeds threatened by afforestation. Elimination of willow stumps is essential in many cases in order to avoid regeneration. In this context, several techniques will be considered in order to get rid of willow stumps: uprooting the stump, applying herbicide on the stumps, drilling the stump, etc. The choice of the technique is difficult for several reasons. First, many constraints render the choice complex, such as costs, access to the sites and the restricted period during which conservation work can be carried out due to nesting periods. Second, we need more information on the relative cost-efficiency of the different techniques. We haven't found, so far, any examples where the stumps had been uprooted. We would also need information on the efficiency of treating cut stumps with herbicide. Considering the amount of work that need to be done, we really cannot afford to get it wrong with the technique.

Alongside this extensive tree removal, a trial of reedbed restoration will be carried out through the cutting and removal of the superficial layer of the ground. In addition, channels and ponds will be created within some reedbeds. Indeed, we need to restore reedbeds not only in terms of quantity but also in terms of quality, the final goal being to re-create potential breeding sites for some target bird species (i.e., bittern, little bittern, marsh harrier, great reed warbler, etc.). Therefore we need to know more about the quality of reedbeds for these bird species in relation with different management techniques.

When talking about biodiversity research, it seems that one aspect is sometimes forgotten, that is research about management techniques. Is it the role of academic research to deal with such concrete problems, or should this problem be dealt by practitioners through the sharing of experiences and information?

Another crucial question is whether this conservation work - coupled with regulation of water levels in the sites where it is possible - will maintain reedbeds in the long term. Without management, reedbeds turn into dry fen and then develop into woodland. This evolution is a normal process, and would not be a degradation if man had not prevented flooding and oxbow lake creation from happening. These phenomenon would regenerate or create a new succession. In a densely-populated region such as the River Haine Basin, it is impossible to get back to a situation where the natural river processes can happen freely. In this context, will we be forced to get back into the reedbeds again and again to remove the trees or to cut the superficial layer of the ground? The LIFE Nature Project is also financing the acquisition of about 60 hectares of new areas. In some of these areas, restoration of reedbeds will be initiated. These new sites might be a hope for the long-term.

As far as monitoring is concerned, a system of ornithological monitoring will be put in place. This monitoring system, coupled with vegetation monitoring, will offer the opportunity to assess the results of the conservation work undertaken. However, one main difficulty is that most species concerned are migratory species (for example, little bittern) and / or species whose decline is generalised across Europe (for example, bittern). In this context, it might be difficult to distinguish between the effects of conservation work and the effects of external factors (such as problems in wintering sites). As you can see, this project raises a number of issues, from very practical ones to prospective ones, that could be dealt with in biodiversity research. Thank you for reading this contribution.

4.1.2.1.7 RE: Action for birds of reed beds in the River Haine basin

Author: Lennart Gladh **Date: 21 November 2001**

Reed bed restoration and management is an exercise that really would need some sum up. Many projects have been, and are, launched all over Europe and lots of resources are spent. Very often the focus for the efforts has been to create /manage suitable habitats for birds (bittern, marsh harriers, great reed warbler and some others). Only in Sweden at least 20 different sites have been "restored" and are managed. The most famous of them is lake Hornborga. This is also the only site in Sweden where the experiences have been published (book and video also in English- contact Sw. EPA).

Talking out of lessons learned from this and other sites and from practical experiences from Asköviken bay restoration some basic things could be forwarded. First -every wetland/reedbed is unique depending on the water regime, status of nutrients, earlier land use etc. there are no easy, single answers.

Second-Reed beds represents typical stages in a succession meaning that willows, birches, alder (or other species) will appear. Normally we want to keep certain stages favourable for some birds.

Third-You should not use herbicides in a protected area especially not when you do it in water. This is not only due to the fact that you might have effects you don't want to have. It also sends strange signals to the public if we should start to manage nature with herbicids. In Sweden it’s out of question and any EIA would consider it impossible.

Four-stumps (willows, trees). A very effective technique is to use a tractor (or any strong vehicle) and wires and pull them up. Depending on the conditions you could do it on dry/solid land quite far away from the reed. There will of course be open holes without vegetation but after 2-3 years these holes will be covered and green. For bigger stumps (trees) there are drills/cutters for tractors that are very effective.

Five- In the past man used reeds for different purposes (roofing, instead of straw and hay for animals, grazing, isolation). This together with less nutrient rich waters and natural water regimes (higher amplitudes) caused stress and less favourable conditions for reed.

So what is needed is to try to copy these conditions and create/manage reed beds where we have open water, areas with other types of vegetation and different quality of the reed stands (different ages). The used techniques (in Sweden) to do this have been "green burning" (which most likely kills the reed) winter burning ("refreshing" the reed bed), winter cutting, and using of different floating cultivators, using of military vehicles to destroy the rhizomes and roots.
Very often the areas where reed beds are established have been used for haymaking and/or grazing as they normally are very productive. So using these traditional methods will "press back" the reed form the landside. This will not so much help the "reed birds" but it will create favourable habitats for other threatened birds like some waders and ducks.

Six-Monitoring-The problem with migrating birds is exactly as described they fly away and could be effected (positive or negative) during the winter. What is needed is -link the monitoring directly to the management (compare managed and not managed areas or areas where different techniques have been practised) -have a long term commitment (10-20 years) -compare with other similar nesting places

The EU funded project Eureed (on the web) has published some interesting findings. A book that could be recommended is: "Reed Bed management for commercial and wildlife interests" CJ Hawke and PV Jose' RSPB 1996

4.1.2.1.8 Environmental impact assessment in heathland ecosystems.

Authors: Knud Erik Nielsen, Morten Strandberg and Jesper Bak

Date: 20 November 2001

We would like to present a case study from a heath area in the western part of Jutland. The project focuses on: "test of conservation objectives, methods to calculate critical loads and assessment of management strategies". In more specific terms the project aims at establishing a link between the present status of the heath and the pressures acting on the heath, i.e. nitrogen deposition and lack of management. From this point strategies to reach the more favourable state, which is expressed by the conservation objective, will be investigated. The strategies will include a selection of heathland management strategies and a reduction of pressures.

In the project a new guideline for assessment of ammonia effects in approval of large agricultural farms under the Danish VVM- regulation (the Danish implementation of the IPPC-directive) will be tested. Furthermore the project will draw on a proposal for conservation objectives in relation to the EU-Habitat directive.

We have chosen a larger heath area with different kind of management as our work area. The conservation status of the Danish heaths is largely uncertain. However the cover of mountain- and dune pine, aspen and juniper increases in major parts of the heathlands. A major threat towards the heaths is the increased deposition of nitrogen. Increased nutrient loading is expected to substantially elevate the nutrient level of the soil. While the elevated nutrient level may prove advantageous to many species, the same levels may become deleterious to several other species leading to their disappearance from the ecosystem. Disappearance of some species may disturb the ecosystem equilibrium because the survival of some species is often dependent on the survival of many other species present within the same ecosystem.

In the Netherlands, where levels of nitrogen deposition are considerably higher than in Denmark, observations have revealed extensive damage to lichens in the dry sand heaths, and a tremendous growth of mosses at the expense of lichens. Nitrogen-induced change from dominance of dwarf-shrubs to grasses has also been observed in heath and dune heath areas in the Netherlands. In Denmark current levels of nitrogen deposition lie close to or exceed the critical load for heathland and observations also point in the same direction as in the Netherlands.

Project periods
Project start: autumn 2001
Project end Report on the value guidelines of IPPC manual and
Conservation objectives as scientific tools for biodiversity / habitat conservation - spring 2002

What are the objectives of the project?

We have made a suggestion for conservation objectives and a technical guidance for the practical monitoring program for heathland and coastal ecosystems. The aim of this project is to test the suggestions related to "dry heathland". As one of the criteria is: "Critical load must not be exceeded" we also test different methods of estimating critical loads both by use of the general chemical criteria and by use of ecological indicators such as vegetation-structure, -composition, N-content in litter and shoots. We will present a poster at the conference.

Thus the primary objectives of our project are:
* To test methods to calculate critical loads for a selected heath area.
* To expose the connection between conservation status and exceedance of critical load.

Secondly the scientific needs, which have to be assessed before relations between conservation status and exceedance of critical loads can be properly established, will be identified. For now the list of scientific needs is already long and is listed here below.

What kind of research is needed in relation to Habitat monitoring and assessment of conservation status?

So far we have identified the following areas, which has to be investigated before the suggestion for conservation objectives will be ready for use in monitoring programmes.

* The interactions of management, biodiversity and CL (nut)exc.
* A comparative investigation of heath areas with favourable and unfavourable conservation status to assess the variation in chemical and botanical parameters.
* The influence of phosphorous. The relation between conservation status, C/N-, C/P-status, former and present land-use, soil fertility.

* Identification of indicators of disturbances on the nitrogen cycle. An increase in deposition of nitrogen will have effect both on vegetation-, soil- and microbiological processes.
* A well-considered selection of indicators on favourable conservation status will be a main task in the following years. Some parameters will be difficult to measure and others might have large year to year variations and will probably not be operational. For example the use of botanical indicators will have a considerable time-lag response in relation to exceedance of critical load of nitrogen.
* The best candidates seem to be a combination of content and composition of amino acids, total nitrogen content in shoots combined with litter content.
* Development of methods to measure the local deposition of nitrogen - bulk-, throughfall-deposition and measurements of air concentrations in passive collectors.
* Calibration and validation of existing dynamic soil chemical models (SAFE, SMART) on a number of locations covering the dominant habitat types of both heathland and coastal heath. Sensitivity analyses for the parameters should be performed in order to optimise the monitoring program on the intensive monitoring stations.
* In order to validate these models the nutrient circulation on nutrient-poor habitat types have to be investigated.
* Adjustment and test of the biodiversity model MOVE on a number of locations covering both heathland and coastal heaths. It will be necessary to combine the vegetation model MOVE with models used in the critical load work in order to establish relations between critical loads and biodiversity.

Literature:

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Bak, J., Uncertainties in large scale assessment of critical load exceedances. In: Nielsen, K.E. and Løkke, H (eds.) 2001 Water, Air and Soil Pollution. Focus, "Critical Load Copenhagen 1999".

Bobbink, R. and Heil, G.W., 1993. Atmospheric deposition of sulphur and nitrogen in heathland ecosystems. In: Aerts, R. and Heil, G.W. (Eds.) Heathlands: Patterns and Processes in a Changing Environment, Geobotany 20, Kluver Academic Publishers, The Netherlands: 25-50.

Heil, G.W. and Bobbink, R., 1993. 'Calluna', a simulation model for evaluation of impacts of atmospheric nitrogen deposition on dry heathlands. Ecological Modelling, 68: 161-182.

Nielsen, K.E., Ladekarl, U.L. and Nørnberg, P., 1999. Dynamic soil processes on heathland due to changes in vegetation to oak and Sitka spruce. Forest Ecology and Management, 114: 107-116.

Nielsen, K.E., Hansen, B., Ladekarl, U.L. and Nørnberg, P., 2000. Effects of N-deposition on ion trapping by B horizons of Danish heathland. Plant and Soil, 223: 265-276.

We have experience from different research and monitoring projects on heathland and as UN/ECE national focal centre for Critical Loads and Integrated Monitoring.

4.1.2.2 Conservation of small populations

4.1.2.2.1 **Can we save small populations?**

Author: Etienne Branquart **Date: 6 November 2001**

About half of the projects presented in the 'document' section of the conference website www.biodiversity.be/bbpf/econf/econfdocpractice.html clearly refers to the conservation of emblematic flagship species. Most of them are highly threatened and only survive in small and fragmented populations, as it is the case for *Bombina bombina, Tetrao urogallus, Mustela lutreola* or *Alopex lagopus*.

Restoration actions undertaken in these cases are often very expensive and rarely fruitful. Interspecific relationships (predation, competition, hybridisation) seem to have a major impact on these small populations and to be able to ruin conservationist's efforts, leading definitively to species extinction!
In this situation, can we really hope to save such populations through 'artificial' processes such as eradication of potential predators, captive breeding or re-establishment of individuals removed from remote populations? Is it worth trying to restore such populations or is it better to concentrate conservation actions on larger populations?

Can the success of such conservation actions be improved thanks to a better knowledge of the functioning of small populations?

I'm really looking forward to know what does your field experience teach us about such conservation issues. This discussion area is yours,

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4.1.2.2.2 **Arctic Fox and other flagship species**

Author: Mark Wilson **Date: 6 November 2001**

In your mail you question the value of expending limited resources on "the conservation of emblematic flagship species. Most of them are highly threatened and only survive in small and fragmented populations". I am as interested as yourself to see what replies your message solicits, but am doubtful that the questions you pose have definitive answers. This is partly because the types of project covered by your description range from those that result in tremendous success stories to projects that (in hindsight, at least) seem to have been doomed to failure at their inception.

As well as this, there is the question of what we want conservation to achieve. In trying to describe what motivates them to try and conserve nature, some people have given me the impression that they consider certain aspects of our environment to be inherently more valuable than others. I think that the value of a particular place, habitat, species or population to any one of us depends entirely on the opinions and view-point of that person. Whatever, the "inherent value" point of view amounts to more or less the same as my own if different people perceive threatened aspects of our environment to have different "inherent values". So, trying to save the Arctic Fox from local extinction is obviously worthwhile for people who see this animal as the most valuable part of the environment (possibly because they derive a huge amount of enjoyment from seeing Arctic Foxes, or even just knowing that they are present). Other people mainly interested in the scenery, vegetation or insects of the region might see the presence of the Arctic Fox there as a near-irrelevance, it is unlikely that its removal would have much consequence for any of those aspects of the environment which they are most interested in. These are 2 extreme viewpoints, most conservation-minded people are likely to have more moderate opinions than these, but you see what I mean about values dictating goals.

Something that complicates the values issue is the concept of "flagships". It might be worth making considerable efforts to maintain even a very small and vulnerable population in an area if its presence there brings benefits to the area in general. These benefits might include a sympathetic attitude from locals, funding from non-locals or even legal protection for the area.

My view is that some small populations are definitely worth trying to conserve, whether it be by intensive protection of sites/individuals *in situ* (e.g. ospreys in the Highlands of Scotland or northern elephant seal in Mexico) or by reintroduction (e.g. Californian condor or Red Kite in Scotland). The topic of conservation of small populations is rich in material for debate and I hope it generates many replies.

Best wishes,

4.1.2.2.3 European Fire-bellied Toad

Author: Zoltan S. Varga **Date: 7 November 2001**

I think, the "emblematic" species may be rather different according to geographical regions. Of course, the saving of the small populations and their fragmented habitats is a central problem in the densely populated and highly industrialised countries. However, one should not forget that these species occur in abundant populations in some regions, where they can survive in vital and genetically diverse populations ("core populations" from the point of view of the conservation biology), if the conservations measures could be taken place at the right time.

Thus, the designation of the "core populations" and "core habitats" should have a priority for the next future.

E.g.:

1) *Bombina bombina* is a rather frequent species of the lowland marshes in the Pannonian region. The large lowland national parks of Hungary (mostly Hortobagy) cover numerous important habitats of this species. Thus, I think it would be necessary to compare the genetic diversity of these large populations and the fragmented western marginal populations, respectively. It would be the scientific pre-requisite of a later, practical restoration.
2) *Tetrao urogallus* seems for me a somewhat more complicated case, because there are South European, probably refugial populations, described as subspecies. Thus, the phylogeographical situation may be -as first working hypothesis- similar to that of the Brown Bear (see: Taberlet et al.). There is a large boreal area, heavily fragmented inn Central Europe, and some genetically probably differentiated populations in the Pyrenees, SW Alps, Balkans etc, which may represent different Evolutionarily Significant Units. My experiences suggest that hybridisation may be dangerous in small and fragmented populations, e.g. the disappearing of *Pieris napi bryoniae* from N Hungary as a consequence of logging and fragmentation of habitats, accelerating the introgression of *P. napi napi* into these populations. But no extinction danger does exist for *B. bombina* in the Pannonian lowland, although a mosaic-like hybridisation pattern with *B. variegata* has been described along the partly hilly, marginal areas of the lowland.

Because the four species mentioned below are ecologically rather different, I would be very cautious concerning the community ecological generalisations, as the possible role of competition, predation, parasites and diseases, etc.

4.1.2.2.4 Screes and other marginal habitats

Author: Henrique Pereira dos Santos **Date: 6 November 2001**

As we developed the managing plan for a natural park (P.N. Alvao, Portugal) we noticed that marginal habitats (rocky slopes, for example) have a very high concentration of endangered species (usually with a very few number of individuals).

Since these habitats are very poor, we worked with the hypothesis that our criteria to define endangered species strongly depend on the ideas of rarity and population isolation, forgetting that some habitats, like the ones referred above, are rare in nature and, probably, some of the species that have a close relation with this kind of habitats are naturally rare and with isolated populations.

If this is true, our strategies for the conservation of some small populations should be changed, integrating the idea of natural rarity and isolation.

4.1.2.2.5 RE: Screes and other marginal habitats

Author: Jan Jansen **Date: 8 November 2001**

As you probably know, Serra da Estrela has affinities with Serra do Alvao. Last year I advised in nature conservation connected to the Estrela master plan developed by ERM Portugal. In Serra da Estrela we have the type of biotopes you referred to. First there are the so-called screes. These biotopes are included in Annex I of the EU "Habitat Directive" (8130). The screes usually support high percentages of endemic species with restrict distribution areas. In the case of Estrela screes there are some 20 "scree specialists". Most of the species are at least Iberian endemics. Nine of them occur on the preliminary red list of vascular plants in Portugal; within Portugal 14 are restricted to Serra da Estrela and two are unique endemic Estrelean taxa (I discovered one a few years ago). Many of these taxa are assumed to be of Tertiary origin. The total surface of all the screes together is probably no larger than let's say three to five football pits!

Rarity of these plant species is not caused by man, but by climate and geomorphology. The biotopes and species in question may be threatened by stone extraction and mining and climate change (In winter most of scree specialists are protected by snow). Climate change is difficult to prevent, but local conservation is relatively simple, namely by legislation and surveillance. Climate change is more difficult of course.

Specific rock-outcrops may host the rare *Murbeckiella sousae*, a Portuguese endemic that occurs in the mountains of Estrela, Lousa, Açor, Freita, Marao and Alvao. This species grows in rock fissures and is listed on Annex IV of the EU Habitats Directive. The biotopes can be included in annex I of EU "Habitats Directive" (8220). The few sites where the species can be spotted are vertical cliffs and rock outcrops at mountain ridges. This species must have been more common before. Most of the potential biotopes have been destroyed by big machines in order to prepare the area for tree plantation. I think here we have a case in which a natural rare species has almost become extinct through bad management. The sites have opportunities for wind turbines. Management here should aim at conservation restoration of the biotopes and wise strategy for developing sustainable energy.

Finally I want to mention an important factor for rarity in Estrela (probably also in Alvao?) and Mediterranean areas, namely arson fires. Excessive burning caused rarity of a number of species that must have been more common before. Many of these species are not endemic. This kind of rarity is for almost 100% on the account of mankind. This is a complex ecological and socio-economic problem that cannot be solved easily. Here we need cooperation on all levels in society.

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4.1.2.2.6 RE: Screes and other marginal habitats - Reply to Jan Jansen

Author: Stanley L. Krugman **Date: 12 November 2001**

At high elevations trees are under an array of elevation stresses. One that is often over looked is solar radiation at the ground level. In the high mountains of western USA once natural forest stands are opened as with fire, clear cutting or block harvesting both natural and artificial regeneration becomes very difficult. After a number of studies excessive heating of the tender seedling stem at the soil surface area was considered the main cause death. Under some experimental conditions by means stem shading it was possible to more then triple the survival rate. Such techniques as shading are costly and not very feasible on a large scale. However we were interested in maintaining what we considered unique genetic populations because of their tolerance to low temperatures and drought. In the course of 30 years a number of high elevation forest stands were placed in our " Research Natural Area " program. This is one of our conservation programs for small tree populations. This protects the area from harvesting or general use by the public. These areas are often very isolated and as such, foreign pollen contamination is less of a problem.

4.1.2.2.7 Semi-natural open habitats

Author: Jan Jansen **Date: 9 November 2001**

I hope you don't mind that I answer you in the e-conference, because I think that other people might get involved in our discussion. Natural treeless areas probably include wet (deep waters, rivers and eroded banks), dry (steppes), salty, windy (ridges, coastline), rocky (cliffs, outcrops), cold (arctic-alpine) and snowy (arctic-alpine) areas. I think that all mountains in Portugal except Estrela would have had extensive forest. In Estrela we have indications (palaeobotanical and palynogical investigations) that there were trees growing close to the top. However, we don't know whether these were dense forests or open formations with some scattered trees. I think that you will agree that the type of screes found in Estrela over 1600 m altitude certainly will not support tree growth? Climax would not be forest but scree vegetation (after millennia perhaps grasslands). This is known for similar screes all over the world. I assume that the so-called "primary" grasslands also do not support tree growth.

As for the wind-swept ridges in Portuguese mountains there must have been open space in the original forest. Also high cliffs would not have had a dense forest canopy. The number of these sites is limited, they occur in different climatic gradients and therefore ideal to host typical small populations of perhaps endemic taxa. My idea is that e.g. *Murbeckiella sousae* would have grown in these natural open sites receiving considerable solar radiation. The forestry destroyed a lot of rock outcrops at these open sites in order to plant (pine) trees.

Before the plantation policy period these open sites were mostly used as common lands or "baldios" and as a consequence covered with heaths. I have the impression that the planted trees do not grow well. I think that these rock outcrops supported natural rock communities surrounded by a fringe of dynamic natural heathlands with perhaps here and there a lost tree specimen. Only in the lee-side an extensive canopy would have cast shadows on the ground. Perhaps somebody in the conference has experience in managing similar sites? I stress that generally high percentage of endemic biodiversity is found in open sites, such as cliffs, screes and primary grasslands. All these sites experience high solar radiation. Do you know anything about the relation between distribution patterns and solar radiation, except that species richness increases going from northern areas to southern areas?

Not all species depending on open sites have discontinuous distribution. Here man is a very important factor! Think about the taxa that came from the east to invade the open lands that were created by man for rye, wheat, etc. Some original forest taxa or forest-fringe taxa must have entered the irrigated meadows known as "lameiros". The semi-natural open sites in our European cultural landscapes must have hosted a lot of those taxa with considerable population numbers that perhaps previously had significantly lower figures when large forests covered this part of the world. However, today the problem of eutrophication, acidification, fragmentation, abandonment, etc. makes some of them rare (again).

I agree that fire is allied to Mediterranean formations and therefore to their conservation. However, nowadays natural forest biotopes and a lot of taxa are very rare because of the huge fires lit by man. Conservation of forest without the prescribed burning of understorey biomass is difficult and perhaps only theoretically possible if we protect very large areas. Since Europe has not the scale for that policy, the consequence is that no natural forest will develop in the Mediterranean region. Is that correct? Prescribed burning is important to manage heathlands and other scrub like broom and rockrose formations that occur in potential forest areas. In Estrela we recommend prescribed burning of scrub and most of the shepherds seem to know very well. I think that if there will be no change in the present fire events in Estrela, only species and biotopes adapted to intense fire will survive. Yes I think we could have a very long discussion about fire...

4.1.2.2.8 **Portuguese forestry**

Author: Mark Wilson **Date: 9 November 2001**

I was interested to read your contribution to the E-conference. I am a postdoctoral researcher on the BIOFOREST project in Ireland. The project's broad remit is to investigate the impact of forestry on Irish biodiversity. As part of this project, we are currently putting together a review of biodiversity assessment of open sites on which afforestation projects have been proposed. Part of this review focuses on assessment procedures overseas, and as one of the countries with the most active afforestation programmes in Europe, Portugal is of particular interest to us. I hope you don't mind if I ask you a few questions about biodiversity assessment in Portugal, both in general and as they relate to the case of *Murbeckiella sousae* habitat, which you used as an example.

I have been sent a document entitled "Plano de desenvolvimento sustentavel da Floresta Portuguesa" which translates as "Plan for the Sustainable Development of the Portuguese Forest". I have scanned through it but can find nothing dealing with assessment of sites prior to planting. This may be due to the state of my Portuguese, which is not brilliant. But I have yet to find out anything about Portugal's policy on Environment Impact Assessment beyond the fact that is compulsory for proposals above a certain size. Can you tell me anything more about biodiversity assessment for new forestry; either the criteria that decide when an assessment must be made, or the ecological information, which is gathered and taken into consideration during the assessment itself?

More specifically in relation to the example you gave, when was the potential habitat was destroyed? And do you know what the Portuguese legislation relating to assessment of sites for new forestry was at that time? I look forward to hearing anything you have to say on the above topics. If there is any information you would like me to give about any aspect of my project, please don't hesitate to get in touch.

4.1.2.2.9 **RE: Portuguese forestry**

Author: Jan Jansen **Date: 9 November 2001**

A part of your questions has perhaps been answered in my reaction to Henrique. I don't know when the sites of *M. sousae* have been destroyed but I guess only when large machines became available; no longer than 25 years ago. Forest plantation policy of heathlands started in second half of 19th century in The Netherlands after the invention of artificial fertilizer. In Portugal I think in the 1930's. Unfortunately I cannot answer all your questions. Simply because I just don't know the procedures of the forestry. I heard we are with some 500 participants in the conference and perhaps somebody else can! I am also curious. However, I can give partly unpublished information on my vision on forests in Estrela since I wrote a book on geobotany of Estrela mountains and one is dedicated to forests, their floristic composition, ecology and management. The book will be edited by ICN and is expected to come out in the beginning of next year. Vision always comes prior to procedures...

Palaeobiological studies show that in the Estrela more than 5,000 years ago human activity increased to such an extent that at least in some areas it became the dominant factor in the forest dynamics. The first serious deforestation that led to a semi-forested cultural landscape must have taken place some 3,000 years ago. Since those days cutting, burning and grazing caused a radical change in the vegetation: virgin forests disappeared, being mainly replaced by shrubby formations. The interpretation of the disturbed forest remnants is precarious. This is all the more so because their degree of naturalness decreased when the forestry introduced a number of non-indigenous tree species. About your first question: I do not know the procedures that are used in Portugal for biodiversity assessment of forests. I can only say that in order to start biodiversity assessment for forestry we first must know the species composition of the original forest types.

The interpretation of the present forest remnants can be simplified with the concept of vegetation series, which tries to understand vegetation dynamics as a range from climax vegetation (usually forest) down to its substitution communities (scrub, grasslands). A series occupies an area, also called phytogeographic unit, in which climatic or edapho-climatic conditions are more or less homogeneous. Within the Estrela several phytogeographic areas coincide and consequently several climax series. The climatic oak forests - both evergreen and deciduous - were all cut down and burnt in order to use their timber and to develop the agro-pastoral mato system. The lower plateaus and some terraced slopes were generally used as arable lands. The rest of the area was mainly for grazing; year round grazing at low altitudes, summer grazing at high altitudes. The edapho-climatic forests must have occurred in damp places in the lower and middle belt. The quasi disappearance of these mostly alluvial and riparian forests is mainly the consequence of the richness and moisture of the soils, which make them suitable for hay meadows or horticultural exploitation.

I distinguish for Estrela the following climatic forest types: Natural evergreen forests: 1 Cork oak and Holm oak, 2.Portugal laurel forests, 3 Holly forests. Deciduous forests: 1 Pedunculate oak, 2 Pyrenean oak, 3 Alder and Willows, 4 Narrow-leaved Ash, 5 Birch (*Betula celtiberica*). Natural coniferous forests: Within the area one indigenous coniferous forest building tree species still exist, namely Yew (*Taxus baccata*); the other disappeared, namely an Iberian variety of the Scots pine (*Pinus sylvestris* var. *iberica*). Stone pine (*Pinus pinea*) mostly occurs outside Estrela's territory. The few existing trees have probably been planted.

From the foot of the mountain up to ca. 1,400 m the forestry imposed strongly its influence on the landscape. Starting from the end of the 19th century a large number of non-local or exotic species were introduced mainly in order to produce faster and/or better timber. Since the 1930's extended areas with so-called waste land (mainly shrubby pasture areas) have been afforestated as a result of the forestry policy of the Salazar regime. In general allochtonous tree species were used for new plantations or to improve the remains of the original climax forests. Most of the planted areas were used before as common land (baldio). After these areas were afforestated local farmers and shepherds were not allowed to enter. This caused a decline of the traditional sylvo-pastoral system. There was considerable resistance of the farmers and shepherds who lost opportunities of communal grazing. The most important tree species used for afforestation in the Estrela was the Maritime Pine (*Pinus pinaster*). The introduction of this highly flammable resinous species appeared to be a major ecological disaster.

I think that modern policy should steer towards sustainable forestry. By using both indigenous tree species and applying the selection forest system, forest management is assumed to promote biodiversity and diminish the risks of wildfires and erosion. The selection forest system is the oldest form of forest management, in Germany known as 'Plenterwald', in France as ' futaie jardinie'. It includes the cutting of one or a few stems from a stand of trees of different species and size, while leaving the empty space open for spontaneous regeneration. This is a contrast to the production of monospecific trees of same age (and size) starting from bare land. Conversion of plantations to more natural forests may take place in special protection areas.

I am curious whether my vision matches with the "Plan for the Sustainable Development of the Portuguese Forest"

4.1.2.2.10 RE: Portuguese forestry

Author: Henrique Pereira do Santos **Date: 13 November 2001**

I will try to answer some of your questions about Portuguese forestry and conservation of biodiversity, taking in account my work at the Instituto de Conservação da Natureza (Nature Conservation Institute). The assessment of sites prior to planting is made through planning instruments (like protected areas master plans or Natura 2000 surveys and, in the near future, regional planning for the management of forest). In all Natura 2000 sites, what means more than 20% of the country; every project of changing of land use above 5 ha must have a conservation approval. This approval may be preceded by an environmental impact assessment if significant negative impacts may be expected. In the rest of the country environmental impact assessment is only necessary for much bigger areas of forestation (350 ha). Anyhow before 1997 things were different, but depending on the regulation of the protected area (protected areas covered more or less 6% of the country) a conservation approval could be necessary. In the present, surveys for establishing Natura 2000 are widely used in the approval of forest projects despite the fact that there is, at the moment, much, much less pressure for forestation. With rural depopulation and the weakness of pastoralism the climactic forest, based on *Quercus*, is now recovering important areas all over the country, without any effort of forestation. This process have very important implications on conservation, in the positive side, by re-establishing large areas of primitive vegetation, but also in the negative side, by the risk of loss of some habitats that actually depend on human management (with animals and fire), like the "lameiros" referred by Jan Jansen, or significant habitats of orchids, and most of this kind of open and marginal habitats we have been discussing here.

Big fires, which are common in summer, may lead to conservation losses of biodiversity, but for most of the relevant habitats of this kind in Portugal it depends on frequency of fires. I did not study the situation in the big Mountains of the North and Central Portugal, that includes "Estrela" previous referred in the discussion, but for Calcareous mountains of Candeeiros and Aire, which I studied, the areas with two fires in less than ten years are very few what, for the given conditions, means that conservation losses due to this fires are not expected. In areas different from limestone the situation might be different, because of the slowest rate of natural regeneration of vegetation. I think I can say that the forestation projects for recovering burned areas are much more risky for conservation than the fires itself. But I am very glad that in one of the more mediatic fires of last year in Portugal, that affected one protected area, the managers decided not to forest the area (against the major public opinion) unless the assessment of the natural recovery after two or three years prove that we can have better results by forestation than by just managing natural regeneration of vegetation.

4.1.2.2.11 RE (3) Portuguese forestry

Author: Jan Jansen **Date: 14 November 2001**

Dear Henrique,

Thank you very much for answering some of the questions of Mark to which I could not answer. Yes, during the past decades mountainous regions in the Mediterranean suffer from socio-economic marginalisation (quite a contrast to the increasing interest in coastal areas!). The result is a drastic drop of the population and their agricultural activities. The situation in the Estrela is not an exception. In some areas I also observed the regeneration of *Quercus* on abandoned fields. Without any land use, succession will lead to climatic forests there I suppose. This from a point of nature conservation can be seen as a positive development!

I fully agree that we must be careful changing all of our open biotopes into forest. It would be great if we could help the traditional agro-pastoral system to survive. In this way we would manage to maintain both our cultural and semi-natural heritage.

One of the biggest problems is the increasing globalisation of the markets. Cheap agro-industrial bulk products from elsewhere (often subsidised by the EU!) invade the local market. Most of these agro-industries have strong negative impacts on the environment. The tradition of low intensity land use is much more in compliance with ecologically sound management. Under the present circumstances the agro-pastoral system is doomed to collapse and eventually the traditional cultural landscape will largely vanish. This occurs spontaneously on abandoned lands, but unfortunately I have seen active plantation going on in these valuable open cultural landscapes for the past few years. Here it seems that he diversity of semi-natural biotopes (especially the mosaic of tiny biotopes separately often less than a few hectares but all together more than 5 or some square kilometres) will be largely sacrificed for the uniformity of extended low-cost same age-class afforestations often with foreign tree species (e.g., *Quercus rubra*), frequently triggering both the increase of fire hazards and the decrease of biodiversity. Here we must be careful.

I think we must try to support the traditional agro-pastoral system otherwise our semi-natural biotopes, our cultural landscapes, our old genetic local breeds (both crops and livestock) will erode and be replaced by non indigenous breeds or perhaps by genetically manipulated mutants. I understand that we cannot afford organic farming everywhere, but at least in protected areas we should. Perhaps just because the area was indeed isolated and disadvantaged, there is still a chance to offer products and services that can hardly be maintained in densely populated areas. Food produced in the Estrela can fulfil modern requirement to the highest degree. The products do not contain any or hardly any foreign substances. Their sale would help the traditional culture and the management of a unique ecosystem, maintaining diversity and quality of the landscape.

4.1.2.2.12 Mangroves

Author: Farid Dahdouh-Guebas **Date: 7 November 2001**

I am following the discussion on small populations with interest and I would like to add even more to the complexity of the problem by elaborating on the ethnobiological aspect Mark Wilson touched upon. Suppose that indeed a very small and vulnerable population in an area brings benefits to the area in general. Or (from my own experience in mangrove ecology): suppose that a direct threat exists on a unique fauna and flora, and indirectly on the lagoon and off-shore fisheries, and on the local people highly dependent on the ecosystem for living and for a living.

How do we go about the conservation of such populations/species/ecosystems?

Possible options are:
* Forbid human access to the area (ethical problem).
* Allow human access to the area (further deteriorating biodiversity problem)

I realise that these are the two extreme alternatives, but I would like to hear your opinions on how to compromise on a scientific and on a policy level.

4.1.2.2.13 RE: Mangroves

Author: Marta Saloña **Date: 8 November 2001**

Farid Dahdouh-Guebas wrote:

>>Possible options are:
>> * Forbid human access to the area (ethical problem).
>> * Allow human access to the area (further deteriorating biodiversity problem)

Debate is open to those who would like to contribute, nevertheless perhaps is better if Dr. Dahdouh-Guebas explains to the forum what kind of "ethical" problem may be related to the fact of forbidding the presence of a strange species in an endangered and vulnerable ecosystem such as is a mangrove. Especially, when any strange intervention in such a vulnerable ecosystem puts into serious risk not only the mangrove but also the future of local communities.

Are we, as species, really allowed to be wherever we are able to arrive and do whatever we are able to do, without taking into consideration the consequences, not only of our actions but also of our presence, in the ecosystem? Are we really such an irresponsible species? I'm unable to understand the argument from a bioethical point of view so more information about such peculiar moral intuition will be welcome.

4.1.2.2.14 RE: Mangroves

Author: Farid Dahdouh-Guebas **Date: 9 November 2001**

In reply to the direct question of Marta Salona, I want to briefly outline a specific example on the biodiversity-bioethics problem. In this example I want to draw your attention to two categories of people who are active within the small mangrove populations (fauna and flora): the subsistence communities and the 'irresponsible species' that Marta was referring to very correctly. I also want to emphasize that although I am referring to mangroves here, it is applicable to virtually all ecosystems.

Chronological chain of events:
1. Mangrove forests in Kenya (but also elsewhere) are used by local people who are dependent on them for wood and non-wood products (e.g. house building, traditional medicine), for their daily protein intake (mostly fish) and for their job (often fisherfolk).
2. Some of the people are commercial mangrove cutters working for instance for a big industry that is using mangrove as fuel wood.
3. The mangrove forest biodiversity deteriorates due to the big impact of mangrove cutting.
4. The government "bans" mangrove cutting, except for personal use
5. The ban is widely neglected and indications in the field are that the flora of the forest is declining and that the tree species preferred by the local people are being replaced by other ones.

My only conclusion is that the mangrove populations are at risk and that local people, who depend on the mangrove, are the victims of larger commercially-based activities executed in the mangrove. That alone is an ethical problem in my opinion. The government has already banned cutting but it does not help. What will be the next step in trying to ensure the survival of the small mangrove populations? It is clear that we have to come up with a solution that addresses both biodiversity and bioethical issues. The point of my question was that when biodiversity loss reaches a critical point, conservation measures are not always evident from an ethical point of view in subsistence communities (often in developing countries), particularly when the biodiversity problem is caused by the industry (often by industrialised countries).

I can reason in exactly the same way for shrimp aquaculture in Sri Lanka, where even smaller mangrove populations (on which people depend) are being cleared for shrimp aquaculture (for export!), a few years after which the shrimp ponds are abandoned and nothing grows there any more.

Under the conference framework 'Scientific tools for biodiversity conservation' maybe it is opportunistic to say that apart from 'monitoring, modelling and experiments' we need more 'integration' (of interdisciplinary studies), but I'm afraid that is more subject of the second session on 'BIODIVERSITY CONSERVATION IN THEORY' (starting 12 November).

In conclusion,
Yes, there is a biodiversity loss problem;
Yes, there is an ethical problem since we jeopardise the livelihood of human subsistence communities;
Yes, I am still soliciting your practical examples and opinions on how to compromise between the biodiversity and the bioethical issues.

For those who are not convinced I recommend further reading on the subsistence and commercial uses of mangroves in Kenya, and as an introduction a more general paper on how much need there is for a more social approach:

Cormier-Salem, M.C., 1999. The mangrove : an area to be cleared. for social scientists. Hydrobiologia 413: 135-142.
Dahdouh-Guebas, F., C. Mathenge, J.G. Kairo & N. Koedam, 2000. Utilization of mangrove wood products around Mida Creek (Kenya) amongst subsistence and commercial users. Economic Botany 54(4): 513-527.

4.1.2.2.15 RE: Mangroves

Author: Mark Wilson **Date: 9 November 2001**

Marta Salona wrote:

"Are we, as species, really allowed to be wherever we are able to arrive and do whatever we are able to do, without taking into consideration the consequences, not only of our actions but of our presence, in the ecosystem? Are we really such an irresponsible species?"

The answer to both of those questions is a qualified yes. The first qualification is that although humans (within the restrictions which humans themselves have imposed) can go where they want and do what they want; if they do then humans must live with the consequences. The second qualification is that while some of our species are irresponsible in their treatment of the environment, many people do their level best to make human behaviour more environmentally responsible. Voila conservation!

Just because a behaviour can be described as ecologically irresponsible doesn't mean that an outright condemnation of the behaviour backed up with legislation is the appropriate response to it. Some of this irresponsibility might be founded in ignorance - in which case it might be resolved through education. Other threats to the environment are the result of desperate poverty, in which case socio-economic situations must be addressed if conservation strategies are to have a hope of succeeding. When, as is often the case, the irresponsible behaviour is caused by human greed then a straightforward ban may well be the best to stop it, but even when authorities can be convinced that such a ban is necessary, it may not be effective. As Farid Dahdouh-Guebas wrote:

"The government "bans" mangrove cutting, except for personal use [but] the ban is widely neglected and indications in the field are that the flora of the forest is declining and that the tree species preferred by the local people are being replaced by other ones."

I can see at least 2 problems involving ethics, which might be encountered in trying to practice conservation in a habitat such as the Kenyan mangroves. Firstly, there is the problem of trying to get the people who are trying to make a quick buck at the expense of an endangered habitat to behave ethically and obey the relevant laws. Secondly there is the problem of trying to behave ethically towards the local people who depend on the mangroves - allowing them sufficient use of the resource to meet their needs, whilst still regulating the resource strictly enough to protect it. A third issue which you might or might not believe to be relevant to the export of Western conservation ideals is that we may be trying to prevent the practice of those kinds of activities which made the Western world as (financially) rich as it is today. It is fair enough to ask developing countries to learn from our mistakes, but when those mistakes appear to have elevated us to an economical level that is unattainable without a sustained level of environmental abuse... I am not sure if this is the right forum for this kind of discussion, but if anyone wishes to respond to me directly my email address is below.

4.1.2.2.16 Living with the sea

Author: John Harvey **Date: 7 November 2001**

Farid Dahdouh-Guebas raises an issue, which perhaps goes beyond small populations, namely how do you conserve more than one interest when there is an overlap of interests on one particular area of land, or water. These interests may be ecological and economic / social, as in Farid's example, or could involve any pairing, or more, of biological, economic, landscape, social, recreational, archaelogical, etc. Also, within any one of the above categories, there may be conflict between special interests. An example of the latter could be whether the filling in of a eutrophic lake by naturally accumulating sediments and its conversion to a wet woodland results in nature conservation benefit or nature conservation loss.

The issues raised on dynamic coasts by the demands of legislation, Species and Habitats Directive, to maintain more than one community type in favourable conservation status, when natural processes are pushing the system to a new state, are at the core of the "Living with the Sea" LIFE project being lead by English Nature.

The general case of reconciling interests is of particular concern to the National Trust, for which I work. The Trust's responsibilities, laid down in Act of Parliament, include the conservation of landscape, nature, archaeological features, buildings and the provision of access, all "for the benefit of the nation". All this on 250,000 hectares of land in England, Wales and Northern Ireland. This ownership also creates social responsibilities, for example to our 700 tenant farmers. Reconciling the conflicting demands of these interests is a regular aspect of working for the National Trust.

Relevant to the resolution of these conflicts are some philosophical considerations, which relate to Geert Raeymaekers opening contribution. I hope to be able to return to these at a later time.

4.1.2.2.17 Chestnut tree

Author: Stanley L. Krugman **Date: 7 November 2001**

In these first discussions various points of views were expressed. Actually various value systems became the basis of deciding which and how small populations should be saved. I would like to share with you another approach with plants in which we attempted to establish a set of priories first on how to employ limited resources to protect and restore an array of plant species essential to maintaining world wide agricultural and forestry production.

With funding from the World Bank (GEF) we identified those regions and countries that still had an array of wild relatives of the major and minor agricultural and forestry plants. Then we identified those countries that had a research and operational ability and willingness to place some importance to the protection and conservation of their natural plant resources.

In this pilot program we chose Turkey as our starting point because it met the first two criteria and is exceeding rich in plants of importance to modern agriculture and forestry. Many of the plant populations that were of interest were small in size and many being annual we needed to apply a long term strategy of conservation. With the support of the Turkish government we established 23 *In Situ* Conservation Areas known as Gene Management Zones (GMZ), which included the priority, as well as, several thousand other plant species native to Turkey. The size of the GMZs ranged from 9 ha. for wheat and barley to 11,000 ha. for a forest ecosystem. To ensure that we protected as much of the selected populations as possible we tried to protect a defined ecosystem based largely on the reproductive biology of the selected populations.

If there is additional interest in our approach I will be glad to provide further details.

4.1.2.2.18 RE: Chestnut tree

Author: Fiorella Villani **Date: 8 November 2001**

Following the Stanley Krugman comments, I would like to know more about the GMZs identified in Turkey. My specific interest relates to a case study that we carried out in that region since 1989. The species under investigation is chestnut. We identified two genetically highly differentiated groups of populations (one along the Black Sea coast and one along the Aegean coast). In addition to these we identified an hybrid zone between the two located in the Bithinian region.

Following our genetic studies, I had information that chestnut conservation programs were carried out in zones chosen according to our results. My question is: is that program included into the more general one that you mentioned? If that is so I would be glad since it could be seen as a simple but concrete example on how to link theory and practice in biodiversity. Another and more general question is: could the hybrid zones, which often include small populations located in rather small areas, be of great relevance for the choice of conservation programs criteria?

I would like to stimulate discussion on this point.

4.1.2.2.19 RE: Chestnut tree

Author: Stanley L. Krugman **Date: 9 November 2001**

Dear Fiorella Villani:

Let me thank you for your comments. I must confess that I was not aware of your research on chestnut. Still we both may well be working in the same area. There are three GMZs containing chestnut in western Turkey in the Kaz mountains - Ayigedigi, Mihlidere and Sivriatran. There are two sets of major studies on the genetic structure of this species. The agricultural staff at EGE Tarimsal Arostima Enstitusii, Menemen, is doing one set and forestry related research at the EGE Forest Research Institute in Izmir. Both groups are trying to define the nature of the genetic variation in this species in order to determine the number of populations and their size needed to protect this valuable species. We have no programs in the Black Sea area.

This Chestnut program involves issues raised by other writers i.e. how to deal with local people populations. The areas in which the GMZs are established have with only a few exceptions have been used for many years by the local populations. It would be impossible to exclude these users. By a series of workshops with the local populations we shared with them the purpose of the GMZs and asked for their help, support and advice. When you take the time to work with the local people they can be very supportive.

To be sure we stressed the importance of the key stone species in order to obtain political support and funding. Since our approach was the conservation of an array of ecosystems it was feasible to include and protect a large number of other plants. Since this project was started the Turkish scientists have found a number of new agricultural species and new populations.

A useful summary and details of our project in Turkey can be found in " The Proceedings of International Symposium on *In situ* Conservation of Plant Genetic Diversity " 1998. Central Research Institute for Field Crops. Ankara, Turkey. For your information among our key stone species are: *Triticum* spp. and *Aegilops* spp. Among the tree species are *Abies* spp., *Castanea, Cedrus, Pinus* spp., and *Prunus* spp. I hope that is of some help.

4.1.2.2.20 RE: Chestnut tree

Author: Fiorella Villani **Date: 14 November 2001**

Dear Stanley Krugman,

Thanking you for your clarifying reply, I would like to include below our most informative publications on genetic, morphological and physiological differentiation in Turkish chestnut populations. This will probably help you to define and possibly extend the GMZs to the Black Sea coast and to the identified "hybrid zone".

Cordially
Fiorella Villani

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4.1.2.2.21 Isolated plant populations

Author: Nathalie Machon **Date: 9 November 2001**

In the Parisian area, in France, the concern is not to preserve plant species because endemism does not exist in the region. Actually, 200 species of plants are threatened i.e. more than 10% of the listed plant species. They grow for a large part of them, in small and isolated populations, but they are common in other regions of France or Europe. In this region, species are not endangered but biodiversity is threatened. We have no choice. Preserving biodiversity means preserving these small populations in limit of the distribution area of the species. Several programs have been undertaken *Arenaria grandiflora* L., *Aconitum napellus* L., *Dactylorhiza praetermissa* (Druce) Soo, *Equisetum variegatum* Schleich., *Ranunculus nodiflorus* L. , *Spiranthes spiralis* Cheval.. Demographic and genetic studies are used to identify the threats and many management methods are tested.
Nathalie MACHON

4.1.2.2.22 March Fritillary Butterfly

Author: Frank Mawby **Date: 9 November 2001**

I wish to present a particular problem we have in Cumbria in north west England in respect of the Marsh Fritillary Butterfly (*Eurodryas aurinia*). There are three small colonies remaining, all on small areas of suitable habitat and all isolated. The site I manage had a colony until 1991 and we are vigorously trying to rehabilitate this habitat to receive a reintroduction and enlarge it to the size we believe will sustain a good population.

Our action group, headed by English Nature and Butterfly Conservation, is also working to maintain and enlarge the areas of suitable habitat around the extant colonies and to try and link the two of them. This will ultimately require habitat rehabilitation from improved agricultural grassland.

Is it worth it? My response is an emphatic yes; whilst the butterfly is here we need to try. If we lose the butterfly we shall still gain habitat that is valuable for other communities and we shall gain valuable knowledge about habitat rehabilitation and the interaction of species. That is if we can match our enthusiasm with the science needed to solve our problems, the scientists willing to put their science into management practise and of course the funding to pay for the science.

Small populations are difficult to manage and one particular reason is the complex relationships between species. In the case of this particular invertebrate it is its relationship with its food plant *Succisa pratensis* and its parasites. Management is further complicated by the condition of the habitat in which the host plant grows and how it is managed. There may even be other complications in respect of the soil conditions in which the plant grows.

There is considerable knowledge about the ecology of the butterfly and a quite a lot about how to achieve the habitat structure it needs. The principal problem with many small populations is habitat size and fragmentation. For various reasons Researchers now consider the habitat size necessary for the survival of marsh fritillary is at least 60 hectares.

For our northern England populations this will require bringing all suitable habitat fragments within a 3 to 5 km area around the colony nuclei into nature conservation management, plus the acquisition and rehabilitation of improved farmland back to suitable habitat. This is where the rescue begins to falter because the acquisition programme is difficult and the rehabilitation techniques are not proven. *Succisa pratensis* is a ubiquitous plant, but does every situation suit the butterfly? Clearly not, so why not? What is the difference between the habitats the butterfly does well in and those where it fails? Most reintroduction's fail, why? We have two other problems to solve on my reintroduction site, the rehabilitation of a field that was improved in 1976 and dealing with agricultural enrichment seeping into the original colony area from adjacent fields. A third problem is dealing with *Juncus effusus*.

Finding solutions to these problems will also help several other sites that are important for species other than marsh fritillary. I think it needs a great deal of scientific problem solving in field scale experiments.

4.1.2.2.23 **RE: March Fritillary Butterfly**

Author: Hauke Drews **Date: 13 November 2001**

I think the conservation problems Frank Mawbys described about the Marsh Fritillary Butterfly (*Eurodryas aurinia*) show very clearly the questions that arise all time in conservation-projects that deal with endangered species. Even if there is envolved "only" one endangered specie, often we do not have enough information neither about the autecology, the different interaction between food-plant and specie nor about the function of whole ecosystems. And the problems increase if there are involved more species than one in an conservation-project!

I think too, that we need to do (nearly) everything, that would help a species to survive, but it is often a problem to get the information what has to be done in special cases. General there are only a few biotope management tools used: grazing, mowing, burning (seldom in Germany), reduce invading species etc. Often we try to imitate the former land use or try to regenerate a degraded natural systems by management, but often we fail.

I think the main reasons are that 1. The management is often too static and not naturally, "chaotically" enough and there is involved mainly one process in conservation, i.e. succession or mowing or grazing, etc., 2. We do not follow consequent enough the knowledge how large a conservation area must be to minimize the heavily impact from outside because we may have otherwise problems with the society about conservation and 3. We do not have a clear and sure functioning concept to connect the areas that are isolated in a completely different landscape. (I think even if we have 13% of Europe within the (good!!) Natura 2000 system that will not be enough to connect all biotope types and we will have further on the problem of the impacts from outside and the loss of biodiversity. I think buffer-zones are not included in the German Natura 2000 areas.)

So I think a good way would be, that we try to establish large (better huge) areas of a kind of "new wilderness" with natural "land-use" by large grazer, that guarantee to some extend a chaotic component. Interesting examples for that kind of landscapes are the "New Forest in Great Britain" and the "Oostvaardersplassen-project" in the Netherlands. More dynamics we need also for the river-systems, for coastal-systems, etc.

Second we need especially in the northwest of middle Europe a much lower output of nitrogen (N), that spoils our natural systems and change them all into the same type of "dung-community". To avoid this we need another agriculture, without an surplus of 120kg N/ha/year. Otherwise we will need for low-nutrient systems, i.e. chalk-grassland, heathlands, bogs, etc. buffer zones of about 10 km size within agricultural areas as in Schleswig-Holstein (Germany most northern state).

Third it would be helpful in conservation practise to have a central database with all the data from scientific projects, with "experience-data" from "try and error projects" and the possibility to find specialist for special questions in short time.

4.1.2.2.24 **Flagship species & small populations**

Author: Zoltan S. Varga **Date: 8 November 2001**

I would like to make some comments to the previous contributions.

1) Problem of "flagship species":
The "flagship species" is for me a symbolic (not strictly scientific) concept - i.e. a species that has some symbolic ("spiritual") value for a broader layer of the society, e.g. the white-headed eagle, the Californian condor, the Apollo butterflies, etc.

It means, the notion of flagship species may be quite different according to cultures (e.g. different religions), levels of education, geographical regions, etc.

Because human beings need also an emotional connection with the nature (not only rational!), "flagship" species may be useful for arousing the feeling, the interest for the nature conservation in the society, in the policy-makers, in the people working in the business sphere, etc.

As a consequence, the "inherent value" of "flagship species", as biological species is not larger than other species, but they belong to the symbols of our sophisticated culture, as traditionally the flags, arms, etc. They are the symbols of our common natural heritage, of the biodiversity, of the nature conservation, etc.

I think, the we need such symbols, which have positive, stimulating mental effects without long and complicated logical explanations.

In addition: "flagship species" can also symbolise some habitat and/or landscape types, e.g. the great bustard the steppe grasslands (the wide open steppe landscape, as the Hungarian "puszta"), the capercaille the boreal coniferous forests (the landscape of the "dark" coniferous forests), the edelweiss the alpine rupicolous swards (the alpine landscape), etc. Thus, the necessity of the protection of such species is synonymous with the necessity of conservation of habitats, landscapes, etc.

Important: Some flagship species are of spectacular appearance, they are beautiful and/or large-bodied creatures, easily to recognise also for non-biologists, non-conservationists, etc. Such species often need large, continuous areas for breeding, feeding, etc. or different habitats for different functions (e.g. great bustard for breeding, for feeding in different seasons, for leks), stages of development (e.g. Apollo butterflies), etc.

The protection of such "flagship species" can be successful only at a rather large scale, due to the protection of the traditionally used landscape, on many thousands of hectares.

2) Problem of small, isolated populations and heavily fragmented, special habitats.

Biogeographically: the Mediterranean, Atlantic and Central (mountainous) regions of Europe represent smaller or larger fragmented "islands" and "peninsulas" of the huge Eurasiatic continent. It means that the large-scaled zonality, typifying the very extended, relatively homogenous table-land of Eastern Europe, breaks down here, becomes fragmented and re-organised into "individual" landscapes. In Eastern Europe we can see long-distance gradients and large-scaled ecotones. On the contrary: the Mediterranean, West- and Central European landscapes are full with short-distance gradients and ecotones, with mosaic-complexes of contrasting habitats, with non-forested patches within the (originally) forested landscape matrix or simply within the cultural landscape. Thus the phenomenon, mentioned by Henrique Pereira dos Santos, represents one of the most general and basic problems of the European nature conservation. I think, the basic question is: how to maintain a stepping-stone system of such patchy habitats suitable for the survival of a metapopulation network of scarce species. This case, the gene-flow between such fragmented demes could compensate the low individual number of the single small colonies.

For me the first step:

- To measure and modelling the connectivity of such patchy systems (see e.g.: Keighobadi et al.: *Parnassius smintheus* in the Rocky Mts, Mol. Ecol. 1998; Schmitt et al.: Forests as dispersal barriers for *Erebia medusa*, Basic and Applied Ecology 1: 53-59., etc.),
- Than, based on such data to define: how to manage the habitats for maintaining the connectivity the edaphically non-forested patches as rupicolous habitats, rocky slopes etc. (e.g. coppicing). I think, my view could also contribute to the discussion: "is single-species approach passé in the landscape era?" (see: Simberloff, 1998)

4.1.2.2.25 **RE: Flagship species & small populations**

Author: Alan Feest **Date: 8 November 2001**

I have followed the initial discussion with interest.
I regard the role of the "star" species to be:

1 - The accessible way of presenting conservation to the political world such that we can obtain their support (and money!). Politicians for whom ecological theory has not been a feature of their education do not readily appreciate the subtleties of the preservation of species and their habitats. For this reason "star" species tend to be glamorous and noticeable.

2 - Preservation of "star" species should, by implication, conserve their habitat and in so doing conserve many other species as well. Many of these other species are of equal conservation interest but just do not have "star" quality. Therefore the function of "star" species is to facilitate the conservation of habitats. If we are talking of top predators then these habitats are often also extensive even if the populations are small. Some species seem to specialise in being rare!

3 - The problem comes when relating to the conservation of rare/important species (or groups of species) that do not have "star" quality yet might be ecologically important or conservation valuable. My own studies have concentrated on macrofungi some of which do have "star" quality but most of which definitely do not. This is exacerbated when the recording of presence of macrofungi by definition depends on the observation of a macroscopic fruit-body. This fruit body may or may not be produced in any year and absence of a fruit body does not indicate absence of species. The sort of question posed by macrofungi is: are rare macrofungi really rare or do they not produce fruit bodies very often (or both = really rare!)? What would constitute a small population when we know that some individuals of macrofungi can occur over hectares of land and yet be fragmented? Then we must consider what is a species when all analyses so far indicate that there are genetically about ten times more species within the concept of a species as described by morphology of their fruit body?

4 - For reasons in 3. I have adopted a methodology that uses a series of numerical indices to indicate the various biodiversity properties possessed by the visible macrofungal fruit bodies of a site. This has the advantage of avoiding bias due to list compilation of species that is for macrofungi input dependant yet the survey input is never stated. Lists are therefore not comparable. The use of standardised methodology of surveying allows the comparison of the various biodiversity indices between sites and through time.

My questions are:

1 - Is this the sort of research that would be supported by the LIFE programme? I would wish to extend the work done in the UK to a pan-European database that would allow prioritisation of sites (according to biodiversity indices) and also follow the effects of a) global warming and b) pollution after having established the baseline indices.

2. Is there anyone interested in such a network collaboration? Is there any other example of considering the biodiversity properties of a taxon as the basis of conservation? Would anyone working on another taxon be interested in applying the principles outlined above to their group?

3. One incidental spin-off of the methodology is it becomes possible to estimate the biomass of economically valuable macrofungal species non-destructively and thus we can relate this harvest to: management of the site; options for increasing the harvest by habitat management; indicators of possible economic value; site history; site environmental factors; plant ecology etc. Is this of interest? My early conversations with foresters indicate that there might be considerable interest in this aspect of the work. I hope this is of interest.

4.1.2.2.26 RE: Flagship species & small populations

Author: Jorge Palmeirim **Date: 8 November 2001**

Dear Etienne Branquart,

You raised a very important (and difficult) issue in the establishment of conservation/research priorities: conservation of emblematic flagship species. Most of them are highly threatened and only survive in small and fragmented populations.

For convenience of discussion I would like to split this issue in two closely related topics: (1) the conservation of emblematic species, and (2) the conservation of small populations.

(1) Conservation of emblematic species

As you say emblematic species are consuming much of our research and conservation resources, and it is very reasonable to question if this is a correct strategy. As Mark Wilson pointed out, at the core of this issue is the fact that different people perceive aspects of our environment to have different "inherent values". I would like to add to this point by contrasting scientific valuation with the values assigned by Society.

From a strictly scientific perspective one may argue that the Panda is worth just as much as an obscure invertebrate with a similar level of taxonomic uniqueness. In contrast, Society in general considers the Panda to be far more important.

It would be reasonable to argue that scientists should avoid these valuation biases (driven by emotions, aesthetics, etc.), and strictly follow scientifically identified priorities. I tend to think that this is not correct, and that we have to take into consideration what the Society considers to be a priority. After all, in my opinion the ultimate objective of research is to serve our Society and we work with the resources that it provides.

I would say that Society would feel that its expectations had been betrayed by scientists and conservationists if we would let the Panda go extinct in because we had to concentrate our attention on an obscure invertebrate.

Of course not all situations are as black and white as the Panda vs. obscure invertebrate, and we mostly have to make decision on less clear grey cases, using the difficult art of combining scientific valuation with public values and expectations.

(2) Conservation of small populations

It is difficult to have a general position on this issue, since many different situations are possible. If the small population is the last of the its species, it seems clear that it should be a priority for all.

If the small population is the last in a country, but it is a peripheral population and the species is well represented in other countries, the situation is more complicated. It may well be a priority for the country concerned, but only in certain cases it should also be an international priority.

Quite often small isolated populations are somewhat differentiated from the core of the species, and are needed to preserve its full genetic diversity. In some cases these small populations even contain a disproportionate genetic wealth. It seems reasonable to say that the conservation of these populations should receive international attention.

Of course, in many cases, it is difficult to decide if a particular small population should become a research/conservation priority, until we have done plenty of research on it! But for a variety of reasons I would say that, as a rule of thumb, small population remnants should be a higher priority than recently founded small populations. But this rule may not always apply, and does not help in many cases.

4.1.2.2.27 RE: Flagship species & small populations

Author: Humberto Rosa **Date: 9 November 2001**

I would like to add some thoughts to the debate on the conservation of emblematic/flagship species, and especially on the question of their scientific versus societal valuation, as raised by Jorge Palmeirim [ola', Jorge!].

Values underlie any definition of conservation priorities, no doubt about that. But I do not think that it is sound to say, "that from a strictly scientific perspective one may argue that the Panda is worth just as much as an obscure invertebrate with a similar level of taxonomic uniqueness". Rather, I think that there is scientific basis to hold that the Panda, keeping Jorge's example, ought to be considered more valuable than any "obscure invertebrate", sole-member-of-its-genus as the Panda.

Consider complexity, to begin with: although the scientific measure of complexity is no simple task, it seems objective to say that a Panda is far more complex than any nematode or insect (as evaluated by their encoding information, or even better, by their capacity of information processing). And as in this Universe of ours high-rank complexity is something rare, fragile and hard to get, I would claim that, other things alike, we should value more what is more complex than what is less complex.

Next, consider cognitive and mental capacities, which are objectively higher in the Panda (or mammals in general) than in nematodes, insects or invertebrates in general. Science shows us that Pandas arguably have self-conscient interests and desires in some degree, while most invertebrates do not. If we ground our ethical valuation of individuals in their capacities to have interests and desires, as ethics normally does, then, other things alike, we ought to value more a Panda than a nematode. As to conserve the Panda as a species is also to respect the interests and well being of the individual pandas, from this point of view, scientifically based, we ought to value more the conservation of the Panda than that of the "obscure invertebrate".

I do not mean at all that the conservation of invertebrates (or plants, or fungi, or microbes) is not important, of course. On the contrary, it is very important, also because it has been far less considered than the conservation of charismatic vertebrates. It can even be more important in specific cases, if a specific ecological situation recommends so. But we should resist to the idea that the priority to flagship species is to be avoided, as being a mere reflex of emotion, aesthetics or subjectivity. People tend to like flagship species more, that is a fact - and, as Jorge recognizes, not at all a minor one, when determining the political options that should lead our societies. But there is also some sound scientific basis to validate the priority to at least several kinds of flagship species.

4.1.2.2.28 RE: Flagship species & small populations

Author: Jason F. Mate **Date: 12 November 2001**

I think that two topics have cropped up in this talk which seem to be at the heart of all conservation programs and I would like to stoke the fire a bit as they say: 1) the equality / inequality of species; 2) humans outside nature.

I have noticed that the topic of 'flagship' species is polarized into two sides: those who think all species are equal, and those who think that some are more equal than others (although, as I shall point out later, for what I think are the wrong reasons). Conservation should be aimed at conserving the largest possible piece of viable ecosystems/communities. I must stress the possible and viable, because some things will go extinct and others will become the 'living dead'. Flagship species (the big and cuddly as I like to call them) should be saved if: 1) they aid in the preservation of a type of habitat (as mentioned by Alan Feest and others) 2) they are vital for the maintenance of an ecosystem. If the unknown invertebrate, of which we have heard so much lately, is more functionally important than a subspecies of mammal, then the mammal has to go. That would be the cold logic. We can then dress it up with our emotions and warp the importance of species (big, smart, warm and cuddly as good, small, cold and faceless as 'who cares?'). But if what we want to protect in the end is as much as possible, then we should be trying to protect functionality (and hence viability). We can do this following the 'top down' approach that has been hinted at by Priyadarsanan Dharma Rajan (8/11/01 'A red list for habitats...'). This would the equivalent of preserving the historical or phylogenetic information as embodied by the lineages. Hence we would be seeking maximal phylogenetic diversity (families over tribes, species over subspecies) when giving priorities to conservation. Although this will not be very popular with the people with the cheque-books (we might have to dress it up with some mammals or birds) it will provide us with a clearer objective than single species. That is how we can serve society's interests best. A second point I would like to raise is the whole idea of keeping nature 'pure', 'unspoilt' or simply human free. I think that by now it has become more or less clear that conservation must involve people and especially those living around what we are trying to 'preserve'. Morality doesn't help the issue. Morality leads to the creation of many of Africa's great parks (the empty ones) and condemnation of the game parks (the full ones). This is no doubt rather simplistic logic, but it brings the message home. Well aimed, human intervention can be a creative force, so I would say to those like Farid Dahdouh-Guebas to try to encourage/teach the locals to use more responsibly the resources instead of imposing ideas which are considered by much of the world as neo-colonial. In the long run we will achieve more.

4.1.2.2.29 RE: Flagship species & small populations

Author: Marie-Noël de Visscher **Date: 12 November 2001**

Can we save small populations? Is the flagship species conservation a good deal for biodiversity conservation strategy? I would like to show with few concrete cases why and how to positively reply to these questions.

- In Europe, a few years ago, the EC program for the Mediterranean Monk seal conservation allowed to gather many scientific and technical resources on sea mammals and at the same time to stress the poor economic situation of small fishermen in the Greeks and Turkish archipelago. The latest were both the main direct threat for the Monk seal and their first victims. The seals are regularly feeding in their nets and damaging them. In fact, the real problem of the fishermen was competition with industrial fisheries and the declining of fishes stock in coastal water.
- In Africa a recent UE project for the Biodiversity conservation of the W national Park will consider the African manatee in Niger. If it is proven that a small population still survive in the Niger River, the project will have necessarily to work on the following question: how to share the natural resources in the flooded areas along the river to improve of local people livelihood and ensure manatee conservation?

In both cases, the rare and flagship species offer a complementary reason to pay more attention to the needed sustainable development in natural ecosystem.

- In Pacific Island, many project work to save very rare and isolated bird species but it is clear that the investment to maintain such small populations can be deeply questioned with regard to the huge need for large natural habitat or general biodiversity conservation. Again, there are flagship species to build a wider conservation strategy. E.g.: The Uvea Parakeet (New Caledonia) or the Marquesan Imperial pigeon (French Polynesia) are being part now of the cultural heritage for the local communities and the starting point for a locally better natural resources management and conservation strategy. If the conservation programs around flagships species maintain an ecosystem approach including local development aspects, there remain completely useful and justified.

During the next weeks, we will certainly consider scientific problems related to this position. Just an example: conflicting needs for the conservation of various flagship species on the same area.

4.1.2.2.30 RE: Flagship species & small populations

Author: Erik van der Spek **Date: 13 November 2001**

ABSTRACT: We can use flagship species to protect biotopes.

In the Netherlands flagship species are used to protect biotopes. The spoonbill is one of these flagships. Most of the efforts where taken to improve the feeding situation. By doing this aquatic systems where improved. Measures are: improving possibilities for migration of fish like sticklebacks from sea to freshwater. The quality and the amount of food for the spoonbill where enlarged. Profitable to spoonbills and other consumers of sticklebacks, but also to the sticklebacks. Al large number of sticklebacks would not be able to hatch if they couldn't leaf the sea. But also for other species the migration possibilities improved. Changes to the banks of small canals where made so spoonbills could hunt sticklebacks; this sites are also used by fish species and amfibians to hatch. So action for a flagship did improve to whole biotope, of course more can be done. But by using the flagship al the people involved, government agency's and local people, could get a feeling why actions where taken.

So flagships can be used, especially if actions in favour of the flagship support the habitat(s) they use.

4.1.2.2.31 Socio-economic research

Author: Robert Kenward **Date: 13 November 2001**

Given the examples at www.biodiversity.be/bbpf/econf/econfintro.html (and many others), the question "can we save small populations" can be answered by "Yes, sometimes, provided that we have (a) the will, (b) the resources and (c) the ability to identify the process causing the population to be small and if necessary reverse the process." It is interesting to note that (a) and (b) are socio-economic factors, influenced in (a) by opinion, interests and ethics and in (b) by availability of public and private funds and volunteer time. For (c), the level of knowledge about processes and management is important, and again these will have socio-economic as well as ecological components.

Some contributions to the discussion have recognised the breadth of factors affecting the original question. These factors are similar to those involved, for example, in healthcare, when asking, "can we save this life". As in healthcare, the answer may be "if we are willing to spend enough". But also, as in healthcare, there are also questions like "could we spend less by diagnosing and acting earlier?" and "could we spend even less by prophylaxis to remove the origin of the problem?" In other words "how can we stop populations becoming small?"

Ideally, we should try to move to a situation where populations do not become critical. To do this, knowledge about processes becomes important again. Some important knowledge comes from all those case studies. However, it is important to remember the need for basic and strategic research too, sometimes done more easily on declining-but-still-large populations or even healthy populations. Unfortunately, rarity can be an asset when it comes to attracting funds. We therefore need to be very careful to avoid the trap of working with more and more constraints on more and more small populations. So we also need socio-economic research on how best to raise and allocate funds to conserve populations and biodiversity in general. Otherwise, the answer may increasingly become "we lack adequate resources" and perhaps, as fewer people acquire the pleasure of biodiverse environments, "we lack the will to provide those resources".

4.1.2.2.32 A Red List for Habitats and Green List for Species

Author: Priyadarsanan Dharma Rajan **Date: 8 November 2001**

A Red List for Habitats and Green List for Species: We need a top down strategy for conserving invertebrates

Invertebrates comprise at least 94% of biodiversity, if not more. While considering the conservation of biodiversity, we forget this 94% for convenience and talk about the 6% and do something for a few charismatic species, which comprise may be 0.0001% or even less. The justification for spending all the resources for this negligible percentage of biodiversity is conserving the habitat for these charismatic species will conserve the total biodiversity of the area by default. How far it is true?

Recently I have got an opportunity for a comparative study on the diversity of dung beetles and ants of a National Park (Rajiv Gandhi NP), which is also a tiger reserve and a wild life sanctuary (Biligiri Rangan Hills) both at W. Ghats, India. Both ants and dung beetles were seen more diverse in BR Hills, which has more habitat heterogeneity- having scrub, moist and deciduous forests, evergreen forests, grasslands and shola forests and an altitudinal gradient of 800-1000m. than the well protected National park. Which one should be given more conservation weight?

The most published prioritisation of species for conservation action has been the threatened species categories defined by the IUCN and used in its RDB and Red lists In the last more than 30 years since its definition the RDB categories have been widely used by IUCN, governments and NGOs to focus their attention in species at higher extinction rates. The red list of IUCN is considered as a the solid documentation of the global extinction crisis. Although it came into existence many years before the concept of biodiversity came to public conscience. IUCN has redlisted 75 mammals but there are only 250 or odd invertebrates in the red list. Is it unbiased?

Many species of insects are being discovered from extremely small areas of Tropics. So the potential insect diversity of tropics will be very high and most of these species are endemic to very small area. So if a relatively small area is logged or disturbed, many species will disappear.

My studies on insect conservation in last couple of years have brought to me a few species of insects that prompted me to think about conserving those. Family Meinertillidae (Microcoryphia) is a primitive family with very few species. In India is so far represented only by one species from NE India. But recently our team could collect one species belonging to this family from a fragmented Soppinabetta (Community owned forest) of Sringeri Taluk of W. Ghats. Also we could collect species belonging to Laemophloeidae (Coleoptera), Sminthuridae (Collembola) and Gonatopodinae (Hymenoptera), which are not reported from India so far. Soppinabettas are under constant pressure from human disturbance. If this particular habitat is lost, India will loose not one but many Families. Relatively Scrub jungles and wetland are getting very little attention when compared to the Evergreen forests. But the recent studies by my team shows that Scrub jungles are more diverse than the evergreen forests taking the diversity of invertebrates into consideration. What should be given more conservation weight?

It is high time to end romancing with the charismatic species and to face the problems in a more realistic way to conserve the real diversity. Very little space on earth is now left for conserving the 30 or 50 million species. So we should give priority to the habitats that species and prioritise the habitats for conservation. So I am suggesting a top down approach to our conservation strategies. Let us start with habitats. Instead of red lists of species prepare red lists of Habitats, which needs at most attention. Since the majority of species remain undescribed and data on the distribution and abundance of only a very few described species are available classifying them will not help much in conserving the biodiversity. So prepare a 'green list' of the species, which do not any attention from the conservation viewpoint and consider the rest as threatened and bring them under CITES.

4.1.2.2.33 RE: A Red List for Habitats and Green List for Species

Author: Les Firbank **Date: 9 November 2001**

I think this contribution is an important one, though not one I agree with fully.

I think it's dead right that a global policy of biodiversity conservation should take a habitat view, and should concentrate on those habitats that are most likely to be sustainable in the face of pressures such land use, climate change, eutrophication etc - they are likely to be fairly large, functioning ecosystems.
Many of the small populations will not persist, no matter how well managed, in the face of such pressure. IN this way, perhaps the conservation of charismatic species at the local scale may well be "romancing". However, that does not make it trivial. Local conservation exercises based on charismatic species are vital, I believe, to involve local people in the wider issue of biodiversity. IN the longer term, biodiversity will only be conserved if people want it, and that

can only happen if they can come into contact with the wonders of biodiversity close to their homes - children, especially, need to experience biodiversity, and just watch the videos.

Perhaps a greater honesty is needed. IN Europe, many conservation efforts may make little contribution to global ecosystem functioning, or the maintenance of global biodiversity. However, they are vital if people are to experience biodiversity, and that experience in turn is vital for biodiversity to have a high public priority. But this only makes sense if priority habitats are recognised and conserved at the global scale. The approaches are complementary - both are needed.

4.1.2.2.34 RE: A Red List for Habitats and Green List for Species

Author: Zoltan S.Varga **Date: 12 November 2001**

Now, only two short notes:

1) I would like to second to the opinion of Priyadarsanan Dharma Rajan on the outstanding importance of the Invertebrates in the Habitat Conservation and in the Biodiversity Conservation. The Invertebrate lists of the Habitat Directive are generally rather poor, and moreover, they are not harmonised, not connected to the list of the Habitats included into the Annex I. I think, we should prepare lists of the characteristic and quality indicator Invertebrate species of the Habitats of the Annex I, at least from that taxonomic groups, which are already involved into the Annexes II and IV.

2) The Gene Management Zones are and will be very important for the future of the mankind. In this connection I should mention that the Kopet Dagh Nature Reserve in Turkmenistan (near to Kara Kala, the site of a former Soviet experimental station, founded by the outstanding Russian geneticist Vavilov before the Lysenkoist era) is a real core area of endemic species (e.g. wild wheat, fruits as grapes, plum, almond, fig, wild mandragora, etc.). There are large semi-arid mountain plateaux covered with tall-grass steppe, dominated by *Stipa* and wild *Triticum* spp. and gorges with patches of ancient forests and scrubby formations. As a result of several entomological expeditions (1990-92), e.g., over 30 new species of Noctuid moths have been described from this area.

4.1.2.2.35 Goals, values and priorities

Author: Miguel Bastos Araujo **Date: 13 November 2001**

It is difficult to discuss the 'inherent' value of flagship species without entailing a broader discussion of goals, values and priorities for conservation.

Values are goal dependent. The degree to which a biological feature is valuable for society depends on the relative contribution it gives to attaining a given conservation goal. The goal may be to preserve the evolutionary potential of assemblages, in which case inter-specific and intra-specific genetic diversity are important. Or it may be to preserve a given set of ecological services, in which case we might like to stress the functional role of biological features within ecosystems. Because, resources for conservation are scarce we need to establish priorities. Priorities are about setting an order of preference. They are a combination of value with an assessment of urgency for conservation action. Here starts our debate.

Some argue that flagship species are valuable targets for conservation. Reasons include: (1) their social appeal (which helps to raise further funds for conservation); (2) their 'umbrella status' (i.e. if we conserve them we would, by default, conserve other valuable organisms); (3) their level of threat (if we do not conserve them they will go extinct); and (4) their complexity (they are usually more complex organisms with more developed cognitive and mental capacities).

Unfortunately, reality is not simple:

(1) Flagships are not always the most appealing targets for conservation (see examples of some seed grasses being more appealing, for South American natives, than jaguars);

(2) Flagships are not necessarily the best umbrellas for wholesale biodiversity (see evidence from Andelman and Fagan 2000 or Williams et al. 2001 that flagship species may be worse umbrellas than expected by chance);

(3) Flagship species may not always be the next species to go extinct (there are many examples of endemic plant and invertebrate species that are more threatened than many typical flagship species);

(4) Flagships are not always the most complex organisms (for example rats are more complex than orchids, but many would prefer the latter).

Naturally, one could argue for some kind of semi-quantitative ranking scheme to combine criteria and summarise perceptions of value into a single number, or ordered-list of preferences. Such approaches have already been developed and the reason we do not have a widely accepted combinatorial scheme to rank conservation priorities is that they are - by definition - idiosyncratic (Araujo 1998). Because these ranking schemes do not answer the basic question of valuing attributes in relation to socially accepted goal, they usually amalgamate criteria of different measurement scales and currencies (also termed as the 'apples and oranges problem', for discussion see Williams and Araujo 2001). The solution to this problem is not to produce ever more complex - and essentially arbitrary - approaches to priority setting, but rather to clarify goals and values and try to measure priorities using a common currency of conservation success.

Conceptually, it is important to distinguish the measurement of value to that of priority. Value is a measure of how much a feature, or set of features, contributes to attaining a conservation goal. If the goal is to conserve biodiversity - i.e. irreducible complexity of life - we have to measure value in terms of evolutionary information contained by the features (e.g. species). This evolutionary information is relative, not absolute. For example, some organisms are more complex than others and those that are more complex are likely to be rare in evolutionary terms (a point made by Humberto Rosa). However, two closely related complex organisms (e.g. the chimpanzee and the bonobo) should be less bio diverse (i.e. contain less information) than two unrelated organisms (e.g. chimpanzee and the lizard). If we had to establish an ordered list of value for these three species we would probably rank the chimpanzee first, followed by the lizard, which is the one adding the greatest complementary evolutionary information in relation to that provided by the chimpanzee (which translates into more evolutionary options for the future). The bonobo would come last, although we recognise it to be individually far more complex than the lizard. These ideas were first discussed in an influential paper by Vane-Wright et al 1991.

In practice, conservationists do not perform such evaluations. What we are used to measure are conservation priorities, not biodiversity value. To do this we implicitly assume that all species are equally important, but we also recognise that some species are more fashionable than others (i.e. scientific assessments of value are substituted by political judgements). So we try to set priorities within the fashionable set of species and hope these to represent the interests of other organisms.

As stated before, priorities are a combination of value with an assessment of urgency of conservation action. If biodiversity value remains steady for all organisms, then priorities can be equated to urgency for conservation action. Assuming that the goal of any conservation policy is, ultimately, to avoid human-induced extinctions we can translate priority into a single measure of conservation success, i.e. probabilities of persistence (Araujo and Williams 2000; Williams and Araujo 2000; Araujo et al. 2001; Williams and Araujo 2001). Focusing our research efforts to try getting right estimates of probabilities of persistence would be probably more useful than discussing whether rare species have intrinsic value or not. Within the 'probabilities of persistence framework' rare species are important because they are more likely to be affected by demographic and environmental stochasticity. Therefore they have generally low probabilities of persistence and we need, generally, more resources for their conservation than other species do.

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4.1.2.3 Science to improve conservation practices

4.1.2.3.1 Improvements to Biodiversity Site Management through Management Planning: the role of Protected Areas in nature conservation

Author: E.T. Idle **Date: 8 November 2001**

Protected Areas of various types e.g. Nature Reserves, National Parks, Natural Monuments and a wide range of other designations, have had a central role in nature conservation policy and action for 100 years or more. Some might say that they go back much further. These designations have been used to fulfil 4 main, though often ill-defined, biodiversity policy functions. These are:

1 To insure against further loss of habitats and species.
2 To act as reference points against which to measure change in the natural environment.
3 As demonstration of sympathetic nature conservation management
4 As a reservoir of habitats and species, which can populate other parts of the countryside when the opportunity arises.

This paper is about current and foreseeable issues in improving site management. I assume that by 'improvement' we mean that 1 or more of these 4 principal roles are fulfilled either more quickly or more cost effectively. I suggest that improved site management has 4 main characteristics:

1 Clearer, well-argued objectives which identify the role of the site in relation to wider national or European objectives or biodiversity.
2 Stronger support and involvement particularly from local communities.
3 More cost-effective and efficient implementation of management programmes.
4 Clearer and more readily available statements of progress and results.

Of course there may be other characteristics which emerge during this E- conference, but if the 4 characteristics, which I have identified are the main features of improved site management, how can management planning help to achieve them? I suggest partly in the content of the plan and partly in the process of producing it. It is the issues concerned with content and process, which I want to concentrate on. These issues emerge from answers to 4 questions:

1 Why produce Protected Area Management Plans?
2 What information is needed to produce a Management Plan?
3 Who has an interest in a Protected Area Management Plan?
4 How do we know if the Management Plan is successful?

*1 - Why produce Protected Area Management Plans?

Considerable time and resources are often spent on the production of management plans, which are often bulky, full of scientific description and of limited practical use! So why do we produce them? Or what benefits do we expect from them? Here are some possible answers:

1 Legislation may specifically require the production of a Management Plan e.g. National Parks or Habitats Directive (Natura 2000 sites).
2 The Management Plan identifies the wider biodiversity context for the Protected Area and provides a rational basis for the management of habitats and species
3 The Management Plan gives credibility, particularly political credibility, to the objectives and management activities at all levels within the Protected Area. In other words people can understand and accept the reasons for the work they are doing.
4 The Management Plan, and the process of its production, is a vehicle for communication with others and a means of meeting the varied demands and uses faced by a Protected Area.

5 It is a practical tool for planning work and priority/target setting and vital for resource allocation.
6 The Management Plan provides for continuity and a well-understood basis for future choices and possible changes.
7 The Management Plan identifies ways of assessing progress and is a basis for evaluation.

To produce a really useful Management Plan, which has these benefits, requires a range of skills. Clearly the Site Manager, or whoever is responsible for the production of the Management Plan, must have knowledge of, or access to, information on ecological processes and ecosystem function. Ecological science has traditionally provided the insights, which help to identify the objectives to be met within Protected Areas. One of the challenges is how the site objectives relate to changes within the wider environment and over which we may have little or no control e.g. climate change.

*2 - What information is needed to produce a Protected Area Management Plan?

The answer may be 'It depends', on a number of factors such as the size of the area, its diversity and complexity and how much is already known or not known about it. However experience again suggests that less information may be needed to produce a useful Management Plan than was first thought. The production of extensive and time-consuming descriptions of various aspects of Protected Areas often has the sole effect of delaying the completion of the Management Plan. Moreover the complexity of ecological processes is increasingly overwhelming, so that the idea that at some point there will be enough detailed information and understanding to produce a fully prescriptive programme of work, seems doubtful. Some information is clearly necessary if a credible and useful Management Plan is to be produced, but what is the minimum?

Information on the flora and fauna and the habitats which support them within the Protected Area is required for any evaluation of importance. Part of the process of objective setting within Management Planning is concerned with evaluation so that choices in objectives can be made with clarity. But it is also necessary to have available information about how habitats might change and some idea of the factors likely to cause these changes. Management programmes are often aimed at controlling or modifying these causative factors. This brings me to the role of science in the Management Planning process. Site management always involves choices. Ecological science cannot make these choices, but it can provide some of the background and essential understanding required for them to be made. For example the decision on whether to increase the population of one species or habitat at the expense of another is not one that ecological science can make, but it can explain the implications of any option. The same issue arises in relation to assessments of progress and evaluation.

A 3rd group of information needs relates to those who have an interest in the Protected Area and its Management Plan. Traditionally little attention has been paid to these people, 'the stakeholders'. We might consider them 'the customers'. Certainly many of them have a close interest in what happens within 'their' Protected Area, sometimes because they might live within it or near it and part of their livelihood depends on it. This is the case in both National Parks and nature reserves. Yet often even the basic information, such as the names and addresses of these people, is lacking

*3 - Who has an interest in a Protected Area Management Plan?

Undoubtedly the first answer given to this question is - the Site Manager and his/her boss. But, depending on the size and nature of the area, the list of others with an interest quickly grows. If the area has European or national status, politicians will be interested. If the status is regional or local, Local Authorities and Councils may be concerned. If the local community uses the Protected Area for recreational purposes, such as walking or horse riding, they will be interested. Nature conservation NGO's keep a close eye on the way Government Departments and Agencies exercise their responsibilities and for more important areas may wish to be involved in decisions on management. The owners of land adjacent to or even within the Protected Area will have a major interest in both management objectives and action programmes, particularly where the results are likely to affect them. There are many examples, but some of the more obvious are the impact of water table management on grasslands and cereal growing, or the impact of the expansion of animal populations, such as wild geese, on agriculture. So what process of Management Plan production can accommodate this wide range of interests, some of whom seem intent on ensuring that no satisfactory conclusion is reached? The lessons are that Management Planning cannot be carried out in isolation. Nature conservation is an activity, which is multi-sectoral, and must be integrated with mainstream land uses.

*4. How does the Site Manager know if he/she is making 'a profit'? *

In commercial terms, profit may be measured or judged at the level of an individual business, or a group of businesses, a section of a national economy or the economy as a whole. The Biodiversity Convention and the Sustainable Development Convention both provide us with the biological equivalent of the national or the world economy. Biological balance sheets as well as financial ones should be possible. But how can we define or measure in wildlife terms what we mean by profit expressed as the results of Protected Area management? Protected Area managers may refer proudly to the way they have increased the populations of animals, often birds, but when more detailed questions are posed they accept that their management may simply have concentrated the birds of a wider region on an area they have made particularly favourable to them. Who can blame the birds? The definition of 'profit' in wildlife terms is not so easy as it is in financial terms. But assuming that a definition of profit can be produced and information collected to demonstrate that it has or has not been achieved, what will the site manager do with the information? There are 4 options open to him/her:

1 Carry on with the same management programme or regime
2 Modify the management programme or regime with a little more or a little less of the same. Examples might be changes in grazing intensity or timing.
3 Change to a completely different management regime, such as cessation of coppice management of woodland and the introduction of high forest management.
4 Stop all management either as a firm choice or until a better understanding of the 'loss of profit' is understood.

The important point is that the information required about 'wildlife profit' is that which is needed to help with decision making on where to go from here. Information is needed to help rationalise the management choices, which must be made.

4.1.2.3.2 Success and failure of conservation projects: first lessons from LIFE-nature projects

Author: Geert Raeymaekers, Mats Eriksson, Kerstin Sundseth, Anton Gazenbeek and Etienne Branquart **Date: 12 November 2001**

The selection of LIFE-nature programmes published on the website of this electronic conference (http://www.biodiversity.be/bbpf/econf/econfdocpractice.html) has been analysed together with the case studies sent by individual contributors. Interesting conclusions can already be set out about the scientific aspects that should deserve to be strengthened to improve the success of field biodiversity projects. These first conclusions are shortly presented hereafter, hoping that they will stimulate interesting discussions during this conference.

1. Conservation research is not the only element that defines the success of a LIFE-Nature project

Success or failure of the implementation of LIFE-Nature projects is in most cases influenced by socio-economical problems. For the practitioner, problems such as local opposition to the conservation measures and the change in land-use, financial constraints and lack of project management are much greater challenges to over-come than how to link the project actions to the relevant scientific experiences. Scientists much too often overlook the fact that for practitioners it is the political and socio-economic constraints that are main difficulties to overcome when launching a project, not (and at least in their view) the scientific ones. Lack in our knowledge about biodiversity is often regarded as minor constraints that has to be compensated by experience, intuition and common sense, although almost no-one questions the necessity of sound scientific bases. The majority of the LIFE Nature projects are "experience-based" (i.e. based on personal experience and intuition) rather than "evidence-based" (i.e. based on a sound scientific approach).

2. Which scientific approach in LIFE-Nature projects?

In general, the importance of previous research efforts are usually not explicitly mentioned in the LIFE Nature applications. Clear references to results from modelling or experimentation are rare.

However, conservation science is directly linked to the sample of LIFE-nature projects selected for this conference. Scientific tools are clearly needed to carry such conservation projects through to a successful conclusion. Monitoring and indicators are involved in each project while field experiments and modelling approaches are used respectively in 38 % and 27 % of the projects.

Using the different research topics of conservation biology that have been described in With's publication (1997) as an analysis framework; we logically found that applied sciences play an important role in all these projects. Conservation management sciences (ecological engineering, restoration ecology, etc.) and studies of threats on biodiversity (impact assessment) account respectively for 88 % and 62 % of the selected projects.

SPECIES MANAGEMENT - More surprising is the use of basic biological sciences for a large proportion of projects, especially species-oriented ones. It involves current theories on:
- Biogeography and species distribution (60 % of the projects),
- Species and population ecology, including habitat use, population dynamics, meta-populations and species interactions (56 % of the projects),
- Population modelling and viability analyses (15 % of the projects),
- Genetic and molecular approaches, including risks of genetic erosion (15 % of the projects),
- Basic taxonomic studies (4 % of the projects).

A modelling approach grounded in a sound background in functional ecology (population dynamics, meta-populations, interspecific interactions) and conservation genetics is particularly useful to conserve or restore small, fragmented and endangered populations. LIFE-nature projects dedicated to *Ladigesocypris ghigii*, a threatened endemic fish to Rhodes island, the Danube Salmon (*Hucho hucho*), the fire-bellied toad (*Bombina bombina*) in Denmark, grouse species (*Tetrao urogallus* & *Bonasa bonasia*) in the Black Forest, Little Bustard (*Tetrax tetrax)* in France, Golden Eagle (*Aquila chrysaetos*) in Ireland, Wolf and Brown Bear in Central Apennines are very nice examples to this purpose.

Additional examples of scientific research as a support to the implementation of LIFE-nature projects oriented towards the conservation of species can be found on the website of the International Symposium on "Freshwater Fish Conservation" (30th October - 4th November 2000, Algarve, Portugal): www.malhatlantica.pt/saramugo/Theme%20II%20oral.doc

HABITAT MANAGEMENT - Theoretical concepts or research questions are less present in LIFE-Nature projects focussed on habitats, although underlying problems related to the functioning of threatened ecosystems (hydrology, nutrient fluxes, trophic networks, ecological successions, landscape ecology, etc.) are often raised and rarely overcome when managing or restoring habitats. A better knowledge in the functioning of ecosystems will unquestionably lead to improve the success of management and restoration projects in the field as it has already been stressed by several contributors to this electronic conference (see e.g. the contributions of Hauke Drews, Didier Alard and Les Firbank).

Approaches related to ecosystem functioning are clearly linked to 38 % of the analysed projects. For example, most of the actions related to the management of bogs and mires we presented are directly grounded in preliminary hydrological studies. Important background information to this purpose is summarised in a document prepared by Ecosystems Ltd for the DG Environment (Conserving mires in the European Union). It that can be freely downloaded at:
http://europa.eu.int/comm/environment/nature/bogs.pdf

Restoration actions undertaken in the context of LIFE-nature projects are very close to the classical experimental approach used by scientists. Providing that these actions are backed up with ad hoc control treatment and replications, information collected during these projects could be used to develop best practices in management!

3. Monitoring approach of LIFE-Nature projects

Monitoring of project results is an important component in the majority of the LIFE-Nature projects. Few project operators question the need to monitor the outcome of a project, and the need to apply scientific criteria also for the choice of monitoring methods and the documentation of results is seldom questioned. The central role is also reflected in the fact that monitoring techniques have sometimes been developed or adjusted for the specific project purposes. However, the scope of the monitoring efforts can be very different, e.g.:

- To look at certain management effects, or to look at population trends without having a specific question in mind;
- To focus on biotic or/and abiotic parameters;
- To focus on species and less on habitat types.

However, the long-term aspect of the need of monitoring must not be neglected. Even when a project is well-prepared and implemented, the effect of the restoration measures on the fauna, flora or habitat types is in most cases visible only after some seasons, i.e. after the LIFE-Nature projects have ended in most cases. Mostly, the soundness of the underlying scientific concepts can be only tested only (long) after the project took place, and it is not until than more general conclusions and experiences for the future can be drawn. An interesting example of this can be seen in the case of a Great Bustard, *Otis tarda*, in Brandenburg where despite tackling conservation problems relating to its habitats, the population did not recover - only then were the additional threats teased out. Find more information to this purpose within the 'Life after LIFE ' report published by the DG Environment (http://www.biodiversity.be documents/bustard.pdf).

It should also be kept in mind, that monitoring within LIFE-Nature projects is primarily in order to check the final outcome against project objectives and to make it possible to evaluate the effects of various project actions. Mostly, the pre-project situation is documented before e.g. restoration takes place. Thus, "before-after" comparisons are often possible. But more seldom, monitoring is done in parallel on "control" or "reference" plots not targeted for any actions, e.g. a pure experimental design is rarely applied.

4. Continuous attention should be given to descriptive biodiversity

Scientific research and practical conservation have in common the need of reliable references in terms of the kind of biodiversity they are tackling. For various taxonomic groups among e.g. insects and plants, the detailed knowledge lies in a handful of experts. Lack of economic as well professional incentives have hampered the recruitment of new and young taxonomists all-over the world. Scientists and practitioners have repeatedly highlighted the “crisis of taxonomy” over the last decades.

Biologists rely to a large extent on the voluntary contribution of amateur scientists to sample biodiversity, and to identify new or disappearing species or populations. The information gathered by these people and stored in natural museums, national or regional herbaria and/or databases throughout Europe are our biodiversity archives and form the baseline data for the development of most biodiversity research and conservation theories. Scientists at these research institutes play a crucial role in solving the taxonomical problems, in making the manuals to identify plants and animals in the field, to clarify the ecological niches of species or to the habitat characteristics and processes. The research is to a large extent descriptive, although new techniques (DNA-techniques, computer modelling, ordination techniques etc) are successfully applied.

Several LIFE-Nature projects have involved much descriptive research (e.g. nationwide inventories), primarily between 1992 and 1996 when member states where preparing the list of proposed sites of habitat types and species as requested by the Habitats Directive (most of such projects took place in the cohesion-countries such as Greece, Italy, Spain, Portugal, and Ireland). It is also significant that a number of these descriptive research projects take place in projects where little is known of the habitat or species (e.g. marine environment, saproxylic beetles)

5. Research in Natura 2000 areas

It is already since long understood that protected areas are crucial to for biodiversity research. We have noticed that many research projects take place in Natura 2000 areas (even if not funded by LIFE), and this will not change with time. However, as our protected areas become more and more islands inside cultural landscapes, these "research labs" could change over time. They could be increasingly important as "reference sites" in studies aimed for a better understanding about ecological process and how biodiversity on the genetic, species and ecosystem levels is affected by various impacts in the "everyday landscape".

6. Priority areas for improving the success of conservation projects

Some preliminary conclusions could be already proposed to identify priority research fields or questions in conservation biology:

- The main obstacles for better and clearer links to science are the political and socio-economic imperatives that must be tackled in a competent way if any chance at all for a successful implementation of a project. Most project operators have an insight of the elements in theories relevant for the problems they tackle, but find the gap between "the ideal world of theory" and realities too wide to bridge. How can we develop efficient strategies to improve the dialogue between managers, scientists and policy-makers?
- In most LIFE-Nature projects, the need of scientific tools in terms of methods and evaluation criteria for monitoring is identified. But the theoretical framework for the project design is mostly less pronounced. One may ask if reliable cost-effective indicators are available for the monitoring of both species and ecosystems management?
- Descriptive research and monitoring are key elements to all projects, but focus essentially on "before-after" comparisons and species/habitat inventories (descriptive studies). More attention should deserve to be paid to the functioning of populations and ecosystems.
- If LIFE-projects are seen as test beds for the development of certain conservation techniques and practices, how can this "experience-based" approach be used to link up with the more "evidence-based" approach of conservation scientists? How can best practices be defined for the management of key-habitats in the context of the LIFE-nature programme and of the implementation of the Natura 2000 Directive? How can we improve the access of field practitioners to such information?

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4.1.2.3.3 **Lack of scientific knowledge to support benefits of grazing on lowland heathland**

Author: Isabel Alonso **Date: 13 November 2001**

Summary. Heathland managers and advisers are currently dealing with a twofold problem: on one side the lack of scientific evidence to back up management decisions and on the other, the length of time required to obtain this evidence and the need of action now.

Lowland heathland is a threatened habitat for which the UK holds 20% of the World resource. Only 16% of the heath present in 1800 remains today and much of it in small, isolated fragments. One of the main problems for the conservation of the lowland heathlands is the lack of appropriate management that, as a man-made landscape, heaths require to be maintained. Grazing was a fundamental part of traditional heathland use and part of the cultural and agricultural landscape.

During the last few years grazing has been re-introduced to a series of heathland sites in the UK in order to improve their ecological condition. However, not all conservationists agree that grazing is the best way of managing this ecosystem. Many oppose this management tool on the grounds that not enough is known about the ecology and histories of many key species of lowland heathland invertebrate, reptile and plan populations, to predict how livestock grazing may affect populations.

English Nature recently commissioned a report to collect all available information (published and unpublished) on this issue. One of the conclusions of the report is that, although there is a lot of experience on grazing around, not a lot has been published and "much of the available data are not easily interpretable, having being collected from sites with no baseline monitoring, from studies which were insufficiently replicated and/or with insufficient monitoring."

The problem is that full replicated experiments to respond to the questions of impact on some populations will only produce results that policy advisors can use in a long term (10 years at least?) and we need to take decisions now. These experiments will require different grazing regimes (and species) and a network of sites. And the same with any of the other options suggested in the report such as detailed monitoring of ongoing and new grazing projects, studies of herbivores behaviour and diet selection, etc., and autoecological studies of key species. The second problem is the high economical costs of such experiments.

The report "Impact of livestock grazing on lowland heathlands in the UK" is available from English Nature's web page www.english-nature.org.uk - publications).

4.1.2.3.4 **"Eco-Flops" in our fields**

Author: Etienne Branquart **Date: 15 November 2001**

Abstract: European agri-environment schemes have been developed across Europe since 1992. However, few of them have been designed or assessed in an appropriate way. Basic ecological studies and applied research need to be developed to improve their benefits for biodiversity.

About 1.7 billon euros is spent each year across the European Union for the so-called "Agri-environment" schemes, aiming at producing environmentally friendly farming and at reducing the level of the agricultural production (Common Agricultural Policy). These measures consist for example in postponing the spring mowing grazing, in sowing flower strips along field margins, in protecting or installing hedges, in creating buffer zones around wetlands and along rivers, etc.

Today, these schemes are not accompanied by a scientifically sound evaluation plan and very few measures have been performed to test whether they really have a positive impact on biodiversity (see also Roger Cummins's contribution to this purpose, session 2).

David Kleijn, a Dutch scientist, recently published in Nature a provocative assessment of the impact of such measures on biodiversity. Though the Netherlands has been implementing agri-environment schemes since 1981 (which is considerably longer than in other countries of the EU), benefit for wildlife seems to be negligible! Management agreement designed to enhance the botanical diversity failed to increase species richness in field edges, probably because nitrogen rates are still too high and seed source scarce in agricultural landscapes. In comparing the populations of breeding birds (e.g. oystercatchers and black-tailed godwits) in fields managed in a "green" way and conventional ones, he found no positive effect on bird diversity. In fact, nesting bird densities are lower in the "eco-fields" even if their reproductive success is much better in these areas. David Kleijn suggests that the introduction of management agreements in agricultural landscapes act as an "ecological trap". In fact, birds avoid to nest in fields with management agreements because the use of fewer fertiliser goes together with a reduction in the abundance of earthworms they use as trophic resources.

Sowing flower strips along fields consists in an other popular agri-environmental scheme in Europe. As they attract large numbers of hoverflies with aphidophagous larvae (Diptera: Syrphinae), this technique has been tested as a biological control technique. However, the creation of such flower strips scarcely allow to increase egg densities of predators in the field and the impact on aphid populations is often not significant. A good knowledge of hoverfly life-histories and oviposition behaviour should however allow to design more efficient ways to manipulate habitat and to increase the impact of these predators on culture pests (Branquart 1999, Branquart & Hemptinne 2000).

Both case studies presented here above show that ecosystems are more complex than it has been originally thought and that just reintroducing "green" elements in agricultural landscapes is not enough to have a positive impact on biodiversity. As agri-environment schemes are used at a broad scale in Europe, I would like to support the plea of Roger Cummins and of David Kleijn: our agri-environmental policy absolutely needs to be grounded in sound ecological knowledge.

I really think that we can implement more coherent and efficient agri-environmental schemes providing that:

(1) Strong basic ecological studies in population biology and functional ecology are performed to identify the cues used by organisms to select their habitat and to understand how they exploit feeding resources, invest reproductive energy, disperse in the landscape and interact with other species.
(2) The results of such basic ecological studies are used to design large-scale field experiments corresponding to different management scenarios (e.g. design and density of agri-environmental schemes).
(3) The adopted agri-environmental schemes are afterwards subject to careful monitoring to be sure that the expected beneficial impacts on biodiversity are reached.

Such approach has already been fruitful to save the last populations of Cirl Buntings (*Emberiza cirlus*) in Devon, UK (Pain & Pienkowski 1997). Hoping that we will not miss the next opportunity to improve biodiversity in European farmlands !

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4.1.2.3.5 Conservation of biodiversity demands/produces ecological theory: myrmecophilous insects as a model system

Author: Karsten Schonrogge & Jeremy A. Thomas Date: 15 November 2001

Abstract: For more than 25 years the myrmecophily group at CEH Dorset is studying the interactions between myrmecophilous insects and their host ants. The studies were triggered by the decline and eventual extinction of the myrmecophilous butterfly *Maculinea arion*. Here we use a description of these studies to illustrate how the development and application of ecological research ultimately allowed the re-introduction of this species to Britain. Detailed studies of the population ecology of ants and butterflies allowed the development of a theoretical model, predicting parameter spaces, which could be used to design site management strategies. We then discuss other fields of ecological research where current knowledge is limited, but which investigation should increase the efficiency of conservation measures ("umbrella species"). Finally we discuss research needed to establish levels to which conservation strategies might be transferable.

The second question of the week specifically concerns research gaps in population ecology. However, we believe that a) lack of understanding in other fields of ecology can be just as important; and b) it is worth noting that, in our experience, research designed to answer questions about conserving biodiversity also has a high potential for developing new fundamental theories in ecology (Hochberg et al 1996, Clarke et al 1997, Thomas et al 1998a); moreover, the application of research results to conservation projects often offers an unique opportunity to test specific predictions and general theory in large-scale long-term field 'experiments' (Thomas et al 1998b).

In the myrmecophily group, here at CEH Dorset, one area of conservation research has focussed for >25 years on socially parasitic myrmecophiles: species that spend the majority of their life cycle inside ant nests, feeding on the resources of the colony. Myrmecophiles are an important, though specialised, group in conservation; we estimate that >10,000 insect species worldwide are obligate social parasites of ants and a further 80,000-90,000 species of insect (twice the number of known vertebrates in the world!) form closely-coupled mutualistic interactions with ants (Schonrogge et al 2000, in press). The social parasites, in particular, tend to be rare specialists that feature highly in Red Data Book lists (Thomas & Morris 1994).

We specialised mainly on *Maculinea* butterflies (including their very rare species-specific ichneumonid parasitoids); more recently on *Microdon* hoverflies. All of the five *Maculinea* species in Europe are listed as globally Endangered or Vulnerable and are protected throughout the EU. Only one, *Maculinea arion*, was known in Britain, but had been in decline for >150 years, finally going extinct in 1979. Like all *Maculinea*, *M. arion* has a life cycle where the adult butterfly lays its eggs on an initial host-plant. The first three larval stages feed on the host plant, but grow very little. The fourth instar then drops from the plant and is adopted, i.e. carried by workers, into the nests of *Myrmica* ants, where *M. arion* lives as a predator of ant brood. This was the state of knowledge shortly before *M. ario*n went extinct in Britain. Despite 50 years of targeted conservation programmes (based on 'educated guesses', not research), there was inadequate knowledge of why the butterfly was in decline to be able to save it (Thomas 1980).

An intensive 6-year population dynamics study was made of the last UK *M. arion* population in the 1970s, which later continued using continental populations. The first breakthrough was the discovery that - although four species of *Myrmica* commonly shared the habitat with *M. arion*, all with an equal probability of adopting the larvae - *M. arion* survived well only in the nests of one ant, *Myrmica sabuleti*. (Thomas 1980) Models indicated that >50% of larvae must be adopted by this host for a population of *M. arion* to persist. Equally important was the discovery that each species of *Myrmica* occupied a much narrower niche within grassland than the initial food plant (*Thymus*) (Thomas 1995). In Britain, *Myrmica sabuleti* was sufficiently abundant to support *M. arion* only in the south and then only in situations where *Thymus* grew on south-facing slopes in close-cropped (<3cm tall) turf, where the microclimate of the soil was exceptionally warm (by UK standards). Other unsuitable *Myrmica* species occupied similarly narrow species-specific niches in cooler (taller) grassland containing *Thymus*. What had happened in Britain was that, due to changes in agricultural practise (mainly abandonment of unfertilised grassland), the ranges of *Thymus* and *M. sabuleti* had become disjunct. *M. arion* were increasingly likely to be adopted into the nests of other *Myrmica* species, where they were killed. Large populations of thousands of adults quickly went extinct (Thomas 1980, 1985, Thomas et al 1998b).

In the following years, the population dynamics of the other European *Maculinea* species were also unravelled. Each has evolved to exploit a different species of *Myrmica* (in the case of *Maculinea alcon*, two host switches occur across its European range) (Thomas et al 1989, Elmes et al 1994). In addition, the five *Maculinea* species represent a spectrum of life history traits that determine the interactions with their host ants, with knock-on effects for their conservation. *M. arion* and *M. teleius* larvae are obligate predators of ant brood, whereas *M. rebeli* and *M. alcon* are cuckoo-feeders, i.e. the caterpillar convinces the ant workers that it is a "super-larva" and is fed directly by the ants in preference to their own brood (Elmes et al 1991, Thomas & Wardlaw 1992). *M. nausithous* is also a predator of ant brood but shares some attributes with the cuckoo-feeders. Predation is a much less efficient way of exploiting ant nests. It requires about six times the density of host ants to support a similar sized population of predatory *Maculinea* compared to a cuckoo species, and small populations of the latter can persist on sites where only about 10% of larvae are adopted by their host ant, compared to >50% adoption in predacious species (Thomas & Elmes 1998).

Our population dynamics studies also showed that all *Maculinea* spp. suffer intense intraspecific competition for food, leading to high density-dependent mortalities within host ant nests. However, the form of competition ranges from contest competition among *M. rebeli* larvae (where some larvae always survive in over-crowded ant nests) to scramble competition among *M. arion* larvae (where all larvae starve to death when over-crowded) (Thomas & Wardlaw 1992, Thomas et al 1993). This again affects population persistence and their ease of conservation. The contest competition experienced by *M. arion* results in much more erratic population fluctuations than in *M. rebeli* (Thomas et al 1998b). Thus small populations of *M. arion* run a much higher risk of local extinction.

This knowledge came too late to save the last UK *M. arion* population from extinction (Thomas 1980), but the studies of continental populations ultimately led to a series of spatially explicit population dynamics models that take into account niche dimensions (i.e. gradients and heterogeneity in soil micro-temperatures, vegetation cover, etc.), interspecific interactions between competing *Myrmica* species, and spatial refuges for the host ants (away from the host plants) (eg Hochberg et al 1994). These models have largely been validated in the field (in the Alps & Pyrenees) by successfully testing six predictions concerning *M. rebeli* (Elmes et al 1996, Thomas et al 1997). Rather simpler mechanistic models also allowed us to design appropriate management regimes for former *M. arion* sites in Britain, with the aim of restoring the species to former regions (Thomas 1994). *Myrmica sabuleti* populations soon returned and responded very closely to model predictions (Rsq 84%). Swedish *M. arion* was then reintroduced from the early 1980s. All but three (of the most northern) reintroductions have been successful, with the longest persisting for 18 generations to date and three being among the largest known for this species in the northern half of Europe. Again, the model predicted the growth and fluctuations of the successful *M. arion* populations on different sites with a high degree of confidence (Rsq 26%-75%).

Myrmecophilous systems have proved to be particularly accessible tools in research and conservation, due to the closely-coupled interactions of the small number of member species in each 'community module'. However, understanding their population dynamic interactions has wider applications, since ants are keystone species which impact greatly on many other species in their habitats. For example, when managing UK grasslands to restore the habitat of *Myrmica sabuleti* (for *M. arion*), it has been clear that a variety of other local and declining fauna and flora have increased greatly, including five others of the most threatened UK butterfly species in the UK. Thus *M. arion* has become an "umbrella species" - a term more often used in the US. A major gap in knowledge is to what extent are the increases observed in other species on managed *Maculinea* sites predictable, and do they result from the direct or indirect interactions of an increase in particular ant species with their populations, and/or do the species that benefit simply possess a similar type of habitat that had become rare in UK grasslands due to socio-economic changes. Understanding this forms part of a new pan-European study (MacMan) funded by Framework V of the EU.

Another question is how far can one generalise from population studies of one species to the conservation needs of others that possess similar life history traits? Our work with *Maculinea* demonstrated the absolute necessity for successful remedies to be based on a detailed scientific understanding of a threatened species or ecosystem, but with so many species listed as endangered in Red Data Books there is neither the time nor resources for detailed studies to be made on more than a small proportion of species. We believe that the careful selection for intensive study of representative species from different guilds would be an effective and efficient approach. We identify the population ecology (including niche partitioning, dispersal and metapopulation structure) of saproxilic species (rotting wood species of ancient trees) as a high priority for research (Thomas & Morris 1994).

As already stated, myrmecophilous systems also contain a disproportionately high number of endangered specialists. Our group at CEH Dorset has recently become particularly interested in the effects of evolutionary history on populations of myrmecophiles in different parts of their range, especially the extend to which co-evolution has occurred locally between each myrmecophile and its host (the Mosaic Theory of Evolution) (Elmes et al 1999). This could greatly affect attempts of their conservation.

For instance, at least one of the *Maculinea* species, *Maculinea alcon*, is known to use different host ant species in different parts of its range in Europe. The same is suspected of another *Maculinea* species. Clearly, it is essential to know which ant is host on a site before one can manage for that species. Here, we study the closeness of the chemical mimicry shown by the butterfly larvae with different species of *Myrmica* ant and different populations of their known hosts, during and after their adoption by ants (Akino et al 1999, Elmes et al in press). These, together with evolutionary studies, should increase understanding of myrmecophile-host ant associations and aid the conservation of these species and others that require specific types of the habitat.

In another myrmecophilous system, involving syrphids of the genus *Microdon*, we demonstrated that *Microdon mutabilis*, already a British Red Data Book species, is in fact two cryptic species (Schonrogge et al in press). While two species in the place of one undoubtedly increases the biodiversity in Britain, each of them now has only half the abundance of the original 'species'. We also found that the two cryptic species have very different ecological requirements. Thus ignorance about cryptic species, a concept that only received full recognition with the arrival of molecular methods, might have led to the extinction of one of them due to inappropriate management of sites to promote the conservation of the other. In this study we hypothesise that cryptic speciation might be prevalent in species were selection is likely to act on physiological rather morphological characters, i.e. myrmecophiles, parasites, parasitoids, etc. (Schonrogge et al in press).

In summary:

1) Only intensive research into the population ecology and life history traits allowed the re-introduction/conservation of Maculines arion in Britain.
2) Theoretical models allowed the prediction of parameter ranges that were used in the design of site management strategies.
3) Comparative studies within guilds should elucidate how transferable strategies are.
4) We are only starting to understand the impact of evolutionary history and geographic variation of life history traits on the distribution, abundance and population ecology of species.
5) We know that *M. arion* sites also promote other butterfly species that are in decline elsewhere. However, further community wide research is needed to understand why that is.

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4.1.2.3.6 Research in untrammeled national park zones: cultural footprints, natural processes and biodiversity

Author: Peter Bliss & Andreas Katzerke **Date: 22 November 2001**

"Untrammeled land" is a metaphor, playing literally with the word "trammel", that "is a net for birds or fish or a shackle used to make horses amble", to picture self-organizing and autonomous land conditions, not manipulated or directed by humans for any purpose (Cole & Hammitt 2000). Synonymous words are "wild", "unconfined", "unrestrained", "natura let" or "self-willed" to describe land's freedom from human control. As a wildernist from Arkansas pointed out in an internet discussion forum regarding pros and cons of wilderness designation, "wilderness is a test to see if we the natural dominators can leave a piece of land alone to let nature have it's way" (Wasson 2000).

We agree with Hauke Drews. More new wilderness areas in Central Europe are needed as a tool to save natural processes and biodiversity. Better we should say, "to develop" because the majority of areas has a rich history of anthropogenous influences. Germany's national park programme is a big step forward.

The natura-led transformation process in national park core zones resembles a large-scale experiment in landscape scales. Here wilderness scientists should learn more about how nature works. And they should learn more about advantages of the strategy regarding biodiversity patterns in untrammeld lands. A central research target from our point of view is to clarify relations between former anthropogenous disturbances (cultural footprints like meadows in wood regions) and today's more natural disturbance-regimes. Furthermore we need an adequate monitoring scheme focused not alone on a net of local fixed small-scale plots. Who has experiences in this field?

We concentrate our research approach on colonies of mound-building wood ants (Narrow-headed ant, *Formica exsecta*) in the Müritz National Park (Mecklenburg-West Pomerania). The narrow-headed ant seems to constitute an ideal bioindicator although it is vulnerable or endangered in many regions in Germany. If it occurs, it usually has a metapopulation-like distribution pattern and sometimes large aggregations with hundreds of nests. The dispersion pattern of nests in open habitats is influenced by vegetation architecture, soil conditions and water table depths.

Because ant colonies are sedentary it is possible to follow population processes to evaluate the impact of natural disturbances (e.g. red deer grazing, flooding, fire). But sometimes research brings completely surprising results as our discovery of mole mounds as a key factor in nest aggregation founding. So we realized in our one-species approach the necessity of a more complex view and the integration of species interactions. Is there anyone specialized in mammalian-ant interactions? The lesson is clear: We do not have enough basic knowledge. Only if we investigate the ecology of ants in detail our models can be precisely enough to sustain the conservation (monitoring) praxis truly.

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4.1.2.3.7 **Biodiversity conservation and the Natura 2000 network**

Author: Matthias Schreiber **Date: 23 November 2001**

Biodiversity research in Europe should be focussed on the species and habitats of the Habitats (92/43/EEC) and Birds Directive (79/409/EEC) in a first step. Under this Directives protecting biodiversity is no longer "only" a scientific or moral value, but also a legal, because member states of the European Union are strictly obliged to realize biodiversity and a monitoring system.

1) The habitats directive of the European Union lays down in Article 3: "A coherent European ecological network of special areas of conservation shall be set up under the title Natura 2000. This network, composed of sites hosting the natural habitat types listed in Annex I and habitats of the species listed in Annex II, shall enable the natural habitat types and the species' habitats concerned to be maintained or, where appropriate, restored at a favourable conservation status in their natural range." Looking to the decisions of the European Court (especially according to the birds directive; for example the Cases C-355/90; C-44/95; C-3/96; C-371/98; C-374/98; C-71/99), member states will be obliged by the European Court of justice to fulfil the legal requirements of those directives.

Therefore, scientists should ask at the actual state of discussion (selecting the "Sites of Community Interest" - SCI): Is it possible to maintain the habitats and species under the habitats directive in an favourable conservation status by protecting the proposed SCI's selected by Germany, Denmark, Spain,..., by the European Union? If not, the habitats directive will be a powerful instrument to demand further efforts and investigations in nature conservation. Prospects of success will be high, if deficiencies must be ascertained. In which European country have been done investigations about this question?

2) Member states are obliged to maintain this favourable status of conservation. What the favourable status of conservation should be, is defined in article 1 of the habitats directive. Scientists should ask, which level of monitoring is necessary to recognize this legal request? In my opinion the level of monitoring has to be very high according to article 1 of the habitats directive, and the Natura 2000 standard data form (EUR 15) of the European Union will be an insufficient starting point to document the status of conservation. What kind of monitoring

must be established to recognize (especially negative!) changes in the status of conservation in the sites of the network Natura 2000?

My conclusion: It could be a huge step forward in nature conservation, to fill up the clear and strict (and political accepted) legal obligations of the Habitats and Birds Directive with a well-founded system of standards according to the network function of Natura 2000 and the necessary standard on monitoring the conservation status of habitats and species.

4.1.2.3.8 **From landscape fragmentation to conservation practices**

Author: Zoltan S. Varga, Date: 23 November 2001

(This message was also posted to session 2 of the e-conference)

1) Fragmentation due to intensive human land occupation should be differentiated from the "nature-like" fragmentation within a mosaic landscape.
2) The formation of metapopulation structures is a natural phenomenon in species, (i) typifying successionally transitional or skirt-like habitats, (ii) connected with different habitats during different phases of their life-cycle, (iii) having a large dispersal activity during the egg-laying phase (e.g. +/- "K-strategist" large butterflies).
3) Indicator species: practically all changes of time/space dispersion of a "measurable" object (species population, assemblage of species pop's, guild, "taxo"cenosis) can indicate "something". Thus, the "sound" (falsifiable!) working hypotheses on the possible causes of the changes are important.
4) Research priorities: There are some general European trends of change (unfortunately, mostly negative!). I think that the landscape-level changes are mostly important (see: items 1-2).
5) "Restoration" may be different according to the "object" which should be restored (restoration of a species population vs. habitat/ecosystem restoration).
6) Since scientists often observe the changes in initial phase, they should be involved also into the practical measurements/actions, etc. (I agree with Allan Watt).

1) Landscape fragmentation: Fragmentation of nature-like habitats and the rather dubious survival of small populations are the unavoidable consequences of the densely populated "high-tech" civilisations. Thus, the saving of the remains of the fragmented habitats and threatened small populations within the frames of some ecological networks should have the highest priority in these countries and communities of countries (e.g. EU). However: There is also an other type of "fragmentation": the high level of habitat diversity within a mosaic landscape with varied relief, with a variety of nature-like and semi-natural habitats and with "surviving" forms of sustainable "low-input" forms of (traditional) land use. If we consider the "Biodiversity Map" of Europe (Williams et al. 1999), it is evident that in Southern Central Europe we can see numerous such types of landscapes within an ecologically transitional region and with a high number of species. The mosaic-like variety of forested and open ecosystems typifies the "traditional" (southern) Central European landscape (e.g. South of France, southern Germany, Switzerland, Austria and last not least the countries of the Carpathian basin, especially the Pannonian region with the typical forested steppe in Hungary, Slovakia, Romania and Serbia). They are characterised by the overlap of ranges of species of different geographical origins caused by dispersal processes along small-scale gradients, e.g. the overlap of species belonging to different zono- and pedobiomes in forest-steppe areas of the Carpathian basin (Varga 1995). We need in these countries landscape-scale strategies of biodiversity conservation, with an enhanced international cooperation in the nature conservation, with "transboundary" national parks (e.g. Ferto-Neusiedlersee or Hungarian/Slovakian karst), protected landscape regions and ecological networks (e.g. within the catchment area of Tisza), etc., and with international support for the survival of the sustainable "low-input" forms of (traditional) land use, and, of course for the survival of the population: the really threatened populations of the species Homo sapiens (keeping the "know-how" of the traditional land use!). I think, the Institute of Landscape Ecology in

Bratislava (as a filial institution of the European Topic Centre) could effectively coordinate the implementation of such programs.

2) Most species can survive in anthropogenous fragmented landscapes only as isolated small populations, or - if they have some dispersal capacity - in (+/- labile) metapopulation networks, with many sinks and not numerous sources. In some cases they are forced to survive in highly fragmented metapopulations, although they could have a nearly continuous distribution under more nature-like circumstances (e.g. *Plebeius argus*). On the other hand: there are numerous species in which the formation of metapopulations is a "life-cycle strategy", e.g.:

(i) Species, living in successionally transitional habitats, e.g. the Heath Fritillary (*Mellicta athalia*), the Assmann's Fritillary (*M. britomertis*), the Danube Clouded Yellow (*Colias myrmidone*, nearly extinct from Central Europe, with some remains only in the transboundary area of Hungary Slovenia and in Romania: Transylvania),

(ii) Species, connected with nature-like or semi-natural forest-skirts or other "skirt-like" habitats, e.g. the Scarce Swallowtail (*Iphiclides podalirius*), numerous species of Hairsreaks (*Theclini* spp.), the Scarce Fritillary (*Euphydryas maturna*); species of tall-forb vegetation types as the Swallowtail (*Papilio machaon*), the Praying Mantis (*Mantis religiosa*) etc.,

(iii) Species, connected with different habitats during different phases of their life-cycle, e.g. the Clouded Apollo (*Parnassius mnemosyne*), the Apollo (*P. apollo*),

(iv) Species having a large dispersal activity during the egg-laying phase, e.g. +/- "K-strategist" large butterflies as the Purple Emperors (*Apatura iris* and *ilia*, the Poplar admiral (*Limenitis populi*). The types (iii) and

(IV) are often combined! I think numerous other examples could be mentioned, also from other groups of Invertebrates. We can conclude that these species have good survival chances within a traditionally used mosaic landscape (nearly no barriers of movements!), but practically no chances in the anthropogenically heavily loaded, fragmented landscapes (unescapable barriers of movements due to pollutions, "threatening" landscape features, etc.).

3) We need much more "operative" definitions of the Indicator Species: What should they indicate?! Since practically all changes of time/space dispersion of a "measurable" object (species population, assemblage of species pop's, guild, "taxo"cenosis) can indicate "something". We should develop more appropriate, aim-oriented monitoring programs, based on sensitive species, sets of species populations, etc. And, generally, the "sound" (falsifiable!) working hypotheses on the possible causes of the observed (monitored) changes are highly important. These working hypotheses should not be too "general", e.g. "land use change" or "global change" as possible background of the change, because they are hardly to falsify.

4) Research priorities: There are some general European trends of change (unfortunately, mostly negative!), mostly the fragmentation and the radical decrease not only of the natural or nature-like habitats, but also of the "softly" used semi-natural ones. Considering the traditionally used Central European mosaic landscapes, these could preserve important fractions of the "original" biodiversity plus an important set of species which had colonised the European cultural landscape in the early periods of human activity, e.g. bronze period (see: "Steppenheide" theory of Gradmann). Since the loss of both types of ecosystems are threatened by fragmentation, decrease or disappearance, I think that the landscape-level changes are mostly important (see: items 1-2). In the Eastern Central European "candidate" countries (i) the consequences of the large-scale "industry-like" (using a huge mass of heavily polluting chemicals) state-owned farming and (ii) the consequences of the recent abandoning of land use: both are important biodiversity threatening changes.

5) "Restoration" may be different according to the "object" which should be restored (restoration of a species population vs. habitat/ecosystem restoration). The species population restoration by re-introduction must be genetically strictly controlled! The habitat restoration must be also very carefully accomplished. Not only the often highly opportunistic birds are to be considered, which often colonise visually attracting but lower-quality habitats (see: "mal-assessment hypothesis") but mostly the narrow specialist Plants and Invertebrates.

6) Practical conservation measures: Since scientists often observe the changes in initial phase, they should be involved also into the practical measurements/actions, etc. (I agree with Allan Watt!). In addition: I agree that biodiversity research and also practical conservation should be focused on habitats (see: Annex I) and species (Annexes II and IV) of the Habitat Directive and Natura 2000, respectively (see: contribution of Mr. M. Schreiber). However, we should not forget the following facts: - Lists of Habitats (Annex I) and lists of species (Annexes II-IV) are mostly not harmonized with each other. We do not have lists of species characterising (as character species, constant species, quality indicator species) of the habitat types included into the Annex I. This is for me an important deficiency of the European nature conservation. - The lists of species (especially of Invertebrates) are rather incomplete and eclectic:

(i) The character species of the important habitat types are lacking (see above);
(ii) The biogeographically important and threatened species of some geographical regions (e.g. eastern Mediterranean, high mountains of the Mediterranean peninsulas, Pannonian region, Steppic region, etc.) are also lacking;
(iii) Important taxonomical groups of high indicative value (e.g. Ephemeroptera, Plecoptera, Trichoptera) are lacking.

4.1.2.3.9 **Conservation of European bryophytes**

Author: Ana Seneca **Date: 23 November 2001**

I may probably have missed some of the contributions due to difficulties in my internet connections. Anyway I hope I'm not repeating something somebody already focused. The problem of bryophyte conservation lies in two simple facts: 1. they are small and inconspicuous 2. They almost unknown to vegetation conservationists

This doesn't mean that they haven't received any attention from a conservationist point of view. There's an European Committee for the Conservation of Bryophytes, but again, should they continue to be considered a separate group to look at when monitoring or conservation work is going on in different communities? Their ecological role is known to everyone, yet most of the preliminary steps already taken for other organisms are far to be taken for bryophytes: solid bryoflora knowledge in the area of the European Community; strong efforts to solve taxonomic problems that tend to tie conservationists, preventing them to take the next steps (conservation at population levels and the quantification of ecological relevant populations parameters, etc.) The task has been left for bryologists on themselves, but an integrated conservation planning and monitoring could save bryophytes and their populations from the vicious circle they seem to have fallen: not known, too problematic taxonomically, not included in most ecological, landscape or other simple conservation planning. And this is even more serious if we consider the bryophyte dominated ecosystems, as bogs and mires, or the important pioneer role they play in restoring areas degraded by human action, or their role in soil conservation, air or water pollution control, regulation of hydrological resources, ...

I propose that in any database information system that these populations and work on these plants should be integrated, always taking seriously the fact that their overall knowledge is far behind the one that exists for other organisms. From a landscape analysis point of view the problem, as far as I know, was not even discussed. In Portugal, particularly most problems on these plants still lye on an incomplete knowledge of the bryoflora despite great efforts done in the latest decades by the few bryologists at functions, but I feel an enormous isolation from what's going on general conservation purposes and also that nobody "takes us too seriously" to integrate bryophytes in the scientifically designed monitoring programs of vegetation communities or integrate bryophytes on a general European flora database. The problem I believe is not restricted to my country, I believe that this situation is merely a reflection on the general density of knowledge on bryophyte biology, flora and ecology. This is strongly connected with a general ignorance of the decision makers when financing, designing and approving conservation programs, either simple or long term ones. In the case of bryophytes the approval of these programs should also include the approval of any basic knowledge of their basic biology and ecology relevant to conservation, in order to see if in the next years it's possible to keep up with the rest of the flora elements. In any case I believe that this is our responsibility as well. Any practical suggestions to inverted the course of this situation, or to improve effective collaborative work to change this situation is welcome.

These plants are small but respectable and, as it was said before, they may be an important reservoir for genetic resources, as they inhabit earth for a much longer period than most terrestrial plants.

4.1.2.3.10 Presentation of the books of habitats in France

Author: Farid Bensettiti **Date: 21 November 2001**

General objective of the book of habitats

Within the framework of the implementation of the directive habitats, the ministries for Agriculture and Fishing (DERF) and Regional planning and Environment (DNP) entrusted, with the National Museum Natural History in Paris the realization of books of habitats. These books aim to give a report on knowledge, in the scientific plan and the plan of management, for each habitat (appendix I) and species (appendix II) for which France is concerned and to make a synthesis in the form of cards of it. France has approximately 133 habitats of the appendix I (including 32 priority habitats), 83 animal species and 57 plant species of appendix II.-To improve knowledge of the habitats and the species with a double approach: + scientific + technical (tallies of management)

To work out starting from the reference frame of the European habitats (Manual of interpretation EUR 15), a detailed French reference frame of the habitats. The project of the books of habitats is the occasion to carry out an important reflexion on the diversity of the mediums which each generic habitat described in the European handbook of interpretation of the habitats represents. It appeared necessary, for a better knowledge in the scientific plan and the plan of the management of these great types of habitats, to carry out in a good number of cases not only one card by generic habitat but several cards, i.e. to decline the generic habitat in various elementary habitats.

Integration of the books of habitats in the process of application of the directive habitats in France

The books of habitats are documents of national range relating to the habitats of appendix I and the species of appendix II of the directive habitats. Written in the dialogue (hunters, farmers, forestry peoples, local bodies), under the responsibility of the Service du Patrimoine Naturel (MNHN), these documents comprise elements relating to the identification of the type of habitat, its operation, the ecological conditions which are necessary for him, with its evolution towards other types of habitats.

These documents also comprise positive orientations of management, which are nonconstraining proposals, being indicative, and which depends on the current state of knowledge. Unfavourable practices of management are also specified, which it is recommended to avoid to fulfil the obligations of the directive.

These documents constitute a framework for the elaboration of the documents of objectives. They aim to allow a certain harmonization of measurements of management, adopted in order to avoid regional disparities which, either by the insufficiency, or by the excess of measurements selected, would lead to a degradation, even to a disappearance of the habitat.

7 volumes carry on the whole of the habitats and of the species were written:

- Volume 1: forest habitats
- Volume 2: coastal habitats

- Volume 3: wet habitats
- Volume 4: agro-pastoral habitats
- Volume 5: rock habitats
- Volume 6: plant species
  Volume 7: animal species

4.1.2.3.11 **What about sociological research?**

Author: Emilio Laguna Lumbreras **Date: 17 November 2001**

Summary: Management of biodiversity is strongly dependent on the relationship between humans and nature. However, scientific forums on biodiversity focus its work on the biological/ecological data, not on the sociological sciences. Are we managing our habitats for biodiversity, excluding local populations?

Geert Raeymaekers proposed a suggestive question to be treated during this week: Has your conservation work identified areas where research is lacking? If so, where?

Probably most nature managers through Europe consider that some not-exactly-scientific topics can become more important for conservation that our current knowledge on biological or ecological matters. I'm thinking, of course, in sociological matters.

Recently, and fortunately, conferences and meetings on biodiversity conservation are growing up in Spain, and nature managers claim to reinforce the function of sociologists to co-design the recovery plans for threatened species. Most conservation projects do not include an intensive sociological research in their planning; they seem to consider that the sociological matters and influences can be well noticed by the same managers (usually biologists or engineers), that obviously don't follow the specific methodologies of the sociological sciences. Can we go long time on with those practices?

The three matters proposed for this conference session: 'Monitoring and indicators', 'Models' or 'Experiments' also should be applied to the human-species or human-habitats relationships. Isn't it? As a practical demonstration, the discussion area on public awareness of our recent e-conference, still opened, on MicroHabitats conservation (www.microhabitats.org) is practically empty, and the opened discussion on scientific matters have been focused on genetic problems of small populations, and so on, but nobody is speaking on the intensive, small-scale research and monitoring on the continuous influence of man on our biodiversity, made by specialists in sociology.

4.1.2.3.12 **RE: What about sociological research?**

Author: María A. Máñez Costa **Date: 19 November 2001**

The rapid loss of biodiversity presents one of the major global environmental problems today. The problem is particularly pronounced in areas, where biodiversity levels are comparatively high, but extremely endangered by increasing population density, poverty and commercial interests. Therefore, one of the major challenges is to identify approaches for biodiversity management that help to reach the goals of both biodiversity conservation and socio-economic development. The natural and the social sciences can contribute to meeting this challenge, especially if integrated interdisciplinary research approaches are adopted with a view to improving current biodiversity management approaches in developing countries. The research aims to contribute to meeting this challenge by studying recent approaches of biodiversity management both from a natural and a social sciences perspective.

The overall objective of our project is to contribute to a better understanding of nature conservation problems by studying in an interdisciplinary approach two benchmark sites of the "Franja Transversal del Norte"- bio-geographic region in Alta Verapaz, Guatemala: the Macizo de Cobán and the region of Laguna Lachuá. The project addresses the question how eco-regional conservation strategies can be devised taking into consideration bio-geographic criteria. Since such conservation strategies imply a much stronger involvement of the local population into the conservation efforts the project simultaneously studies how trade-offs between rural development and conservation can be minimised.

On the international level, eco-regional conservation approaches have received increasing attention in recent years. One rationale behind this approach are the difficulties to determine, from the natural sciences perspective, especially from the perspective of conservation biology, a clear understanding of viable population size and habitat requirements to reasonably assure species survival. Efforts to quantify these requirements proved extremely costly and time consuming. To enable effective biodiversity conservation in spite of this lack of exact knowledge, increasingly eco-regions instead of individual species are targeted for protection. The rationale behind this concept is to protect an ecosystem and thereby the species depending on it without a detailed knowledge of the requirements of each species involved (Renner, 2001). From the conservation management point of view this implies that individual protected areas need to be sufficiently large in size or well connected to other protected areas i.e. through corridors in order to protect a habitat of sufficient size. While there are several investigations concerning ecosystem fragmentation (Lovejoy, 19xy) there are rare projects that specify the consequences for conservation. There are indications that the success of eco-regional approaches to conservation can be considerably improved when applying biogeografic criteria. Although biogeografic criteria are not usually taken into consideration when devising conservation strategies in developing countries, partly due to the urgency with which decisions are made due to high rates of biodiversity loss. It is however conceivable/possible that protecting certain key ecosystems as centre of species formation, understood as components of evolutionary processes could provide security against the current biodiversity impoverishment (Meffe & Carroll 1994, pp. 135-138).

>From the social sciences perspective, a comparative study is promising because the basic underlying problems and the available income generation options are comparable, while the institutions involved employ different strategies to reach the goal of reducing deforestation and stopping the fragmentation of important wildlife habitats. Both areas are populated by the same ethnic group, the Q'eqchi'. In both cases, high population pressure, high incidences of poverty, limited infra-structural development; low market integration and restrained off-farm income opportunities contribute to the deforestation problem. However, both areas also have considerable potentials with regard to eco-tourism and the introduction of non-traditional crops. In Laguna Lachuá, the strategy to achieve nature conservation in this setting is an officially declared protected area, which is administered by a state agency and supported by an internationally funded integrated conservation and development project with an eco-regional development vision. A committee operating at the level of the eco-region, involving government and non-governmental institutions, the "Foro de Tierras, Desarrollo y Conservación" (Forum for land, development, and conservation), has been created to support eco-regional development. The strategy in the Macizo de Cobán differs from the approach in Laguna Lachuá in that it avoids to make use of the regulatory authority of the state. Forest areas belonging to local communities are protected by voluntary conservation and development agreements. According to these agreements, the Proyecto Eco-Quetzal provides assistance for income-generating projects, such as eco-tourism and introduction of new crops, while the communities or individuals commit themselves to stop slash and burn agriculture. Forest areas that belonged to large landowners have been protected by international organisations and individuals who purchased land for conservation purposes. A comparison will allow to study the advantages and disadvantages of both approaches and derive conclusions that are policy relevant not only on the regional level, but also on the national and international level.

Our research group "Valuation and Conservation of Biodiversity" is not only working in Guatemala but also in Germany and is composed of:

1. A conservation biologist, a geographer, an institutional economist, an ecological economist and an cultural anthropologist, working in Guatemala
2. A conservation biologist, a biologist, a political scientist, an agricultural engineer, a physical geographer, a cultural geographer and a lawyer working in Germany
3. A philosopher, a lawyer, a resource economist and an economist working on the international meaning of biodiversity.

For more information: http://www.gwdg.de/~izne/gk.htm

4.1.2.3.13 **RE: What about sociological research?**

Author: Emilio Laguna **Date: 20 November 2001**

The reply of Maria A. Mañez Costa shows an excellent demonstration of the possibilities to coordinate a wide, interdisciplinary team, working in a coordinate effort for nature conservation and eco-development. Thinking of this example, I notice that those coordinate programmes are usually difficult to be developed by any public administration, mainly in the case of richest countries, where the public managers are simultaneously specialized in very small, closed matters (as hyper-specialists). We have corroborated that, in our case (Valencian Community), some facts tend to repeat:

1) Coordinated, multidisciplinary teams are easily working through NGOs or semi-public organizations (some foundations for nature conservation, as the known cases of 'Territori i Paisatge').
2) This multi-disciplinary approach, where sociological and economical topics are more integrated, both in research and management matters, only can be easily developed working on small zones. However, our attempts to wide this option to bigger strategies (i.e., through any regional planning for biodiversity conservation) use to crash against the 'factic' powers (mainly against the opinion of other ministries or public departments, often expressing opinions closer than the economic powers, or some extremely corporative professionals -i.e., public works engineers, forestry engineers, etc.-.

Our experience also show that the spreading of this philosophy seem to be easier when the projects fit several conditions: -Local people has directly promote the initiative -usually after a starter idea or any orientations given by the public nature managers, sometimes expressed by 'non-official' channels¡¡-; so, they become protagonists of those project

- The projects raise a multi-focused goal, not only centred on nature conservation, but if possible also on some parallel benefits -not necessarily in economical terms, i.e., if the landowners are publicly recognized as good managers- or matters -i.e., promoting environmental education-.
- They are best established on the economically favourless zones¡¡¡ In those areas, the inter-relation people-nature is stronger, and the natural elements (trees, rocks, forests, etc.) also are considered as a symbol of certain local 'nationalism' (not exactly chauvinism, of course); at the same time, the nature is still an important source of local economy.

In those cases (but not easily for the remainder cases) the conservation of nature is equivalent of the conservation and improvement of the economic power and life stand. Probably this philosophy is extensive to big territories on countries in development, if political conditions can permit it; however, it can’t be easily transferred to more 'advanced' countries as Spain or Germany.

Please, notice that the laws of those most evolved countries, as in the case of the EU, are also strongly 'atomised' (extremely sectorial laws); this interconnection sociology-economy-nature conservation seem to be reserved for the EU’s financial tools, or to some great (but not concrete) declarations, but it's not well transferred to the legislation. Simultaneously the national laws are excessively focused on the responsibility (and protegonism) of the public powers, but their promotion of the NGOs activities is still poor (even in countries with a large tradition in nature conservation under private hands)

Our experience have been developed on our LIFE plant micro-reserves network (LAGUNA, 1999, 2001 and in press), a project focused on the preservation of small public plots to ensure their study and development of plant conservation experiences, also open to the protection of private zones owned by people actively engaged in nature conservation ideas. At this moment 155 zones have been officially declared, 25 of them belonging to the 'private model' (owned by individuals, NGOs, or municipal lands not agreed with regional administration); most private managers have created a new NGO ('Espacios para la Vida') focused on the management of their microreserves, obtaining alternative EU's funds from LEADER/PRODER initiatives, promoting a mixed management for plant conservation, environmental education and eco-tourism.

Thanks for any ideas in advance

LAGUNA, E. (1999): "The plant micro-reserves programme in the region of Valencia, Spain". Proceedings Planta Europa 1998,. Second European Conference on the Conservation of Wild Plants: 181-185. The Swedish Threatened Species Unit and Plantlife. Uppsala & London. ISBN 1-872613-06-3

LAGUNA, E. (2001). "The network of plant micro-reserves, a multifunctional instrument for awareness raising, involving landowners and scientific research". pp. 99-103 in 'Proceedings of the 2nd International Symposium of the Pan-Ecological Network: The partnership of local and regional authorities in the conservation of biological and landscape diversity (Rochefort, Belgium, 18-19 Sept 2000' Council of Europe. Strasbourg. ISBN 92-871-4610-1.

LAGUNA, E. (in press 2001): "The micro-reserves as a tool for plant conservation in Europe". 100 pp. Nature & Environment series. Council of Europe. Strasbourg. (also available via internet, entering the e-conference on microhabitats conservation, fater electronic registration, at www.microhabitats.org)

4.1.2.3.14 Online restoration information resource

Author: Wouter Vanreusel **Date: 15 November 2001**

Summary: Terrain managers and conservationists often lack relevant information concerning rare species/habitats conservation and restoration. An online database with comprehensible summaries of successful restoration projects, unpublished reports and scientific literature could be a major advance in increasing the success of local initiatives.

It might be clear from previous contributions to this conference that a major bottleneck for the successful conservation of small populations of endangered species and the restoration of endangered habitats is the availability of relevant information to the terrain managers. Relevant information can be scientific knowledge about the ecological demands of the species or the system involved, but also conclusions of political and ethical debates, discussions on choice of target species, experiences of other managers, problems with or successes in the conservation of similar systems in other countries.

I see four main reasons for this information gap.

1. Most scientific information is available for specialists only, not in a format that can be used by conservationists in the field. Only a very small proportion of terrain managers read primary literature. Review articles and handbooks are an important source of information for them, but the information presented is not always (or always not) up-to-date and discuss only a narrow selection of case-studies.

2. A lot of information does never gets published because it doesn't fit the scope of scientific journals which demand authors to present new, large-scale or spectacular research. Many small findings or minor research topics are not published and only reach conservationists

that are directly involved in the research. Because scientists are valued on the impact factor of their publications, they are often reluctant to publish their findings in journals read by practical conservationists.

3. Conservationists who are protecting the same species/habitats in different regions or countries do not often share their field experiences. Minor successes in restoration programs are only described in regional papers. Terrain managers and local associations mostly lack the skills or the budgets to get the results of their experiences published in international journals (or don't see the necessity of doing so).

4. In many countries (e.g. England, Germany and Holland) a wide array of Species Action Plans, Internal Notes, PhD's, Reports, etc. containing valuable information on management, restoration and monitoring of the effects already exists. These documents are often based on scientific literature and the best available ecological knowledge and are of large value for practical conservationists. Unfortunately, they are most often very expensive, hard to find (if you already know of their existence), kept internal, very case-specific and not always in English.

In general the problem is that the existing knowledge is diffuse, often not published, hard to find or too complicated and therefore not available for conservationists.

When Isabel Alonso says there is a lack of information concerning the grazing of heathlands, I do not totally agree. Lowland heathlands are one of the best studied semi-natural ecosystems in Western Europe and a lot of research already has been done. Besides, plenty of heathlands all over Europe are being grazed for many years. She is right in a way that there is a lack of collected and interpreted information and a lack of hard scientific evidence for choosing specific management regimes. But although many questions on the effects of grazing on e.g. insect diversity still cannot be answered, a comparison between succesful and unsuccesful management elsewhere could be very informative when management regimes have to be planned.

My point is that a lot of information already exists, but that it should be made public and summarized by experts in different fields who share the same concern: trying to increase the chances on successful protection and recovery of threatened habitats and species on the short term by bringing the information to where it is needed.

An online database with restoration information, freely accessible, in comprehensible language, updated by experts from different countries and centrally managed could bridge the information gap between scientists and managers and between managers of different areas. An interesting precedent is the free online publication of all (expensive) reports of the Dutch Institute for Green world Research Alterra (www.alterra.nl/default.asp?keus=rapporten). But most reports are available in Dutch only and the list is not ordered by subject.

Such an Online restoration information resource (ORIR) should include:

For each target species and habitat treated:
1. Summaries of relevant scientific articles;
2. An overview of successful and unsuccessful restoration projects;
3. An overview and summaries of non-refereed literature (Species Action Plans, Internal reports, ...).

(and possibly) 4. Summaries of unpublished findings commented by other scientists)

Each summary should include comments and interpretations of experts and links to e-mail and web pages of authors, contact persons and experts. Focus should be in the first place on species and habitats of the Natura 2000 network, but a database as presented here could be expanded with other threatened species and habitats as it grows.

I believe such an information resource could be a major advance in increasing the success of local initiatives. But it certainly requires a lot of time, funding and volunteers to keep it up-to-date.

4.1.2.3.15 RE: Online restoration information resource

Author: Erik van der Spek **Date: 15 November 2001**

I totally agree with Wouter Vanreusel that an information would be a great asset to nature management. Not only from the scientific site but also provided by managers with information on the effect of working methods and machinery. An important problem aside of the fact that scientists not always publish their knowledge in a way that it is useful for site managers. For instance the fact that most scientist only use scientific names, for a site manager who has tot take as much as possible the whole system into account and not one part of it, its not possible to know all the involved scientific names. It’s also almost to no use, in communication with workers, partners and public the use of scientific names is the best way to let them lose interest. And to manage a site well that is the one thing you can't afford.

So to make scientific information useful to management use normal language. Adding of scientific names can be helpful for translation use.

Another problem is that site managers in many cases don't report. So when you want to make it possible that others can learn from management experiences you have to stimulate reporting. Of course the existence of a site can be a support in itself. But other stimulants are also needed. Combine external funding with reporting? At least should for instance with help of Eurosite be promoted that in Europe each report by managers and scientist should have an English summary. So that you can decide which report or paper is worth to be translated.

4.1.2.3.16 RE: Online restoration information resource

Author: Ben Delbaere and Graham Drucker **Date: 15 November 2001**

As ECNC does not work on 'management' of biodiversity as such, we will not comment on the specifics of the first question of the week. However, on a more global scale in regard to expert systems, databases and sharing of information we would like to draw the attention to the Clearing-House Mechanism under the Convention on Biological Diversity (CBD-CHM). This CHM actually has the objective to 'promote and facilitate technical and scientific cooperation, within and between countries; develop a global mechanism for exchanging and integrating information on biodiversity, develop the necessary human and technological network'. This very much reflects what Geert Raeymaekers, Etienne Branquart and Wouter Vanreusel are suggesting.

Countries that have signed the CBD (including the EC) develop their own national CHMs so as to ensure country-specific information exchange. Also on the EC level a CHM has been developed (http://biodiversity-chm.eea.eu.int). All these CHMs form the ideal platform for exchanging information on biodiversity of any kind, such as experience and best practices in the field of management practices. The EC-CHM would be the right place for such information focusing on management practices in Natura 2000 areas.

In our view there is no need to establish new systems for the topic mentioned but a strong need to use what is available and enhance existing systems based on user experience.

4.1.2.3.17 **RE: Online restoration information resource**

Author: Frank Mawby **Date: 20 November 2001**

This contribution from Wouter Vanreusel strikes a very loud chord with me. I agree, it is very time-consuming looking for the relevant science and practical information to help with practical management problem solving and decision making. Over the past 20 years I have spent a great deal of time searching through the literature, especially scientific papers that seemed to offer some words of wisdom that might solve practical problems. Fortunately English Nature has an excellent library service which helps with the searches across a broad spectrum of journals and publications. What I discovered quite early was that science did not seem to address my problems. I believe that many site managers gain their knowledge from workshop situations and site visits, learning from other site managers' experiences and gaining the scientific knowledge from those researchers willing to present science in the context of a practical application.

I fully endorse and encourage the development of a database that identifies who is doing what, where and why. But, it needs to be backed up with the means that enable practitioners to travel and communicate freely, encourage them to discuss their work and write it up. English Nature publishes an excellent magazine called ENACT that encourages site managers to do just that.

Again, I agree with Wouter Vanreusel on the reasons he gives why conservationists and site managers do not put their experience into reports and papers. Some site managers find the task of communicating their knowledge. In writing or orally to a large audience, somewhat daunting. However, on our own sites we communicate very effectively to small groups and individual visitors. Capturing that knowledge is the key issue. I also think there is a gap between site managers and scientists that needs to be bridged. Perhaps this is happening because site management is at last being seen as a 'profession' with its own disciplines and standards. Perhaps this is why we are now beginning to identify what the role of site management problem solving by scientific methods really is.

Some years ago, over a period of three years, English Nature organised a series of lowland peatland workshops in the UK. These workshops were attended by site managers and scientists and presented a blend of practical knowledge and science about peatland rehabilitation. They were important for the exchange of ideas and techniques. The Mires Research Group of the BES provided another similar forum for the science base. More recently English Nature and Eurosite ran a peatland workshop in the UK. These workshops were all written up as are so many so where is all the knowledge?

However, within the organisations involved in site management there is quite a high staff turnover and that is another issue that perpetuates the need to maintain an up to date database, of who is doing what and to encourage and develop knowledge exchange by all appropriate methods. Eurosite of course is doing just that and there are other exchange programmes. We need to keep organising field meetings and workshops, encouraging site staff to attend and indeed ensure that employers understand the value of site staff attending meetings throughout Europe. In the UK we still seem to have a culture that thinks of visits to Europe as 'Foreign Travel' and thus a bit out of the ordinary. I believe we all need to think more as 'Europeans'. The message here is that people learn more from personal experience and face to face contact than they do from reports and books, seeing is believing? I hope this conference can begin to erode some of the barriers that seem to exist between site managers and scientists.

I would also strongly urge that if a central database is established it is managed by staff rather than volunteers and is properly funded and well advertised.

4.1.2.3.18 **Species biology information and expert systems**

Author: Hans Henrik Bruun **Date: 16 November 2001**

Summary: A discrepancy exists between the needs of conservationists and the way scientific research is organised. Conservationists need information on the biology of many species simultaneously. Research in species' biology is on the other hand faced with the demands of scientific journals that the findings should be novel, not 'replication' in a different species. If we want data for expert systems and to parameterise models, we are forced to let 'conservation money' pay for new screening programmes and construction of data-bases.

It has been repeatedly stated during this conference that conservationists need easily accessible data on the biology and autecology of many species simultaneously, typically all endangered species of a certain higher-order taxonomic group in a larger area. The trouble is, that on-line databases are unlikely to be brought into existence as a result of basic research. There is a discrepancy between the needs of conservationists and the way research funding and publication is organised. Editors of scientific journals only want to publish novel results. "In biology, replication of a study is so broadly defined that testing for the same relationship in another species or phylum can still be classified as replication. These attitudes strongly discourage authors from replicating studies" (Mxller & Jennions 2001). Funding agencies follow suit. They do not allocate money to research likely to produce explicative results. For instance, this means that once a scientific study has established that a certain species of vascular plant or butterfly is or is not sensitive to habitat fragmentation due to its inherent life-history traits, screening a number of species for the same traits and testing for the same relationship with fragmentation is considered replication.

Furthermore, a lot of autecological information can be retrieve from already existing sources. But synthesis is laborious, even too time-consuming for most scientific researchers. Examples of syntheses are the Biological Flora of the British Isles published in the Journal of Ecology, and the new Biological Flora of Central Europe. But given the speed at which new contributions have appeared so far, it will last centuries before all species are covered. Much of the information in these syntheses is retrieved from quite old publications. And much more is available written in odd languages like Danish or Hungarian. To compile this information into databases, e.g. on-line information systems, would be a tremendous task. But it is urgently needed, along with novel (in a much less restricted sense) research.

References:

Matthies, D. & Poschlod, P. (2000) The biological flora of Central Europe - aims and concept. Flora (Jena), 195, 116-122.

Mxller, A.P. & Jennions, M.D. (2001) Testing and adjusting for publication bias. Trends Ecol. Evol., 15, 580-586.

4.1.2.3.19 **Best practices: agreement and new questions**

Author: Etienne Branquart **Date: 19 November 2001**

I think it's now time to summarise the different ideas related to the discussion about best practices and information systems and to stress some unsolved questions related to this topic. I propose hereafter an agreement based on past discussions and new thought directions:

AGREEMENT PROPOSAL

This agreement is one of the result of the discussions of the first session from the electronic conference 'Biodiversity conservation in theory & practice'. It is more particularly based on the contributions made by Isabel Alonso (English Nature), Etienne Branquart (Belgian Biodiversity Platform), Hans Hendrik Bruun (Stockholm University), Ben Delbaere & Graham Drucker (ECNC), Hauke Drews (Stiftung-Naturschutz Schleswig-Holstein), Geert Raeymaekers (Ecoystems Ltd), Fernando Valladares (CSIC, Madrid) and Wouter Vanreusel (Antwerp University).

1/ Field managers and conservationists urgently need easily accessible data on basic ecological information and best management or restoration practices in order to conserve threatened species and habitats in Europe.

2/ A restricted number of field practices are used to manage/restore habitats and to conserve threatened species: grazing, mowing, burning, managing water level and quality, controlling the impact of invasive and predator species, captive breeding and re-introductions, etc.

3/ Although a huge amount of relevant information to this purpose already exists in scientific literature, biodiversity action plans or internal reports, it is often hard to find, quite expensive, case-specific and written in an 'odd' language.

4/ Moreover, a lot of useful information is not published because it is not innovative enough to fit the scope of scientific journals or because management actions were not designed as controlled and replicated experiments.

5/ As a consequence of points 3-4, conservationists who are protecting the same habitat or species in different European countries rarely share their common experience and fail to improve their management skills.

6/ Basic ecological and management information should be synthesised and organised per species and habitat in a user-friendly information system. For each item, this system should give an overview of knowledge extracted from scientific literature and from field experiments, include a list of European experts and specialised working groups, make the list of relevant literature (including non-refereed works), etc.

7/ This information system should be developed at the European scale as a support for the implementation of the Bird (79/409/EEC) and the Habitat (92/43/EEC) Directives and as a tool to improve the success of field conservation projects. It should be hosted by an existing structure such as the European Clearing-House Mechanism under the Convention on Biological Diversity (http://biodiversity-chm.eea.eu.int/) and should be built in enhancing the experience gained by other international and national relevant initiatives such as the Eurosite network (http://www.eurosite-nature.org/en-accueil), the UK Biodiversity Action Plan (http://www.ukbap.org.uk) or thematic working groups.

UNSOLVED QUESTIONS

1/ Providing that an information system is developed and information standards are defined, can we entrust existing international thematic working groups with the expert work of compiling/updating information and of defining best practices for habitats management and species conservation?

2/ Where can we find funding resources for developing the information system and encouraging the work of compiling information?

3/ How can we encourage conservationists to design management and restoration actions as scientific experiments with adequate controls, replicates and monitoring in order to learn from management practices and to improve management skills? Should funding for conservation actions be restricted in the future to projects based on appropriate trials and monitoring programmes, as suggested by Pullin & Knight (2001)? Should we have to enhance collaborative approaches (e.g. adaptive resource management) when designing management strategies?

4/ How can we encourage conservationists to publish the results of their field experiments? Where can they publish such results?

Reference
Pullin A.S. & Knight T.M., 2001 - Effectiveness in conservation practice : pointers from medicine and public health. Conservation Biology 15 : 50-54.

4.1.2.3.20 Re: Best practices: agreement and new questions

Author: Carlos Romão and Sophie Condé **Date: 21 November 2001**

On the Agreement Proposal

Item 3
It is important to notice that several national initiatives are going on or have already been done in order to compile and to produce informative sheets on species and habitats. Regarding the species and habitats from the FFH directive, we can notice for example:
- France: Cahiers d'habitats (cf contribution from Farid Bensetti)
- Sweden: Swedish animals and plants in the European Network Natura 2000 - ArtDatabanken

Most of the EU member states have produced these types documents but they are not all published Several Accessing Countries have also published this kind of documents.

The contain of these publications varies from manual of identification to a very complete informative sheets with advices in term of management. Some countries took the opportunity (needs from the CBD or EC Directives) to publish informative document such as Spain, which published this year an atlas on Fishes (Doadrio I. - Atlas y libro rojo de los peces continentales de Espana). Regarding the species in general, Switzerland has published a series of sheets on plant conservation (Office Fédéral de l'Environnement, des Forêts et du Paysage - Fiches pratiques pour la conservation: plantes à fleurs et fougères).

Most of the times, these works are coordinated by Ministry of Environment and/or nature conservation national agencies with a network of scientists and managers.

Item 6
It would be useful to further define/explore, which is the 'basic ecological and management information' that should be synthesised and organised per species and habitat type. The spectrum of potential information is too large and we need to aim the most relevant information. Is the information below useful and appropriate as 'basic ecological information'?
- Distribution and population / surface / cover
- Habitats and ecology
- Harvesting / uses
- Limiting factors / threats
- Recommended conservation actions / management
- Legal status
- Conservation status
- Summary of conservation actions - with evaluation of results

At which level should the above information be collated? National, regional (e.g. EU), European or Global? What kind of 'management information' would be required?

Item 7
We do agree that such an information system should be developed at the European, scale. Not only to support the Birds and Habitats Directives but also pan-European and Global agreements. This would avoid developing of competing and non-co-ordinate systems - human resources are limited and must be rationalised. The European Community Clearing-House Mechanism under the CBD could be an appropriate 'host', providing it would be open to a

pan-European system. The European Environment Agency (EEA) / European Nature Information System (EUNIS) could be seen as a skeleton to support the gathering and linking of ecological information.

On the Unsolved Questions

Item 1
The issue is that one needs a long-lasting infrastructure to host and maintain alive an information system. Working groups may be appropriate for compiling/updating information, but they are unlike to have the characteristic of a long term-infrastructure. In our opinion, the EEA could host and, therefore finance, such an infrastructure, namely through the ETC on Nature Protection & Biodiversity. This would fit the EEA general mandate of providing timely, targeted, relevant and reliable information. Making the parallel with national agencies - that put together national information systems at national level -it is logic that the European equivalent is the EEA. In reality, the priorities set by the EEA, its Management Board and main clients (e.g. European Commission) do not allow a full development of the EUNIS system. Priority and resources are directed to the production and quick delivery of indicators for regular reporting (annual, thematic, state of the environment every 5 years) and policy making. The paradox is that relevant biodiversity indicators need the basic information European-wide, which field managers, conservationists and researchers are looking for. Without a clear and fundamental change in its priorities for Nature & Biodiversity, the EEA cannot provide such a service to Europe.

4.1.2.3.21 Re: Best practices: agreement and new questions

Author: Geert Raeymaekers **Date: 21 November 2001**

Many people have expressed the need for better expert systems and see the creation of databases as one of the solutions to the information problem. I agree that databases are important for all but I have been often frustrated when I used these and do thus see several shortcomings. I would like to ventilate these here and to suggest some alternatives. Before you keep reading, please understand that these comments are very preliminary and personal reflections to further stimulate the debate.

- Quality checks needed: still too many databases exist with data, which are not controlled. It may be simple problems like a wrong email address or a name of a person who is no longer working at the address mentioned in the database, or more fundamental problem like the copying of outdated taxonomic information etc.
- Time to invest: although databases are set up to increase the speed of information access, one often spends much time consulting these data bases and often, one can't find the answer to the question. It seems that the structure of the databases does not allow exploiting the available information or that the sought information is simply not there...
- Not very practical: CD-ROMs, web sites etc. can be used individually, but confronted with a problem, one often wants to compare different data sources simultaneously. Then, one realises that books and 'printed information", becomes easier to handle. For instance: try to identify a difficult plant species with a CD-Rom and one notices that going back and forth trough the keys may become a nightmare.

Databases need continuous care (input and output): A team of experts is needed to control the information which is entered, to stimulate scientists to update the system and to promote the use and to assist people when data base exploitation is not successful. Data bases need to be maintained by experts.

Finally, as an alternative or support system to databases, I promote the use of existing networks of experts. Such networks exist for experts of different species groups (European Mycological Association, Planta Europa, European Committee for the Conservation of Bryophytes, ...) and for habitat types (European Union for Coastal Conservation, International

Mire Conservation Group, European Heathland Forum, ..). These organisations often link scientists at research institutes, NGOs or volunteers and share together and better up to-date information. Wouldn't it be better to promote these organisations instead of focusing too much on the production of databases alone?

4.1.2.3.22 **RE (3) Best practices: agreement and new questions**

Author: Wouter Vanreusel **Date: 22 November 2001**

ABSTRACT: The debate about building an information system is getting concrete, good! But one may not forget that the applicability and quality of the practical information is essential. I suggest that the basic information should be collected and distributed in standardized formats.

In the debate about building a concrete information system for restoration and management of threatened habitats and species, I would like to stress again the need for focussing on the link with the field. Distribution and legal information for example can relatively easily be obtained from other sources (but of course it would be very useful if this information were available in a standard format from now on), but collecting and distributing practical and scientific information with direct relevance to conservation actions is the main challenge. Collecting this diverse information is only useful if it happens in an organised way and if the results are offered to the end-users in a logic structure. Therefore, the development of concrete formats in which available and future information can be collected and distributed is important.

I suggest a hierarchical structure:

General information on the species or the habitat (adapted from Carlos Romão and Sophie Condé)

SPECIES
- Latin name and names in European languages
- distribution (per country)
- trends in distribution (based on European Red Lists for certain species groups)
- habitats used (+ carrying capacity)
- ecology and life-cycle
- limiting factors
- main threats
- legal status (Bird directive etc.)
- conservation status
- list of experts and institutions concerned with the species

HABITATS
- Eunis or Corine category
- distribution (per country)
- trends in distribution
- typical species (+ links)
- ecology and abiotical conditions
- limiting factors
- main threats
- legal status (Habitat directive)
- conservation status
- list of experts and institutions concerned with the habitat

This general section must form the superstructure. Beneath this, a twofold information system is necessary. This is the most difficult but also the innovative part.

1. Summaries of relevant documents;
2. A list of documented restoration projects and management schemes (both successful and unsuccessful).

Based on the accumulated information in this second section, the general information part can be adapted and expanded with chapters on recommended conservation actions, best management practices,..., a summary of the summaries.

1. Summaries of relevant documents.

I believe each record in this section must contain at least the following fields:

- Target species/habitat
- Country
- Document type (Published paper/Unpublished paper/Book section/Species Action Plan/Internal Report/...)
- Title
- Year
- Author
- Citation
- Study area
- Habitat type
- General description
- Summary in plain language
- Most important conclusions
- Funded by
- Contact persons

2. A list of documented restoration projects and management schemes.

This database would be the appropriate tool sharing management/restoration experiences. Following fields are necessary:

- Target species/habitat
- Country
- Area
- Owner
- Habitat type
- Management/Restoration
- Field practice (mowing/grazing/sod cutting/burning/top-soil removing/...)
- Year of measures
- Situation of target species/habitat before measures
- Situation of target species/habitat after measures
- Results (after year)
- Problems encountered
- Possible solutions to problems
- Remarkable successes
- Author
- Organisation
- Funded by
- Contact persons

In order to make information easily accessible for terrain managers and conservationist the database must be made searchable (e.g. only information on Hesperia comma habitat restoration on dry heathlands, not in calcareous grasslands), all internal reports on grazing as a management tool in lowland heathlands, ...). This is only possible if information is centrally available and in the same format.

If a standard data format can be proposed, future information can be entered easily and made public immediately after publication of research or evaluation of management schemes. A basis Access database or Excell table containing the necessary fields to enter can be available on the website and sent back by mail after completion. If this approach can be promoted under both terrain managers and scientists, this is an answer to Etienne Branquart's unsolved question nr. 4.

A document containing general rules for setting up basic field experiments (need for controls, number of replications necessary, information on sample sizes, nested structure of study plots, ...) could answer partly question nr. 3.

In reply to unsolved question nr. 1. I think a network of specialists is necessary to check and process the raw information from field managers and scientists. If in each country a few scientists or experienced conservationists volunteer to be responsible for this task, the job of publishing and managing the information centrally can become feasible.

4.1.2.3.23 Which EU support to improve biodiversity conservation?

Author: Hauke Drews **Date: 20 November 2001**

Summary: This report gave an overview how biodiversity is endangered and what has to be done to stabilize biodiversity, from a conservationist point of view.

First I would present you this quotation from Douglas Adams and Mark Carwardine in "Last chance to see." (1990) W. Heinemann, London (Here a "bad" back translation from German to English),

"The discovery can hit you as a stroke, that the world, that we know from historic data and also from biologists from our times, has really existed. The actual condition of our world shows just want we have done to our environment and the at best mild disappointment, that we feel if we step out to our biotopes and recognise everything a "little bit shappy", is just a barometer to what extent we have reduced our own expectations. Those people, who are aware about this, are those, who are running around in total excitement and try to save the little, that can be saved."

Because I think this is one of the best descriptions about the situation of conservationist in our time.

As a biologist I am used to think about systems. So I think about our society as a system and I think the lost of biodiversity is a problem, that is caused by our society. The central problem is that we still invest money in the wrong way into our landscape. So we "feed" with a high amount of money (also from EU) an agriculture that "predates our biotopes". The relation between land use, Nitrogen and the changes within the biotopes on land and sea (i. E. www.bernet.com) are well known. On this filed we need no further investigations, but we need better presentation of the results to the public.

Many other activities as the canalisation of river systems, diking the coasts, draining the wetlands, etc. are mainly done to support the agricultural land use in Schleswig-Holstein and also Germany. Due to this activities over 75 % of the land of Schleswig-Holstein is used for agricultural purpose. This system is supported by 450 Mio Euro each year in Schleswig-Holstein. Within the same time there is spend "only" roundabout 15 Mio. Euro each year for nature conservation. So its clear that mainly the money that is spend into agriculture is responsible for the lost of biodiversity. We are far away from an environment friendly agriculture. The average surplus of Nitrogen is over 120kg N/a/ha. The animal density is too high and the farmers spray a slurry amount comparable the amount of excrement of 4.3 Mio human people each year to our landscape. A traditional farmer receives for this activity direct between 420 and 580 Euro per ha and year.

Nearly all human activity in Europe endangers biotopes may be except the military land use. In Schleswig-Holstein we have in these areas the highest biodiversity and many endangered species and habitats. These areas are often large enough to allow stable populations of a sensible specie. So what can we learn from these areas: they are normally much larger than nature reserves, (i. E. nearly all natural grasslands in Schleswig-Holstein within the CORINE land cover are actual or former military areas), we have no application of fertiliser and we have dynamic components as fire and catastrophic land use by tanks.

Before we think about monitoring and modelling in nature conservation, we need area, we need not a few areas, we need a huge amount of areas, we need in this areas no application of nutrients and we need within these areas a land use that imitates nature with all dynamic components. We need a new wilderness as Hans Kampf suggested and as can be seen already in the Netherlands (Oostvaardersplassen). And at least we need this areas EU-wide within the next 10 years.

If we have this areas for nature conservation, we can apply a monitoring and try to organise special species-protection-programmes, but if we do not conserve these large areas, I think we will have no chance to save biodiversity in western Europe and if we export this actual land use system to east Europe we will fail and will increase there also biodiversity.

The NATURA 2000 is the first legislations which could be helpful instruments in reaching the aim of conserving biodiversity, but it will fail in areas as Schleswig-Holstein, were the aspect of coherence is suppressed by politics. The main group, who criticise the NATURA 2000-registration of Schleswig-Holstein, are the land user association, because they are in fear, not to be allowed to act as usual on their land. So the registration mainly includes "only" nature reserves, state forests, military areas and legal conserved biotope-areas without the urgently needed buffer zones. Within an agricultural land most of these areas are more or less heavily effected by the surrounding land use.

The usability of the Water Framework Directive could not easily be estimated, but the possibility to classify watercourses as "heavily modified" if they have drainage function is a great danger for the implementation of a "good biological status" in water bodies, because in Schleswig-Holstein nearly every water system has a drainage function and has been canalised to fulfil this duty.

So what support do we need from the EU (in order of importance):

1. Hard demands on the fulfilling of the NATURA 2000 and the Water Framework Directive by the EU-Commission
2. A program to buy land for nature conservation to support biodiversity in areas with a high amount of agriculture and forestry
3. More pressure on changing the agricultural politics and forcing the member states to follow these guidelines
4. Making the public aware about the situation of biodiversity AND AT LEAST
5. Central database with an expert systems for special conservation questions

The time in-between before these 5 demands are realized, I hope every conservationist will act as Churchill suggested (Answering the question how the second world war was won): "Never, never, never, never give up!"

4.1.2.3.24 **Priority Research Topics**

Author: Zoltan S. Varga **Date: 15 November 2001**

(This message was also posted to session 2 of the e-conference)

(A) Research Priorities:
The most important biodiversity research topics for our Department of Zoology and Evolution (of course, also for me):

1) Mapping and population ecological surveys of Lepidoptera and Orthoptera species of the Habitat Directive in Hungary, including some new candidate species, suggestions for practical conservation measures.
2) Character and indicator species (Lepidoptera and Orthoptera) of the threatened and/or biogeographically significant habitat types, typifying the Pannonian biogeographical region, included into the Annex I.
3) Population and metapopulation genetics and ecology of some selected species (e.g. Orthoptera: *Isophya, Pholidoptera* spp., *Podismini* spp.; Lepidoptera: *Maculinea* spp., *Aricia* spp., *Melitaeaini* tribus - mostly *Euphydryas maturna, Parnassius mnemosyne*).
4) Connectivity and gene flow in metapopulation systems, management for maintaining the connectivity.
5) Geographical aspects of species diversity (endemism, faunal elements) in the Carpathian basin (Carpathians + Pannonian region) with conclusions on conservation priorities.

Publications in these topics:

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Meglécz, E., K. Pecsenye, L. Peregovits and Z. Varga. 1997. Allozyme variation in Parnassius mnemosyne (L.)(Lepidoptera) populations in North-East Hungary: variation within a subspecies group. Genetica 101: 59-66.

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Varga, Z. 1998. Diversity of insects, threatened and protected species of Orthoptera and Lepidoptera in xerothermic grassland habitats of the Aggtelek Biosphere Reserve (NE Hungary). In: Guziova, Z. & Slavikova, V. (eds.): 2. International Seminar for Managers of Biosphere Reserves of the EuroMab Network, Stara Lesná (Slovakia), 23-27 September 1996, pp. 77-93.

Meglécz, E., K. Pecsenye, Z. Varga & M. Solignac 1998. Comparison of differentiation pattern at allozyme and microsatellite loci in Parnassius mnemosyne (Linnaeus, 1758) (Lepidoptera) populations. Hereditas 128: 95-103.

Meglécz, E., K. Pecsenye, L. Peregovits & Z. Varga 1998. Effects of population size and habitat fragmentation on the genetic variability of Parnassius mnemosyne (Linnaeus, 1758) populations in NE Hungary. Acta zool. hung. 43(3): 183-190.
Sipos, J.V. & Varga, Z. 1998. Loess grasslands and semi-dry swards: composition, structure, insect assemblages. (In Hung. with English Abstract) Kitaibelia III (2): 331-334.
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(B) Practical Conservation:

Due to the close co-operation with some National Park Directions, we have the "interface" between research and practical conservation. The Pannonian region is facing both a climate change and a land use change, although we didn't lost most of our important and typical habitats. However, most of them are threatened. Because many typical species of this region need large open habitats (like great bustard, saker falcon) or need a forested steppe mosaic landscape rich in ecotones, forest skirts (many butterflies forming metapop's), we need a strategy of landscape-scale nature conservation. As a consequence, we often have a different approach to "small and isolated populations". E.g. our problem is not: "how to conserve small and isolated populations of the Large Copper", but "how to conserve a sustainable metapopulation system of this butterfly in the marshy areas of the Pannonian lowland" (see also *Bombina bombina*), how to maintain or restitute the connectivity of more or less fragmented metapop. systems (e.g. mole rat, other typical species of sandy and/or loess steppe areas: *Lacerta taurica, Acrida hungarica, Isophya costata*; species of forest skirts as *Zerynthia polyxena, Iphiclides podalirius, Euphydryas maturna* etc.).
Now, I am very sorry that I cannot give a more detailed contribution to the very interesting discussions, but tomorrow starts an other conference, and I should urgently finish my verbal presentation. I am planning an other contribution for the next week.

4.1.2.3.25 Biodiversity research priorities

Author: Sue Everett **Date: 19 November 2001**

This is in response to the question related to the identification of current biodiversity research needs asked by Geert Raemaekers.

I am focusing my contribution on large scale strategic research issues - as I feel that some of these have been rather neglected, and that they are of EU wide relevance.

There are some large-scale strategic research priorities that need to be addressed. Some of these have been identified through the UK Biodiversity Research Working Group project, Science in Action for Biodiversity (http://www.ukbap.org.uk>www.ukbap.org.uk - see library, research papers).

During this project, experts identified many research cross cutting research areas, which they considered a priority for delivering the UK Biodiversity Action Plan. (Cross-cutting meaning issues, which affect a range of species, habitats and/or activity sectors). Most of these issues are also of international relevance and will require effective collaboration on an international scale.

Among those which I feel are particularly important are:

RISK ASSESSMENT FOR BIODIVERSITY - ensuring that such risk assessment is integrated into research that is otherwise directed to economic development or the development of products likely to have an economic value. Biotechnology is an example, but there are many examples where conventional plant and animal breeding are resulting in new strains of genetically uniform flora and fauna being imposed in the countryside - when these are native species these have the potential to put at risk the genetic diversity of remaining fragmented native populations. Rye grass breeding is an example of where we already have evidence of negative effects, but there are many others, e.g. farmed fish. As far as I know there is no biodiversity risk assessment built into this research, despite the fact that much of it is funded by governments or government-funded research councils.

In addition, risk assessment of new methods likely to be introduced on a large scale, that could affect biodiversity and the wider environment, is also a priority, especially in agriculture and forestry. Looking into the past, if we had risk assessed the impacts of large scale use of inorganic fertilisers on the environment and biodiversity, we might have prevented significant ecological damage, which has occurred over the past 50 years. (This assumes that those with political and economic interests had taken notice!).

This is a difficult area to manage, because it does require sectoral integration - which in my opinion is non existent in every country of the EU - (has anyone who has evidence to the contrary?).

HOW TO DEAL WITH INTRODUCED (NON NATIVE) INVASIVE SPECIES - is another area where research and conservation action is a priority. The workshop that was held on this subject is on the ukbap web site, and I feel that the research priorities were very well addressed by that workshop so I won't spell out the detail here. Facilitating action however is just as important a priority - again, requiring sectoral integration. For example, controlling invasive species requires joined up thinking, action and laws, cutting across shipping, agriculture, horticulture, hunters and fishers, forestry, nature conservation, the management of water and the work of highways and planning authorities. What laws and regulations for managing invasive species are likely to be most effective - a research project looking into this important area, may be helpful and give member states some ideas to take forward, rather than each MS "reinventing the wheel". An EU-wide project, in collaboration with the IUCN invasive species specialist group might be helpful here - maybe the ISSG could do the project - after all, it has the people with the international knowledge.

HOW TO ACHIEVE SECTORAL INTEGRATION FOR BIODIVERSITY: I have mentioned this several times, but how can we achieve it? Can we have a specific research initiative to set up some model mechanisms to demonstrate how sectoral integration might work for addressing some key issues, such as invasive species? And I don't mean short term projects to deal with a single species, but long-term strategic partnerships that have specific long term objectives for biodiversity and concerted actions among the relevant sectors. I think the lack of sectoral integration is our most significant hurdle in achieving nature conservation on a strategic and large scale (outside of nature reserves and strictly protected areas). What incentives can be given via the EU, to encourage such sectoral integration? There may already be some examples, e.g. work on endocrine disruptors.

ENVIRONMENTAL ACCOUNTING: This subject came up in a number of the workshops that were organised. Environmental accounting is also a priority identified by IUCN The World Conservation Union (I presume there is more on the IUCN website). We must be able to demonstrate the value of biodiversity, and the financial penalties we all suffer by destroying biodiversity. Again, invasive species is a good example of where, unless we take action, there are significant negative economic impacts as well as negative impacts on biodiversity. For example, *Buddleja davidii* in the UK, colonises waste ground, takes root in railway bridges, road gutters and drains and is very expensive to remove! It is also invading river banks, pushing out native flora. The economic value of maintaining wetlands (e.g. mangroves for fisheries, coastal protection) is another example (where quite a lot of work has already been done). But we need more comprehensive environmental accounts - in fact an EU wide environmental accounting initiative for biodiversity is a high priority. Another aspect is that biodiversity is a valuable commodity for tourism and becoming more so - and in many areas must exceed the economic value of agriculture (which of course is largely maintained by virtue of taxes and subsidies - so has a negative economic value in some areas), and so on. Collaboration with IUCN is also suggested here.

ECOLOGICAL RESTORATION is another key area. My particular interest is in the use of native species for ecological restoration, but in the UK we have been doing things rather badly when we create new areas of wildlife habitat. This is because much of the flora planted or sown as seed, originates from inappropriate sources - often E Europe (This is particularly true of trees we have been planting, and hedgerow shrubs for hedge restoration), or we sow agricultural cultivars rather than native seed. I am personally interested to know more about the genetic diversity among our native flora - including selectively neutral variation - which can't be easily assessed by molecular genetic studies). This knowledge is especially needed in NW Europe, so when we have to plant sites (when we can't rely on natural regeneration) - we know how to sample native populations for seed, and where to source seed from. See <http://www.floralocale.org>www.floralocale.org for further information. Our Forestry Commission has identified some broad research issues in Genetic variation and Conservation of British Native Trees and Shrubs (Forestry Commission Technical Paper 31, see <http://www.forestry.gov.uk>www.forestry.gov.uk). This issue was also addressed in one of the technical workshops (Introductions, translocations and genetic conservation) - see http://www.ukbap.org.uk>www.ukbap.org.uk for details.

4.1.2.3.26 **Strategic research programmes (IUCN and expert systems)**

Author: Robert Kenward **Date: 21 November 2001**

ABSTRACT. Cross-cutting research is important for conservation, but complex. It has been easier to attract funding for single, applied issues, to the detriment of strategic research. However, much cross-cutting research has been done in southern countries, stimulated and funded from IUCN. IUCN's expertise is available through specialist groups that can serve as expert systems.

The conference steering committee has emphasised the importance of identifying strategic research needs, such as those mentioned by Sue Everett from the UK Biodiversity Research Working Group project, Science in Action for Biodiversity. The problems of prediction/risk assessment, invasive species, integration, economics and restoration ecology become important in almost all nations, and hence are of international interest too. As Sue Everett wrote, these issues require "joined up thinking, action and laws, cutting across shipping, agriculture, horticulture, hunters and fishers, forestry, nature conservation, the management of water and the work of highways and planning authorities."

This makes conservation seem horribly complex, which partly explains early emphasis (in this conference and generally) on single species and reserves. 'Protect and reserve' conservation has been convenient for attracting funds to "Save the X" (where X = a given species or reserve site). This approach to conservation has helped many NGOs to grow and become influential, providing funds and encouraging government spending on species and reserves. This has been good in that it has raised public awareness, and typically preserved populations of species somewhere in each country so that biodiversity remains high at a national level. 'Protect and reserve" has been less good when it has created conflicts between conservation stakeholders (e.g. protectionists and game managers) or diverted funding (e.g. from strategic research) and public attention (e.g. from devastating changes in land use beyond reserves).

Sue Everett also mentioned IUCN. In 1948, government and non-government organisations combined to create an International Union for Protection of Nature. As early as 1956, the organisation changed its name and remit to the International Union for Conservation of Nature and Natural Resources. Now known broadly as the World Conservation Union, IUCN brings together 79 states, 113 government agencies, 754 non-government organisations, 36 affiliates and some 10,000 scientists and experts from 181 countries. The growth of conservation interest and NGOs has benefited IUCN, enabling it to take a leading conservation role in the developing world, where harsh realities were neither exacerbated by perverse subsidies nor given scope for restoration through agri-environment schemes. IUCN realised long ago that conservation went far beyond protection of species and habitats, requiring full socio-economic consideration, cooperation of all stakeholders and cross-cutting treatment. This was the rationale behind the emphasis on Biodiversity at Rio, and for IUCN's Sustainable Use Initiative, which seeks to optimise conservation from all uses of wild resources, whether non-consumptive (e.g. wandering, watching) or consumptive (e.g. harvesting, hunting). That optimisation will require massive cross-cutting strategic research. Surveys have shown that recreation (including but not merely tourism) could provide huge financial resources for that research and the resulting conservation. 'Sustainable use', in which use of reserves can also provide funding (e.g. through visitor centres) may in many cases be a better conservation paradigm than 'protect and reserve'.

The specialist groups of IUCN are also highly relevant to discussions in this conference on expert systems. Such groups can provide quick answers to questions that may occur too infrequently to be worth the expense of constructing software-based expert systems. IUCN has already established specialist groups for most taxa of conservation concern, for sustainable use in the regions (for example, European Sustainable Use Specialist Group has >100 members, with expert groups on agriculture, fisheries forestry and wild species resources), and also for many issues. Groups can be contacted through the chairs, identifiable by exploring www.iucn.org, and some currently very active groups (e.g. Invasive Species, Re-introductions) have standing internet discussion groups. They are a good place for scientists to volunteer some time to help conservation management.

4.2 Session 2: Biodiversity conservation in theory: A synthesis

(Moderator: J. Tack)

4.2.1 Summary of session 2

Jurgen Tack

Belgian Biodiversity Platform; Institute for Nature Conservation

On Monday 12th November we opened the 2nd session of the electronic conference 'Biodiversity conservation in theory & practice' with a number of statements of which we assumed they were widely accepted by as well the scientific community as by policymakers:

- New theories and paradigms as well as the use of adequate scientific tools - controlled and replicated field experiment, careful monitoring and modelling approaches - are absolutely essential to improve the success of conservation programmes and manage ecosystems in a sustainable way.
- The lack of conservation theory may hinder the development of guiding principles for managing ecosystems and the transfer of state-of-art research into practical management tools.
- Monitoring is acknowledged as one of the key challenges facing conservation biology by most scientists and field practitioners: we need to be able to detect trends and effects due to the management of biodiversity and natural resources.

At the end of the electronic conference none of the above statements was considered as a correct representation of the actual situation.

While indicators, monitoring and models are discussed widely by as well scientists as policymakers, in situ-experiments seems to be the interest of a very limited group of researchers.

In the beginning of the e-conference Etienne Branquart and myself (BBPF-Belgium) gave a summary of an article of Kimberley With (1997) in which she surveyed 304 papers in Biological Conservation (British Ecological Society) and 267 papers in Conservation Biology (American Society for Conservation Biology) to know what kind of approaches are used in conservation research and how large is the theoretical ground of this discipline. Her study shows that conservation biology is dominated by descriptive and empirical research, focusing on monitoring approaches to assess threats to biodiversity (overharvesting, habitat degradation and fragmentation) or species status (definition of biodiversity surrogates and delimitation of biodiversity 'hotspots'). Moreover, basic scientific tools such as modelling and experimentation are only small components of published research.

We have seen a similar tendency under the contributions of the electronic conference: 70% of the contributions were related to ‘Monitoring and indicators’, 20% to ‘Models’ and only 10% with field related research. At the moment we have more biodiversity on our PC than we have in the field. Do we really think to solve the biodiversity problems on our PC?

Monitoring and indicators

The main purpose of developing indicators is actually their use for monitoring trends in the status of biodiversity. In Europe, many biodiversity monitoring activities are ongoing. Some of these are linked to a certain policy instrument, others to advancing scientific knowledge on a certain topic, yet others to lobbying for conservation action. Too often, however, such monitoring programmes skip the initial step that is required for successful monitoring: definition of objectives. Ben Delbaere (ECNC-The Netherlands) was asking the basic question: What do you want to monitor for? The answer to this question will actually define much of the monitoring process. This is definitely also the case for the use of indicators as a tool for monitoring. A multitude of indicators has been defined for biodiversity.

Yet, European policymakers call for the development of new or better indicators in various policy documents (e.g. the EU 6th Environment Action Programme, the EU Sustainable Development Strategy and the EC Biodiversity Strategy). Apparently the indicators developed and the policy needs do still not match. Or is it so that policymakers are afraid that current indicators will actually be used and give bad news? Whatever the answer to the current mismatch, at some stage indicators will need to be used in a consistent way that clearly answers the basic question when talking about biodiversity conservation: what is the status of biodiversity?

Not only policy makers are asking for more research. Also researchers are asking for more research. But maybe there is a hidden agenda: researchers do want to have more research money while policy makers need the time offered by the researchers to do additional research.

If we have a look at monitoring programs within as well environmental companies as organisations we see quite often very costly and resource intensive short term effort. Isn't it time for Europe to invest in simple, reliable and cost effective methodologies for biodiversity assessment and monitoring, in the context of projects with long-term commitments?

Maybe Robert Kenward (CEH-United Kingdom) is having a solution when he proposes to use professional expertise to optimise voluntary monitoring. It is important that 'volunteer monitoring' is well standardised for compilation and analysis, is practical and is not too onerous (or people stop volunteering!). Crucial roles of salaried biologists are in developing appropriate systems as well as communicating results. Research to improve monitoring encourages scientists to work with managers and volunteers, thereby helping to break down the communication gaps. Financial encouragement for research that integrates different interests and broadens the base of human resources for conservation should be a sound investment for the future.

Researchers do not agree what kind of indicators should be developed: indicators at the species level, habitat level or landscape level. Arguing what level is the most important, no one is thinking on the reality that we probably need all levels in our indicator process. Isn't it so that more and more nature areas are becoming protected while species biodiversity is dropping at the same time? Even if we have indicators showing that trend we are still missing the knowledge to explain what is happening.
To solve at least part of this problem Klaus Henle (UFZ-Germany) thinks we need a combination of new innovative research, improved research management, a more systematic translation of existing research results into user friendly tools for managers and politicians, and a better training of users including scientists when applying sophisticated methods. He finishes with what he called a provocative statement on monitoring schemes. He states that the major problem of the dozens (hundreds?) of monitoring schemes suggested so far and those currently in development is that they rarely have specific objectives for monitoring and that they hardly ever start from a realistic organisation framework. So except for a few specific purposes (such as linking monitoring with population viability predictions) we should abandon research on yet another ecological monitoring methodology unless we first explore that a realistic financial and organisational framework is available. I would not call this a provocative statement. This should be the base of each and every research project. Future project evaluations should take much more into account whether the proposal is realistic and more projects should be evaluated afterwards to check whether they reached the goals proposed.

Sophie Condé (ETC/NPB-France) tried to give a clear overview of the main policy questions, the types of answers policy makers need and the scientific tools we need to give policy makers the answers they want.
The overview gives a clear list of policy questions, of answers wanted, but when we come to the tools we need a lot of questions remain unsolved:

- Which spatial and time scales can be used to produce indicators relevant at European level?
- A number of monitoring research projects to develop methodological tools are funded in the 5th Research programme. If some of these programmes can fit with the policy

needs, how far can the monitoring be effectively implemented after the end of the research project? It is not only a question of funds but also a technical question. Can no-scientist staff easily use the methods and protocols developed during the research project? Can non-scientist staff easily handle the results?

She comes to the conclusion that the bridge between the two sides is still not enough developed and the two parties must discuss more closely in order to produce usable, valid and accurate scientific tools. Do scientists really need policy makers to produce usable, valid and accurate scientific tools? I think the gap between scientists and policy makers is a gap that cannot be filled by one of the two groups. We urgently need to train science communicators. If we are capable of translating science to the large public (e.g. popular science magazine) we certainly should be able to translate science towards academics with another background.

But maybe researchers do not want to get involved into policy aspects. Lennart Hansson (Swedish University of Agricultural Sciences-Sweden) questions the recent trend of scientists approaching biodiversity problems as stakeholders or engaging in decisions about applied research. He is afraid we will lose the only independent source of ecological information, however imperfect.

This certainly does not mean that scientists should not have the right to have their own ideas about value-laden topics in society. However, they have to draw strict borders between their professional tasks and their political ideas. Scientists and ecologists should not use their, sometimes, prestigious place in society to impose their political values on other people. They should clearly declare when they are talking as scientists and when they are talking as common citizens. They should always keep the distinction between 'is' and 'ought'.

We should observe subtle aspects of this problem when we suggest tools for conservation research. Suggestions about monitoring of indicators (e.g. species or structures) may lead to a valuation of either species or ecosystems as most important biodiversity components. An argumentation for population viability analyses places species in the centre. The type of models employed may be particularly relevant for genetic, population or large-scale systems. In order to ask scientists for tools, politically responsible organs should first delimit the type of biodiversity that should be conserved.

However we should keep in mind that politics and policymaking is not always the same. Politicians always want to make policy but policy makers are not always politicians. In my personal opinion researchers should not become neither politicians, neither policy makers, but a good interaction with high skilled policy makers will certainly bring us closer to solutions that are more than just theoretical.

Models

Models can be used in biodiversity research and management for different purposes: to deduce the consequence of our present detailed knowledge, to make rough predictions, to get an understanding of the functional relations and to provide decision support.

It is an inherent problem of biodiversity research that, despite the availability of detailed data and information, it is not clear what these details mean for the whole system e.g. population, community or ecosystem. Models offer the opportunity to combine such details in a logical manner and deduce consequences for the whole system. In many projects data are only sampled at some representative locations and

for a short time period. But information on systems dynamic on larger spatial and temporal scale is needed for management decisions. Models can integrate data collected at small spatial and temporal and deduce the consequences for larger areas and for longer periods of time.

Prof. Wissel (UFZ-Germany) states one should resist the temptation to overload these models with biological details. This would hinder the understanding of the model. In biodiversity research and management we need rather understanding than data and models are very powerful tools for getting understanding.

Not everybody agrees with this point of view. Other scientists think the quantity and the quality of data is a corner stone of a good working model. Roger Cummins (CEH-United

Kingdom) states that monitoring programmes can often be turned into controlled experiments for little extra cost.

A typical example is remote sensing as indicated by Farid Dahdough Guebas (VUB-Belgium). An excellent technique to gather a large amount of data, but quite often of a low quality (strongly improved during the past decade), compared with in the field monitoring with high quality date but a very limited spatial extent. Combining both levels of quality have proofed to be an interesting but very difficult exercise. Another very interesting combination of a landscape approach with metapopulation models was presented by Jana Verboom (Alterra-The Netherlands). However Ilkka Hanski (University of Helsinki-Finland), a world renown specialist in metapopulation models stated that here too there is a need and much scope for further testing the modelling approach with better quality data than has generally been available so far. High-quality data are time-consuming and expensive to obtain, because the data should cover large areas and should include accurate biological information on the occurrence of the focal species. It is likely that there already exist many data sets in Europe which include most of the information needed, and the most cost-effective way of critically testing the metapopulation models might be to identify such data sets and to invest the necessary resources to complete these data to reach the requirements for model testing.

Models have similar limitations compared with indicators. They are scale dependent, data dependent. A major difference between model makers and indicator makers is that modellers have learned to live with conditions. Their models are valid when you take into account certain conditions. And even then their accuracy is limited up to a certain level. Indicator makers can't live with this kind of problems because their indicators have to explain something to policy makers. And they hate conditions and accuracy problems. Or maybe they like them because they give them an alibi not to act.

Nigel G. Yoccoz (NINA-Norway) thinks adaptive management is an efficient framework for developing closer collaboration between scientists and managers, but it will require better attention to the basic questions of "how", "what" and "why" we monitor biodiversity.

In-situ experiments

In the few reactions we got on the in-situ experiments part we found some very interesting material. Gerard Jagers op Akkerhuis (Alterra-The Netherlands) showed how habitat quality and its fluctuations could be assessed by studying the composition of Life History Tactics and functional demands of the species in the habitat. He proposes knowledge of the functional demands of broad species groups as a tool for managing the biodiversity and species composition of ecosystems on the basis of process parameters.

Wouter Vanreusel (UA-Belgium) prefers small-scaled field experiments designed to test specific hypotheses as helpful tools for identifying problems with restoration measures. Probably this is one danger of the present research funding: too much globalisation and not enough attention to small-scaled experiments resulting in a good story. Isn't that the reason why, as child, we (at least me) we were dreaming of studying nature? Maybe there are larger communication possibilities in a small-scaled field experiment compared with global modellisation and monitoring.

Out of the electronic conference we can recommend the following actions:

- Take care we are not creating a biodiversity paradise on our hard disks while the basic field experiments are disappearing even faster than biodiversity itself
- Clear need to study scale related problems
- Promote research on processes (on different scales) in function of monitoring, indicators, and modellisation
- Monitoring projects with clear definition of objectives

- Improve science communication taking into account this is a speciality not given to the majority of researchers and policy makers. Science communication should be developed as a separate speciality, not as a quality of the whole scientific community
- Do not overestimate innovative research, there is an urgent need for simple long term monitoring projects
- A more systematic translation of existing research results into user friendly tools for managers and politicians
- We need a new generation of models easy to manipulate by as well professionals as amateurs that can handle gaps in our data distribution

I would like to end with two remarks: the first one giving the summary of this second part of the e-conference in one sentence, the second something to think about before we send our next research proposal to the EU.

"How do we combine policy relevance with adequate scientific rigour?" (Erik Framstad, NINA-Norway)

"Policy makers do not so much need additional indicators, they need the guts to act" (Eckhart Kuijken, IN-Belgium)

4.2.2 Messages posted to the electronic conference

4.2.2.1 Indicators, monitoring and modelling

4.2.2.1.1 **Potential and limitations of ecological modelling for biodiversity research and management**

Author: Christian Wissel **Date: 12 November 2001**

ABSTRACT: Models can be used in biodiversity research and management for different purposes: to deduce the consequence of our present detailed knowledge, to make rough predictions, to get an understanding of the functional relations and to provide decision support. Rule-based simulations provide the opportunity of more realistic and transparent modelling. Ecological models cannot produce results of high precision.

It is an inherent problem of biodiversity research that, despite the availability of detailed data and information, it is not clear what these details mean for the whole system e.g. population, community or ecosystem. Models offer the opportunity to combine such details in a logical manner and deduce consequences for the whole system. In many projects data are only sampled at some representative locations and for a short time period. But information on systems dynamic on larger spatial and temporal scale is needed for management decisions. Models can integrate data collected at small spatial and temporal and deduce the consequences for larger areas and for longer periods of time.

But the expectation of what models can produce should not be too high because model results cannot be more precise than the data that are used as model input. All models are based on assumption and parameter values are often inaccurate due to unpredictable effects of some environmental factors. Models can never contain all the details of nature. They cannot claim to give the truth. Therefore we cannot expect quantitatively accurate results from these models. But new techniques of validation are available which improve our capacity to evaluate the relation between model and reality. These validation techniques can be used to reduce at least a part of the uncertainties of the model results.

There are different purposes for which models can be used. It is often assumed that models are constructed to make predictions. But because of the above mentioned uncertainties and inaccuracies ecological models can make no precise prediction. But roughly quantitative and qualitative prognoses are possible. These are valuable as they show us the logical consequences of our present scientific knowledge, which may be based on hard or weak data, expert opinion and even educated guesses. If these uncertainties of the model input and the resulting uncertainties of the model results are well documented the rough predictions of models can be used in biodiversity research and management.

The main utility of models (especially those which will be mentioned below) is that they are tools for getting a better understanding of the functional and structural relationships found in ecological systems. They can be used to reveal factors and processes which are important for the coexistence of species, for the survival of populations and consequently for the loss or maintenance of biodiversity in specific situations or in general. In this way they show gaps in our data and give hints for needed field research. A good understanding of functional and structural relationships is the precondition for a good management of biodiversity.

Models are valuable tools for assisting management decisions. In most of the management problems of biodiversity conservation it is not possible to determine the best management option by field experiments. Models can be used as a substitute for these impossible field experiments. The different management options can be tested in computer experiments. In this way models can be used to derive suitable management actions for situations that have no empirical precedent. Experience models of this type show that the question of whether management strategy A or B is better in a particular situation is not substantially influenced by the uncertainties mentioned above. This can be checked by varying the parameters of the model. Although models should never make the management decision they can support decision-making.

New types of models have been developed during the last two decades facilitated by the development of fast computers. Traditional models were based on classical mathematics like differential equations. Much of the structure of these models was determined by the mathematical confinement, i.e. by the available mathematical techniques. These models were extremely idealised and could produce some rather general results only. Rule-based simulation models can be made more realistic. They do not use mathematical equations but are formulated directly in terms of a computer program. Biological detailed knowledge is formulated in precise verbal rules, which can be transformed to rules of a computer program with high fidelity. These rule-based models are extremely flexible and can be applied in a wide range of problems and cases. They can be adapted to the specific question and to data knowledge available. A great advantage of these models is that field ecologists and practitioners can easily assess their biological content because the model's rules have a clear biological meaning.

One should resist the temptation to overload these models with biological details. This would hinder the understanding of the model. Blind faith in model results is not science and does not help the management. The complexity of reality can be reduced in the model by concentrating on a specific question or problem. This allows the modeller to disregard details of reality that are not important for a specific question.

Individual-based models are one type of rule-based models. They follow the fate of single individuals and can take many of the differences between individuals into account. This is important especially for small populations that are exposed to extinction risk. On this basis species and habitat specific population viability analysis (PVA) can be made. PVA models have been criticized because of the inaccuracy of the parameter values. Indeed, although they cannot make precise predictions they can provide qualitative predictions that are often sufficient for selecting between different management options. A consequence of the uncertainties in the model data and structure is that only probabilistic results can be obtained with the help of stochastic simulations.

Spatial aspects play an important role in ecosystem dynamics and influence the distribution (space-time) of biodiversity. Grid-based modelling is a spatially explicit rule-based simulation technique which is applicable to almost any spatial-temporal problem. It can be used to model invasion, dispersal, source-since populations and other spatial processes of importance for biodiversity.

Modelling of biodiversity questions can be done for specific case studies. In this way they may contribute to the solution of a specific management problem. But it is not possible to construct a custom model for every management problem. Also for practical purposes we need generalisations at least with certain domains. Models are tools that help to reveal these generalisations.

Most models deal with problems where only one or few populations are involved. It is not sensible using current approaches to construct models, which deal with, say 40 or more species explicitly. Here we need new approaches.

In biodiversity research and management we need rather understanding than data and models are very powerful tools for getting understanding.

4.2.2.1.2 Information and data - missed opportunities

Author: Roger Cummins **Date: 13 November 2001**

ABSTRACT: Models are only as good as the data on which they are based but the data we have are frequently very limited - either spatially, temporally or in the target species/habitats. Monitoring programmes (e.g. of current European agri-environment schemes) can often be turned into controlled experiments for little extra cost.

Contributors to this session have already emphasised the limitations of models, often due to a lack of suitable data for constructing robust models and validating them. This is not surprising when financial constraints mean that projects usually have to be highly focused at target species or locations and are often of short duration. In their excellent overview of LIFE projects, Geert Raeymaekers et al pointed out the added value that can be obtained from adding controls and replication to monitoring exercises, instead of just obtaining 'before/after' results. To have widely applicable models of systems, we frequently require data with a suitably wide geographical scale and over long time periods (particularly where long-term ecological successions are involved) and this is expensive. However there are many agri-environment schemes in the EU that (a) cover whole countries, (b) are often relatively long-term, (c) include species or habitats of conservation relevance, and (c) are subject to monitoring. Participants in the schemes are already paid for implementing specific management regimes but if we were allowed to use even part of the area under agreement for experimental work, we can have the spatial and temporal scales that we so urgently need. A good example from Britain would be the various Stewardship Schemes, which often include the fencing of riverine habitats to prevent access to herbivores; these habitats vary widely in composition and structure. For almost negligible cost, we could substitute parts of the permanent fencing with temporary fencing that could be removed to apply different grazing regimes. The resulting information would allow us not only to plot response curves for vegetation changes in these habitats and to develop system models, but would also provide information for developing better management prescriptions for particular species or habitats. As the sites are being visited anyway, to monitor the effects of the agri-environment scheme, the additional costs of recording these experiments would not be very large. I see this as an opportunity missed.

4.2.2.1.3 Demographic information in conservation management

Author: Peter Galbusera **Date: 13 November 2001**

Our research group in currently preparing a project aimed add contributing to conservation management by developing and improving scientific tools. Below I copied a short description of this project. Since the conference aims at strengthening links between theoretical and practical conservation work, I think this project description might stimulate some discussion on the importance of demographic information (and methods to obtain estimates) for the conservation of biodiversity. Furthermore, if someone likes to support our initiative or even be involved as an end user (applying our tools), you can contact me directly on the email address given below.

Short description of project proposal:

In view of the conservation of biodiversity, it is extremely important to be able to estimate demographic parameters, especially for those species for which no or few data are available. Such demographic information includes: population structure, effective population size, changes in effective size, identifying patterns of historical and current gene flow, and the dynamics of colonization and fragmentation. By inferring the demographic history of populations, it is possible to pinpoint those populations that require most attention in conservation plans (e.g., Bird Directive). Such demographic history can be inferred from genetic data. The ecological insights that molecular genetics can provide might help us in threat assessment in ways convention ecological data (e.g., abundance estimates) might not. Two important issues to stress are: (1) genetics data provide a potentially longer-term view of population behaviour than abundance data that is only available in detail for a small number of species (mainly birds and mammals) over a period of several decades; and (2) genetics data is the only option for examining population behaviour when ecological data are lacking.

With the increase of computing facilities and data (e.g., on temporal collections), new methods for the statistical analysis of population molecular genetic data have been recently developed. However, it is largely unknown how well these methods can accurately infer population demographic parameters. Furthermore, their relative performance is unknown.

We are proposing to (1) develop models that are able to deal with different data availability (e.g., only extant samples, or extant samples and temporal data); (2) validate these models using populations of known spatial and temporal behaviour; and (3) apply the models to certain case studies to illustrate their use

4.2.2.1.4 Do biodiversity indicators provide the right answers to the right questions?

Author: Ben Delbaere **Date: 12 November 2001**

ABSTRACT: Biodiversity indicators are wanted by policymakers to assess the effectiveness of their work. Using them as a communication tool to bring across a simple message may be more important than developing scientifically correct indicators that are incomprehensible for policymakers.

Policymakers want to know what policy measures need to be taken and how effective they are. This is true for all geographical levels, from the municipality to the entire globe. The larger the geographical scope, however, the more generic policy measures are and the more abstract the subject matter gets for which they design policy. This is especially true for biodiversity, a topic known for its complexity. Indicators are generally regarded as good tools to simplify, quantify and communicate complex issues to a certain target group. They therefore are widely appreciated by policymakers as possible ways to have their basic questions answered. What is the status of nature/biodiversity? Is this status improving or decreasing? Why is that so? Are policy measures in place to reverse negative trends? And are these policies reaching their goals? Various methodological frameworks are in place for developing indicators that may answer questions as the ones listed above. A commonly used framework is DPSIR (Driving force - Pressure - Status - Impacts - Response). This framework seems to be suitable for structuring the thinking in indicator development. It is however open to interpretation and its implementation depends on the topic under view. An indicator for the status of water quality, for example, may be a pressure indicator for biodiversity value.

The main purpose of developing indicators is actually their use for monitoring trends in the status of biodiversity. In Europe, many biodiversity monitoring activities are ongoing. Some of these are linked to a certain policy instrument, others to advancing scientific knowledge on a certain topic, yet others to lobbying for conservation action. Too often, however, such monitoring programmes skip the initial step that is required for successful monitoring: definition of objectives. What do you want to monitor for? The answer to this question will actually define much of the monitoring process. This is definitely also the case for the use of indicators as a tool for monitoring. A multitude of indicators has been defined for biodiversity.

Yet, European policymakers call for the development of new or better indicators in various policy documents (e.g. the EU 6th Environment Action Programme, the EU Sustainable Development Strategy and the EC Biodiversity Strategy). Apparently the indicators developed and the policy needs do still not match. Or is it so that policymakers are afraid that current indicators will actually be used and give bad news? Whatever the answer to the current mismatch, at some stage indicators will need to be used in a consistent way that clearly answers the basic question when talking about biodiversity conservation: what is the status of biodiversity? The following recommendations may help in reaching such stage:

- Involve stakeholders in the process (i.e. TALK to the policymakers and ASK what they want);
- Focus on testing existing indicators rather than developing new ones;
- Select from the many existing indicators a few that intuitively seem to be useful and test those on the basis of existing data;
- Selection of indicators should be policy-driven rather than data-driven;
- develop an index (or test an existing one) that aggregates multiple indicators into one message but which is composed of multiple underpinning indicators;
- Communicate the messages based on indicators in a coordinated way rather than confusing policymakers with numerous reports with different - sometimes conflicting - messages.

Two messages may also be taken as a guidance when developing/applying indicators:
- It is time to apply what is there, even if it is not perfect;
- Scientific debate may be slowing down the process of development, rather than leading to a solution. The scientific world should accept that when talking to policy makers scientific accuracy may be less relevant than clarity in bringing over a message.

4.2.2.1.5 The cost implications of monitoring

Author: Willie McGhee **Date: 12 November 2001**

I would like to raise the issue of cost effective biodiversity assessment and monitoring.

An organisation I work for, the Borders Forest Trust, is a small, charitable, environmental NGO working to conserve, enhance and expand native woodlands in the South of Scotland. We have often attempted to build monitoring schemes into our project work; from the very basic, such as fixed point photography, to the very complex, such as hydrological recording and species monitoring (vascular plants, lichens, invertebrates, birds, etc.) and have found that cost and complexity ultimately lead to very intensive short term efforts, or failure to continue assessing/monitoring.

Is it worth discussing simple, reliable and cost effective methodologies for biodiversity assessment and monitoring, in the context of projects with long-term commitments and limited financial resources? Often environmental companies and organisations, who are involved in assessing/monitoring through contract work, appear to contrive very costly and resource intensive methods of biodiversity measurement.

Thank you for the opportunity to contribute to this excellent e-conference.

4.2.2.1.6 Conservation and indication of biodiversity in agricultural landscapes of Central Europe

Author: Rainer Waldhardt **Date: 13 November 2001**

By signing the Convention on Biological Diversity in 1992, European countries, as well as more than 160 nations worldwide, have pledged themselves to the conservation of biological diversity. Even though the conservation of selected, valuable habitats is still important - this goal dominated nature conservation politics until c. 1980 - it is more and more recognized, that the preservation of biodiversity is only to achieve through the (re)establishment of a mosaic of suitable habitat patches at the landscape scale. Since virtually the entire land area of Central Europe has been subject to anthropogenic land use, we have to focus on land use management for the preservation of biological diversity. Sustainable development, meeting the requirements of ecology and socio-economy has to consider all specific biotic and abiotic characteristics and potentials of our landscapes. The total species richness at the landscape scale, which could serve as a criterion for the evaluation of sustainable land use, is impossible to assess (Duelli, 1997). Thus there is a need to search for indicators, that show either quantitative relationships to overall biodiversity (i.e., correlates), or that are at least qualitatively connected to biodiversity measures (i.e., surrogates) (cf. Duelli 1997). The elaboration of such indicators on a regionally differentiated scale is the goal of various research projects.

Results obtained by the Division of Landscape Ecology and Landscape Planning within the framework of the Collaborative Research Centre (SFB) 299 "Land Use Options for Peripheral Regions" at the Justus-Liebig-University Giessen, Germany, may exemplify this kind of research. As in many other cases of biodiversity research (cf. Waldhardt & Otte, 2000) the main focus of these studies is on species diversity. However, other components of biodiversity, i.e. genetic diversity, biocoenotic diversity or space-time patterns of habitats appear to be equally important. This also holds for structural and functional aspects of biodiversity, which are often ignored (Hobbs 1997). The goal of our studies is not primarily to provide indicators of landscape biodiversity as a contribution for the development of rules for modelling purposes. This kind of research within the framework of the Collaborative Research Centre (SFB) 299 is carried out by the Institute of Plant Production and Plant Breeding II, Biometry and Population Genetics.

Our results demonstrate the importance of landscape composition (range of habitat types), structure (fragmentation, connectivity, proportional and total area of biotope types, biotope-matrix) and dynamics as well as ecosystem processes that may affect landscape biodiversity. For details we refer to the following publications (follow the links to English abstracts):

SIMMERING, D., WALDHARDT, R. and OTTE, A. (2001): On the significance of field and meadow edges for the diversity of species and structures in vegetation - Case study from a fragmented landscape. - Peckiana 1: 79-87.

SIMMERING, D., WALDHARDT, R. and OTTE, A.: Syndynamics and ecology of Scotch broom stands in the Lahn-Dill-Highlands (Germany). - Tuexenia (in press).

WALDHARDT, R. and OTTE, A. (2001): Calculation of the area needed to conserve arable weed species in the rural district Erda. - Peckiana 1: 101-108.

WALDHARDT, R. and OTTE, A.: Indicators of plant species and community diversity in grasslands. - Agriculture, Ecosystems & Environment (submitted).

WALDHARDT, R., FUHR-BOßDORF, K. and OTTE, A.: The significance of the seed bank as a potential for the reestablishment of arable-land vegetation in a marginal cultural landscape. - WEB-Ecology (accepted).

WALDHARDT, R., SIMMERING, D. and OTTE, A.: Site-specific surrogates and correlates of alpha-diversity in grassland vegetation of a marginal region in Hesse (Germany). - Berichte der ANL (accepted).

WALDHARDT, R. FUHR-BOßDORF, K. OTTE, A., SCHMIDT, J. and SIMMERING, D. (1999): Classification, localisation and regional extrapolation of vegetation potentials in a peripheral cultural landscape. - Journ. of Rural Engineering & Development 40 (5/6): 246-252.

WALDHARDT, R., FUHR-BOßDORF, K., SIMMERING, D. and OTTE, A. (2000): Floristic-phytocoenotic diversities of a peripheral region in relation to land use, space and time. - Agrarspectrum 31: 121-147.

Information on the current status of further publications can be found at http://www.uni-giessen.de/sfb299/eng/f-publications.htm.

The approach of combining organismic and landscape indicators - as it is applied by the groups within the SFB 299 - is regarded as straightforward for the analysis and indication of biodiversity at the landscape scale (Debinski & Humphrey, 1997, Duelli & Obrist, 1998, Margules & Pressey, 2000, Wagner et al., 2000). However, currently there is hardly any set of regionally applicable biotic indicators (in the sense of correlates and surrogates) available. Further efforts identifying biotic groups of indicators as carried out by Duelli & Obrist (1998) and Waldhardt et al. (2001) in a Swiss and a German landscape, respectively, are needed. Apart from this, further work should try to quantify to which extend various components of landscape biodiversity depend on landscape composition and structure and within-landscape processes. Analyses of, e.g., the importance of composition of habitats and fragmentation (Hansen et al., 1988, Poschlod, 1996, Fagan et al., 1999), their heterogeneity (Thies & Tscharntke, 1999), and their surface area at the landscape scale (Waldhardt & Otte, 2001), as well as the processes affecting biodiversity (Jones et al., 1994, Simmering et al., 2001) supply further information important within this context. Finally, the significance of interactions among the above named and further possible landscape characteristics at different spatial and temporal scales are largely unknown.

Biodiversity of landscapes, even when focussing on single components such as species diversity, will depend on numerous landscape characteristics related to land use. The impact of these land use characteristics will probably vary in relation to spatial scale and level of aggregation (?- to ?-diversity; cf. Whittaker, 1972). Consequently, it appears to be very unlikely that there should be one single indicator for biodiversity at the landscape scale. Valid models of landscape biodiversity should therefore include a sufficient number of indicator-response rules concerning the consequences of land use and land use changes on biodiversity.

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4.2.2.1.7 Monitoring and indicators

Author: Jari Niemelä and Allan Watt **Date: 14 November 2001**

ABSTRACT: Suggested criteria for the development of biodiversity assessment tools (or indicators) are presented. We also argue that this e-conference should focus less on indicators for policy and more on monitoring for conservation programmes.

Ben Delbaere makes some excellent points about biodiversity indicators and we completely agree that there is a need to apply indicators, even if not perfect. We do, however, also consider that a twin-track approach is needed - apply the best available indicators now but carry out research to both verify these indicators and develop better ones for future application. These are our aims in the BioAssess project - more details are available in a summary attached to this contribution on the e-conference web-site. Like Ben Delbaere, we considered the important criteria for biodiversity indicators and came up with (in order of importance):

1. Biological relevance
2. Cost-effectiveness
3. Sensitivity
4. Easy to understand and politically relevant
5. Historical data available, particularly time series

A more detailed discussion of criteria for biodiversity indicators in given in: Niemelä, J. 2001. Biodiversity monitoring for decision-making. - Annales Zoologici Fennici, 37: 307-317.

We do, however, suggest that within this e-conference, the discussion on monitoring and indicators focuses on the needs of conservation programmes.

As regards the use of bioindicators in monitoring programmes we fully agree with Ben Delbaere that quite often the goals of the monitoring exercise are not clear. If goals are not clear, the programme may not efficiently deliver the kind of understanding of changes that the society expects. This may lead to a general mistrust of all kinds of monitoring efforts. Furthermore, as these programmes are labour intensive and thus expensive for the taxpayer, it is important that they are properly planned and that their goals are explicit.

Some of the basic questions to be answered before monitoring is started include:
1. What is the goal of the monitoring to be undertaken?
2. What are the indicators and methods to be used to achieve the goals?
3. How are the data going to be analysed?
4. How are the results going to be interpreted in terms of biological and socio-economic implications?
5. How are the results and interpretations going to be communicated to managers, decision makers and the public?

Questions 1-4 basically deal with monitoring itself, while question number 5 puts the programme into a larger, societal context. The purpose of a monitoring programme determines to a great extent the kinds of field methods, indicators and data analysis used, and the ways of synthesising and communicating the results. Communication is important, because the results of any monitoring exercise need to be communicated to the planners, managers and decision-makers. As these individuals do not necessarily have academic training, communication of results must be done in a way and language familiar to them.

Enhanced communication between the scientific community and the users of research results is of outmost importance, if we are to successfully monitor, manage and protect European biodiversity. Monitoring is an important component of management and protection as it provides a vital feedback link between human actions and the environment. However, it seems that incorporation monitoring results into decision-making is hampered by poor communication between ecologists and decision-makers. This e-conference and the subsequent EPBRS meeting will be important fora to enhance this communication.

4.2.2.1.8 RE: Monitoring and indicators

Author: Ben Delbaere **Date: 16 November 2001**

Alan Watt suggests to focus the discussion of this e-conference on monitoring for conservation programmes. Since the aim of this conference is to provide input into the scientific programme of the EC I fully understand and appreciate this approach. However, we should not forget that ultimately the information that is communicated via the indicators is meant to inform (and influence) decision makers. I fully support Alan Watt's strong emphasis on the importance of communication in this regard. Especially between scientists and policy makers this often proves to be very difficult or overlooked.

Indeed, we need a two-track approach: use what is available now (even if not perfect) so as not to loose the interest of the policy makers for the conservation of biodiversity and at the same time continue developing solid indicators on a scientific basis. This will only enhance the accuracy and credibility of the messages conveyed through indicators.

Although I would put policy relevance first I think the criteria for selecting indicators are suitable (and not too many). As regards the last one (historical data available) one should note that there is a risk to select indicators on a data-driven basis, rather than purpose-driven or user-driven.

4.2.2.1.9 The use of remote sensing and GIS as tools for studying biocomplexity

Author: Farid Dahdouh-Guebas **Date: 15 November 2001**

ABSTRACT: This contribution highlights how suitable 'remote sensing and geographical information systems' are as tools in studying biocomplexity, and which are the needs and priorities for further action. It shows how both common and new remote sensing technology can be integrated in long-term studies. The imagery used to study past and current evolution of species' distributions can then be combined with fieldwork on younger populations of the same species in order to make predictions for the future, and, if necessary, to intervene to prevent degradation.

The term 'remote sensing' (RS) is broadly defined as the technique(s) for collecting image or other data about an object from measurements made at a distance from the object, and can refer for instance to satellite imagery, to aerial photographs or to ocean bathymetry explored from a ship using radar data. However, in the present context we refer to the optical images acquired by space-borne or air-borne sensors. A 'geographical information system' is the tool that allows the storage and analysis of spatial data. Not only does GIS form an excellent medium for the construction of a multi-layer database of such data, it also allows to manipulate and display these data depending on what type information must be retrieved or what type of scenario is being simulated. RS & GIS are therefore extremely powerful tools that can be overlapping between the tools of 'monitoring' and 'modelling' in study of the complex regulation of biodiversity and ecosystem functioning, termed biocomplexity.

With respect to the past, aerial photography often forms the only set of data available for long-term retrospective research of spatial nature. Today, this airborne imagery still possesses an unbeaten resolution, although space-borne remote sensing images now start to challenge this resolution, often having the additional advantage of multi-spectrality. However, this quality implies a very high cost for the scientific community. Nevertheless is it important to notice that RS & GIS are suitable in a specific need of scientific knowledge that we urgently need on an international level (beyond Europe) to improve the success of conservation actions: 'predictions' and 'early warning systems'.

In our research we elaborate on how future population structure and degradation can for instance be predicted based on history and current structure in the field, and how RS technology can be combined with other techniques to do so. For instance, sequential aerial photography can be used to view how populations have changed over time and whether it is dynamic or static (i.e. in a steady-state), and whether or not it has degraded. Socio-economic analysis may help to understand which are the underlying causes of degradation and what local people's dependency is on the natural resources. Current distributions of adult, young and juvenile populations in the field can be confronted mutually and with the past situation. The combination of these three aspects, generates information about the regeneration capacity of the ecosystem and may act as an early warning system. If degradation symptoms such as the decline of certain populations or reduction in a certain species' dominance then appears, human interference such as rehabilitation may be required. It is equally important to monitor the restoration effort and evaluate succession or migration patterns. Such spatial and temporal data can easily be introduced and manipulated with GIS.

Many publications exist on the effects of global change for marine environments and on the needs for marine protected areas. Apart from the needed integration of past and present data outlined above (including calibration of RS technologies), a lot of effort should be put in the prediction of future scenarios and early warning systems in order to help the identification of such areas. Not only is it important to do this within Europe, but I it is equally important that Europe continues to develop expertise and expert systems on biodiversity and ecosystems outside the borders of the European Union, such as for the globally important tropical coastal ecosystems (mangrove forests, seagrass meadows and coral reefs).

Research and financing priorities:

* financial tools to acquire multispectral high resolution data
* integrated long-term monitoring (both remote sensing and fieldwork-based)
* development of early warning systems
* understanding of the interlinkages within an ecosystem, amongst ecosystems and between ecosystems and man (biocomplexity)
* development of such expertise inside AND outside the borders of the European Union

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4.2.2.1.10 **Forest biodiversity**

Author: Ulla Pinborg & Tor-Bjorn Larsson **Date: 15 November 2001**

ABSTRACT: We highlight the current development of indicators of forest biodiversity in Europe.

We basically agree with the introductory contribution about the need for indicators by Ben Delbaere but would like to add some comments. There are several international and national actions to develop and coordinate indicators, but they are nearly all in very early stages yet. With respect to the European forests, though, there is already a strong and positive development, and three partly interlinked activities may be pointed at:

1. TBFRA-2000, the most recent forest resource inventory performed within the framework of ECE/FAO (Forest Resources of Europe, CIS, North America, Australia, Japan and New Zealand UN-ECE/FAO Contribution to the Global Forest Resources Assessment 2000 see http://www.unece.org/trade/timber/fra/pdf/contents.htm) The TBFRA-2000 contains, for first time a specific "Biodiversity chapter" with data in 17 tables showing e.g. "Forest and other wooded land" by categories of "naturalness"; Protection status and forest not available for

wood supply for conservation/protection reasons; reported number of species (total and forest-occurring), of which endangered; Data on forest regeneration incl. origin of planting material; Data on extension of forest (afforestation and reforestation). Furthermore in other part of the report biodiversity relevant data are presented, e.g. with respect to "Forest fires".

2. The "Ministerial Conference on the Protection of Forests in Europe" is an ongoing initiative for co-operation between around 40 European countries to address common threats and opportunities related to forests and forestry, see www.minconf-forests.net .In this framework indicators for assessing biodiversity are currently being developed (expert level discussions), including e.g. dead wood and possibly fragmentation. Moreover it has been recognized that the biodiversity of European forests most often has to be analysed in a biogeographic context and preferably with respect to specific forest types.

3. Research projects. Several current European level research projects will - and has - presented results that will help the further development of indicators of forest biodiversity. The following three reflect some types of results we can expect:

- The BEAR project "Indicators for monitoring and evaluation of forest biodiversity in Europe" www.algonet.se/~bear/ has presented a framework for assessing forest biodiversity based upon key factors and an indicative list of forest types. This framework could be used to identify the most relevant biodiversity indicators.
- The Nat-Man project "Nature-based management of beech in Europe - a multifunctional approach to forestry" www.flec.kvl.dk/natman will e.g. try to define the natural reference for the nature-based management of European beech forest. This will be of great value for target setting.
- The BioAssess project "European biodiversity assessment tools" will by field studies in a landscape gradient test a large number of potential biodiversity indicators with respect to their relevance to reflect a wider part of biodiversity. Validation of indicators is highly needed!

4.2.2.1.11 RE: Forest biodiversity

Author: Ben Delbaere **Date: 17 November 2001**

In addition to the overview presented by Ulla Pinborg and Tor-Bjorn Larsson on forest-oriented indicators I would like to draw the attention to a proposed initiative coordinated by ECNC and EEA to enhance convergence between the multiple biodiversity monitoring and indicator initiatives in Europe.

The proposal is to establish a European Biodiversity Monitoring and Indicator Framework (EBMI-F) in support of the implementation of the Pan-European Biological and Landscape Diversity Strategy (see http://www.strategyguide.org/ebmf.html). EBMI-F aims to enhance the possibilities for creating more synergy among past, present and future biodiversity monitoring-to-reporting efforts at the European level in order to reach higher efficiency and effectiveness in communicating the state of, and trends in, Europe's biodiversity to the policymakers concerned.

Amongst other partner EBMI-F also aims at providing input into the monitoring and indicator development at the EU level.

4.2.2.1.12 Biodiversity assessment tools for land-use scenario studies in fragmented landscape

Author: Jana Verboom **Date: 17 November 2001**

Summary
1. Tools for biodiversity assessment in fragmented landscapes should be based on metapopulation theory.
2. Simple inventories are not sufficient because of metapopulation dynamics, time lags leading to out of equilibrium situations, and the impossibility to predict effects of future landscape change scenarios.
3. We propose a tool based on indicator species, ecologically scaled landscape indices (ESLI) and habitat network approach where we perceive the landscape from a species' perspective, and assess the sustainability of networks on the basis of a set of simple spatial standards, such as the key patch standard.

For assessments of biodiversity in land-use scenarios, a functional approach is vital. A landscape however does not have a function for biodiversity, but for individual species. Therefore, we must scale down from landscape level to species level and work with a set of indicator species, instead of biodiversity itself. I argue that there is a need for assessment tools that are based on processes in populations. In man-dominated landscape, these processes are often metapopulation processes: extinction and colonisation events occurring locally in habitat patches in a network.

Four types of assessment method are (1) an empirical approach (census based) (2) a fully mechanistic approach (PVA model based), (3) a statistical approach (landscape index-based) and (4) a spatial standard based approach (mixed). I discuss these approaches briefly here.

Algorithms based upon the presence/absence of do not take into account spatial relations. In fragmented landscapes, the occurrence of a species at a certain moment in time does not mean that the species has a sustainable population for at least two reasons. First, metapopulation dynamics, i.e. local extinctions and recolonizations, limit the value of a single snapshot. Second populations or metapopulations might not be in equilibrium with the current landscape. More probably, the populations are lagging behind the landscape changes. A practical limitation is that gathering distribution data is very time consuming and costly. Finally, even if the data are available, it is not possible to predict the consequences of nature restoration scenarios.

Another method of assessment is using spatially realistic Population Viability Analysis (PVA) to determine the management perspectives for certain species, usually key species, indicator species, or endangered species of specific interest. Here we can take into account the dynamical processes of the populations. However, this approach is time consuming and, such models can hardly be calibrated and/or validated because of their stochastic nature and long time horizon, and chance fluctuations in real metapopulations. The outcome is often very sensitive to the very exact value of certain parameters, where even a perturbation of 1% may have a large effect upon whether or not the network is found to be sustainable: the range of uncertainty of such models is often enormous. Such a PVA can be performed for only a small number of species.

Instead of using species distributions or dynamic modelling, one can evaluate the landscape by calculating landscape indices; statistics such as habitat area, number and density of patches, and various connectivity or heterogeneity measures such as fractal dimension and Shannon diversity. These techniques are nowadays readily available in free GIS packages (e.g. FRAGSTAT). The merits of this approach, as opposed to the approach based upon distribution patterns, are that one can calculate these statistics not only for existing landscapes, but also for future projections and other scenarios, and it is not so time consuming. Drawbacks are the ecological interpretation of the statistics and the lack of reference values and standards. In this paper I discuss an approach that combines the merits of the ones above, without their drawbacks. The approach is based upon ecologically scaled landscape indices (ESLI, Vos et al. 2001) and the key patch approach (Verboom et al., 2001). Ecologically scaled landscape indices (ESLI's) take landscape characteristics into account as encountered by the species in the landscapes, thus adding an ecological scaling to the landscape indices. For example, distances between patches are not recorded in meters but relative to the dispersal distance of the species under consideration. Areas are not recorded in acres or hectares but in estimated carrying capacities. These ESLI's have a greater power for predicting sustainability of populations than distribution statistics and landscape statistics alone (Vos et al. 2001). We developed a method in which landscapes, through a set of indices that are ecologically scaled (ESLI's), are compared to a data set of spatial standards. In this mixed approach, results of PVA simulations, analysis of empirical census data and GIS techniques are combined. The derivation of this spatial standard based approach is described in more detail in Verboom et al., 2001. The approach has been implemented under the name LARCH.

The theory and practice of functional network analysis

1. Choosing species
It is important to choose the right species for an assessment. For example, one can choose species that represent different life histories (e.g. small, medium, large animals), different systematic groups (e.g. birds, mammals, insects), and/or different habitat types (e.g. forest, marshland, grassland). The scale and legend of the map, together with the scale and habitat requirements for species, also puts a limit to the species selection. For example, if a species (e.g. Kingfisher) needs shallow water but the map only has one category 'water', not discerning water depth, the species is not suitable for the analysis, unless reasonable assumptions can be made about the amount of shallow water

2. From map to functional habitat networks for metapopulations
A prerequisite for the analysis is a landscape map that has a meaningful scale and legend for the species under consideration. We need a set of rules and parameters that link the species to the map, taking into account the suitability of the map categories for the species, in terms of density and quality. For this analysis a database is needed with specific parameters, both species-specific and map-specific. In the Netherlands a land cover map exists with vegetation categories with grid size 250 x 250 m. We consider patches that lie well within the dispersal range of the species as belonging to the same functional ecological network. In merging patches and delineating networks, specific barriers prevent the formation of habitat patches or functional networks. The result of this procedure is functional habitat patches for populations and functional networks for metapopulations.

3. From functional network to specific rating
We need to calculate some statistics of the network, statistics that can be used as ratings. In order to get comparable results for the different species, we add an extra ecological scaling, comparing the ESLI's to specific standards for sustainability of ecological networks. The approach is described in full in Verboom et al. 2001. Here, we restrict ourselves to a list of definitions and the results of the analysis.

A Minimum Viable Population (MVP) is a population that has a probability of extinction of exactly 5% in 100 years, even in complete isolation
A Key Population (KP) is a population in a metapopulation that has a probability of extinction of less than 5% in 100 years, under the condition that immigration of at least one individual per generation takes place
A Key Patch (KP) is a patch in the habitat network large enough for a key population
A viable population is a population with a probability of at least 95% to survive 100 years
Patch carrying capacity (PCC)= patch area x patch quality x average density in the patch type
A metapopulation is a set of populations in a habitat network connected by inter-patch dispersal
A habitat network is a set of habitat patches close enough to have a reasonable level of inter-patch dispersal.

A minimum viable metapopulation (MVMP) is a metapopulation size or network carrying capacity corresponding to a probability of exactly 95% to survive100 years. Network merging distance = the distance below which ca. 80-90% of all dispersal movements take place.

We distinguish between three different levels of fragmentation, corresponding to three possible situations in which a patch network is expected to be sustainable:

1. Low fragmentation: if one or more patches in the network is large enough to support an MVP (sustainable)
2. Medium fragmentation: if one or more patches (key patches) can support a key population. Sustainable if the other patches in the network can provide enough immigrants, i.e. if the total network carrying capacity is high enough.
3. High fragmentation: if no key patches occur in the network. Only sustainable if the total carrying capacity in the network is large enough to compensate for the high degree of fragmentation. Note that the minimum area requirements increase from 1 (low fragmentation) through 3 (high fragmentation).
   In terms of ESLI's we calculate the carrying capacity of the largest patch (ESLI 1) and the carrying capacity of the habitat network (ESLI 2).
4. The standards
   Data on population turnover and presence/absence were used to derive MVP and KP standards. See for a detailed description Verboom et al. 2001. Then, simulations were performed with a variety of models in order to determine how much more habitat is needed for a sustainable network in fragmentation classes 1, 2 and 3 (resp. with at least an MVP, without MVP but with at least a KP, with neither of these).

Discussion

This method has a number of advantages and drawbacks. One of the advantages is that although being conceptually simple, there is a whole body of scientific data and knowledge incorporated. Another advantage is the modular approach, in which all the modules can be improved, as more knowledge becomes available.

A disadvantage of the method described is the high level of uncertainty. Sensitivity analysis showed that the outcome can be sensitive to small alterations in the parameter values of e.g. patch merging distance, network merging distance, and parameters used for translating habitat type and area into carrying capacity. A full uncertainty analysis would have to take into account all the uncertainty in these parameters, the underlying GIS map, and the values in the spatial standard data set. Such a comprehensive uncertainty analysis has not been performed yet but the outcome can be predicted: a high level of uncertainty of the results. We think the best way to deal with this is to use the method for comparing scenarios, focussing not on the absolute values of the results, but on the main differences between the results for the various scenarios, and for species groups.

The unique property of the LARCH-model is that it assesses ecological networks as functional networks, with reference to the way species are able to survive in them. This means perceiving landscapes from a species' perspective. Not the structure of the landscape as we perceive it, but the species' perspective counts. Therefore, every species has its own functional ecological network.

It needs stressing that all such methods should be used only comparatively, comparing land use scenarios. The LARCH model results can be used to prioritise scenarios, not for assessing the (potential) long term viability of metapopulations of particular species in particular locations: these tools are not meant and unsuitable for predicting the future.

* References *

Verboom, J., R. Foppen, P. Chardon, P. Opdam, and P. Luttikhuizen. 2001. Introducing the key patch appoach for habitat networks with persistent populations: an example for marshland birds. Biological Conservation 100: 89-101

Vos, C. C., Verboom, J., Opdam, P., Ter Braak, C. J. F. 2001. Towards ecologically scaled landscape indices. Am. Nat. 183: 24-41

And references therein

What deserves more attention?

- Algorithms predicting viability of metapopulations in complex realistic landscapes: with unequal patch size, unequal number of patches and realistic patch configuration.
- Time lags in population responses to landscape change and other transient dynamics
- Interactions between species and how these modify conservation algorithms
- Provocative question-

Is biodiversity a useful term for conservation research? Or should we focus on individual species?

4.2.2.1.13 RE: Biodiversity assessment tools for land-use scenario

Author: Tor-Bjorn Larsson **Date: 22 November 2001**

Jana Verboom presents very nicely an approach for assessing landscape fragmentation based upon meta-population information from selected species. This arises some thoughts regarding the operational possibilities right now to assess fragmentation on a European scale, e.g. as regards forests.

First of all: is there a consensus about what we mean with landscape fragmentation? Well, to a certain extent I think most can agree to the definition given by e.g. Heywood et al. (1995): Fragmentation = "The breaking up of extensive landscape features into disjunct, isolated, or semi-isolated patches as a result of land-use change". The effects of this could be considered to be of two kinds: - Firstly you have a mere habitat loss that of course will affect biodiversity, - Secondly you have an additional effect caused by the isolation of remaining patches.

It is the second kind of effects that justifies the concept of fragmentation. This latter effect could even be considered to be the fragmentation effect in a strict sense. No doubt is this a typical landscape-level effect. Whether this always can be addressed by metapopulation approaches may be debated, depending on how the metapopulation concept is delimited (but this debate may be "academical").

Now, the operational issue - from my point of view - is how do we optimally measure and express fragmentation to catch both of the above kinds of effects. For forest it should be possible by e.g. satellite remote sensing of defined landscape segments to present data on total forest area and also the area distribution of forest "patches". This may, however, only partly reflect the second of the above kinds of effect and suggestions of additional, feasible, indicators would be most welcome!

Reference: Heywood, V.H., Watson, R.T., Baste, I. (eds) 1995. Global biodiversity assessment. Cambridge University Press.

4.2.2.1.14 Value of metapopulation models for conservation

Author: Ilkka Hanski **Date: 21 November 2001**

ABSTRACT: Metapopulation models are available that can be parameterised for species living in highly fragmented landscapes. With these models, one may investigate and compare

the population dynamic consequences of different scenarios of landscape change, and thereby the models provide a potentially useful tool for management.

Many European landscapes are highly fragmented, by which I mean that the total area of particular habitats is quite limited and that the habitat occurs as discrete fragments of varying sizes and isolations. This is the landscape structure assumed in metapopulation models, which investigate the long-term and large-scale viability of species in situations in which individual local populations have a substantial risk of extinction, but where these extinctions are potentially compensated for by the establishment of new local populations. The spatially realistic metapopulation models (Hanski 2001) take into account the first-order effects of landscape structure on metapopulation processes, namely the effects of habitat fragment size and isolation on population extinction and establishment. An advantage of these models is that they can be parameterised with data that are often available, namely the results of systematic surveys of the presence or absence of the species in networks of habitat fragments. The theory involves a measure of landscape structure, called the metapopulation capacity of the landscape, which together with parameters describing the properties of the species determines the threshold condition for metapopulation persistence (the extinction threshold). With this measure, one may compare different fragmented landscapes in terms of their capacity to support viable metapopulations. One may also assess the contributions of particular habitat fragments to the metapopulation capacity of the network as a whole. For instance, one may investigate whether improving the quality of particular patch A is more beneficial than creating a new patch B in some specific location in the existing network through habitat restoration. One may also include in the analysis the cost of various management actions to study the cost-effectiveness of conservation measures.

Not to give an overly optimistic view about the power of metapopulation models it is necessary to address the situations in which these models can be effectively used. The modelling approach is most appropriate for highly fragmented landscapes, but not all landscapes are highly fragmented. The models discussed hear are so-called patch occupancy models, meaning that only the presence or absence of the focal species in the habitat fragments is modelled, whereas local population dynamics (changes in local population sizes) are not modelled. The presence/absence description of local dynamics is not sufficient when some of the populations are very large and have practically no risk of extinction. In such cases the regional persistence of the species may critically depend on such large extinction-resistant populations rather than on the stochastic balance between ongoing extinctions and colonisations Finally, it is generally difficult to obtain sufficient data to parameterise the model for very rare/endangered species living in very limited habitat patch networks. I believe that the modelling approach is most valuable for the study, management and conservation of "ordinary" species (not yet very rare) and biodiversity in "ordinary" fragmented landscapes (not in specific systems of a small number of reserves).

I have suggested that the current models can be used as an effective management tool in the case of species living in highly fragmented landscapes. However, there is both a need and much scope for further testing the modelling approach with better quality data than has generally been available so far. High-quality data are time-consuming and expensive to obtain, because the data should cover large areas and should include accurate biological information on the occurrence of the focal species. It is likely that there already exist many data sets in Europe, which include most of the information needed, and the most cost-effective way of critically testing the metapopulation models might be to identify such data sets and to invest the necessary resources to complete these data to reach the requirements for model testing.

Ideally, such tests should be closely integrated with real management situations.

Reference:

Hanski, I. 2001. Spatially realistic theory of metapopulation ecology. Naturwissenschaften 88, 372-381.

4.2.2.1.15 Monitoring, indicators, modelling -and volunteers

Author: Robert Kenward **Date: 19 November 2001**

ABSTRACT: A research priority is to use professional expertise to optimise voluntary monitoring.

In a changing world, monitoring of the status of species and systems is likely to remain as important as the research and management needed for restoration. Resources for such work must partly be financial, but can also be volunteered time. Trained volunteers help greatly in research and management, and can become indispensable for monitoring. Bird populations in the United Kingdom are monitored mainly by volunteers in the British Trust for Ornithology, which processes their data to provide one biodiversity indicator for government. Local Biodiversity Action Plans in the UK also contain much voluntary input. Recognising the importance of volunteers when funds for conservation are limited, English Nature targets a volunteer increase of 20% in its Corporate Plan for 2001-2005.

It is important that volunteer monitoring is well-standardised for compilation and analysis, is practical and is not too onerous (or people stop volunteering!). Crucial roles of salaried biologists are in developing appropriate systems (Watt's goals, methods, analysis and interpretation) as well as communicating results.

For example, monitoring raptor populations has traditionally estimated nest occupancy. However, recent studies in CEH show that less than a third of adults are breeders in some raptor populations. The preponderance of non-breeders was predicted in models by survival estimates from radio-tagging that were much higher than from ringing for pre-breeders (but not for adults), and was confirmed by field data. In such populations, a high proportion of birds could be lost to reduced survival (e.g. from cyclodiene or organophosphate pesticides) before nest occupancy would fall. A solution is also to monitor first-breeding-age (e.g. from moulted feathers) when checking nest occupancy.

Experience and improved technologies can simplify data collection. We waited 18 years from the start of radio tagging 350 goshawks (*Accipiter gentilis*) for ring recoveries to show that loss of many tag signals had not underestimated survival (Kenward et al. 1999). Tags with improved reliability and life then gave equivalent survival data from 146 buzzards (*Buteo buteo*) in 8 years (Kenward et al. 2000). Models can now be built in about 4 years using 60-80 radio tags, with genetic data to estimate adult survival in the absence of adequate ringing (Wink et al. 1999). As the survival and productivity of radio-tagged raptors can be recorded adequately for modelling with only 3 checks per year, data could be collected by trained volunteers. Noting the second important intervention by Dahdouh-Guebas, GIS such as the Landcover Map of Great Britain (derived by CEH from Landsat TM imaging, Fuller et al. 1994) can be used with the raptor and nest locations to relate habitats to dispersal (Kenward et al. 2001), productivity and survival. Thus, fieldwork by volunteers can now in principle lead to spatially specific individual-based modelling.

This research, now in its concluding stages, may seem an extreme example. However, there are many other ways for salaried biologist to use precise but expensive techniques to develop or improve techniques practical for volunteers. Indeed, radio-tagging can be used simply to calibrate or correct other types of survey for vertebrates. Monitoring by volunteers might help meet the monitoring deficits noted by Cummings and Branquart.

Monitoring obligations for users of wild resources are a way of obtained conservation benefit from sustainable use activities. Finally, research to improve monitoring encourages scientists to work with managers and volunteers, thereby helping to break down the communication gaps mentioned by Conde & Richard, van der Spek and Bruun. Financial encouragement for research that integrates different interests and broadens the base of human resources for conservation should be a sound investment for the future.

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4.2.2.1.16 **Using functional biodiversity for the management of habitat quality and species diversity**

Author: Gerard Jagers op Akkerhuis **Date: 19 November 2001**

1. Habitat quality determines the suitability of any habitat in terms of the local fitness and population viability of the species that are present
2. Habitat quality and its fluctuations can be assessed by studying the composition of Life History Tactics and functional demands of the species in the habitat
3. Knowledge of the functional demands of broad species groups is proposed as a tool for managing the biodiversity and species composition of ecosystems on the basis of process parameters

Scientific tools for biodiversity research

Local habitat quality is the most important prerequisite for population survival. The resources offered by local habitats are never constant. Changes occur within years and over longer periods. Resources and their fluctuations determine the biodiversity of a terrain both in terms of the number of species and in terms of the species composition. Species have adapted to environmental variability by the development of Life History Tactics (LHT), which help them to escape unfavourable circumstances in time (dormancy, diapause) or in space (dispersal ranges, phoresy), the latter linking LHT's to metapopulation approaches. In addition the evolutionary success of a species depends on its capacity to use terrain-own resources (Jagers op Akkerhuis 1999). The environment thus acts as a mould for the overall composition of the species with their Life History Tactics and demands for resources. These different compositions can be regarded as indicative for relative environmental quality and yield information about processes in the ecosystem that must be understood when formulating ecosystem management, ranging from the protection of ecosystem types to the conservation of rare species. The LHT approach has been shown effective both in the soil environment (Siepel 1996) and in above ground environments (Jagers op Akkerhuis, unpublished monitoring results in 20 different culturally used terrain types ranging from city quarters to farms and roadsides). A broad approach that covers many species is advocated to prevent that fluctuations in the population of any individual species (also selected indicators species) lead to variable and possibly misleading conclusions. The use of more species also solves the problem that the indication of changes in environmental conditions becomes problematic when the indicator species is absent.

For the analysis of the LHT's and resource relationships of species in a given environment detailed information is required on the ecology of the species, as well as a database, which allows a rapid consulting of these data. Such a tool is, for example, offered by the SPECINFO database.

Research axis to improve biodiversity conservation

The use of species-environment relationships in biodiversity conservation based on LHT's and resource demands is still in its infancy. Once, the manipulation of large datasets has been a bottleneck but recently scientific progress in this direction is hampered most by a lack of coordinated initiatives to search for the available ecological information and bring it together in a digital form. Developments should also focus on the selection of the most relevant (combinations of) LHT's and resource demands for the characterisation of functional ecosystem changes. Here the focus should lie on fundamental dimensions of ecosystem quality. Initiatives in this direction represent an important research axe for the development of functional biodiversity approaches.

Discussion statement

When the ecological information about species is rapidly available, a multispecies assessment of a given terrain yields much more valuable, complete and more quantitative information about changes in the functional aspects of the local ecology than any indicator species could do.

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G.A.J.M. Jagers op Akkerhuis and C. Damgaard (1999). Using resource dominance to explain and predict evolutionary success. Oikos 87: 609-614.

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4.2.2.1.17 Surrogate taxa and landscape variables as predictors for overall biodiversity - working better than thought

Author: Norbert Sauberer **Date: 21 November 2001**

ABSTRACT: Based on an extensive study in the agricultural landscapes in eastern Austria, we can demonstrate the utility of surrogate taxa and landscape variables for the prediction of total species richness.

Introduction

Biodiversity patterns are scale-sensitive (Wiens 1989, Rahbek & Graves 2000). So global or regional biodiversity comparisons cannot be applied to fine scales. Moreover, single species approaches for biodiversity prediction are often flawed (e.g. Chase et al. 2000). Ideally the development of biodiversity indicators should include information on a variety of different taxa and be carried out at different scales and in different landscape types. But where are these studies?

Insights from a biodiversity study in rural landscapes in Austria We want to draw your attention to a project that has been carried out in the last 5 years as a contribution to the broader "Austrian Landscape Research Programme for a Sustainable Relationship between Man and Nature". Our project was intended to search for surrogate taxa and environmental correlates of species richness, to allow predictions for the best approximation of overall biodiversity in the rural landscapes of Austria. The study was carried out in eastern Austria at a scale relevant to local land use (38 sample sites with an area of ca. 38 ha each).

Surrogate Taxa

There has been criticism in the recent literature (Landres et al. 1988, Ryti 1992, Caro & O'Doherty 1998) on the use of charismatic groups (e.g. mammals, birds) for biodiversity prediction and reserve selection, because of neglecting multi-diverse groups such as insects or fungi. We studied 8 taxa: bryophytes, higher plants, gastropods, spiders, orthopterans, carabid beetles, ants and birds and compared their species richness in 38 randomly selected sample sites. The taxa were selected according to their ecofunctional character (e.g. vascular plants as immobile, soil dependent, homoiohydric, but C-autotrophic organisms as opposed to bryophytes as relatively mobile, soil independent, but poikilohydric organisms; or gastropods as relatively immobile, mostly herbivorous, drought sensitive organisms versus spiders as mobile, carnivorous, but relatively drought insensitive organisms).

We found strong evidence for the usefulness of certain organism groups (especially birds and vascular plants) as indicators of the overall diversity at the landscape-scale explaining 75% to 80% of the variation. Additionally, subsets of two groups (e.g. gastropods and ants or bryophytes and spiders) can also have high predictive power, explaining 78% to 84% of the variation. We know that a true test for biodiversity indicators requires a complete biotic inventory for a region of interest, but this will hardly be realized. However, we think that our subset is representative for terrestrial flora and fauna in agricultural landscapes in Central Europe.

Structure-based Indicators

Structural features of the different cultural landscapes might correlate with biodiversity, and therefore, could be used for prediction and monitoring of biodiversity. We have tested a variety of environmental variables and found land use intensity and heterogeneity as the most efficient predictors of the overall species richness. A very simple approach, of mapping a maximum of 13 habitat types, can explain 69% of the variation of the overall species richness. A land use intensity index - the hemeroby index - can explain about 76% of the variation.

Conclusion

Biodiversity prediction is only one tool in biodiversity conservation, which, ideally, needs to clarify conservation goals at a range of geographic scales (i.e. local, landscape, region). It is within such a conservation framework that predictive models need to operate. This implies that the geographic scales at which relevant land management decisions are made need to be known, and that the study provides user-friendly tools for decision-makers at finer geographic scales (e.g. farmers, district-level agricultural advisors).

Literature

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4.2.2.1.18 More research, new tools, or better use of existing tools in biodiversity monitoring and biological indication?

Author: Klaus Henle **Date: 19 November 2001**

ABSTRACT: To improve conservation success, I argue that we need a combination of new innovative research, improved research management, a more systematic translation of existing research results into user friendly tools for managers and politicians, and a better training of users including scientists when applying sophisticated methods.

Two issues featuring prominently in discussions of biodiversity research and application are the use of indicators and monitoring chances in biological diversity. Meanwhile, a large number of approaches have been suggested for the development of indicator or monitoring systems. So do we really need more research in these fields, or should we preferentially aim at better applying existing knowledge?

Both, indicator and monitoring systems require adequate methods for biodiversity assessment and for linking observed changes to driving factors. If adequately done with an appropriate methodology, this should allow us to predict future changes under alternative managements scenarios. Very sophisticated methods have been developed for assessing biodiversity, for example mark-recapture methods. With the translation of this methodology into user-friendly software in recent years and special training courses, they have started to infiltrate applied biodiversity research. These methods have been used successfully by many research teams including my own in applied biodiversity research and conservation in practice. They can be very accurate if used cautiously but totally misleading if used without careful understanding. Unfortunately, this happens too frequently even in basic science due to an insufficient understanding on the side of the user. Also, for some crucial issues related to the survival of species in fragmented landscapes, practical methods are still lacking. Especially, we have hardly any suitable methodology to quantify dispersal and the consequences of dispersal on mortality and population survival. The same applies for linking genetic and demographic processes for populations in real landscapes. These are two prime issues where I suggest that more research should be done regarding the assessment of biodiversity in the sixth EU framework of environmental research.

However, at least as important is the lack of standardisation of methodology and there is a tremendous gap between applied conservation and the sophistication reached in research. Standardisation often has not even been achieved within countries let alone across Europe. Researching the suitability of calibrations and networks working towards achieving standardisation should be a prime issue for further EU activities. Also translation and appropriate illustration of the utility and limits of results into tools for scientists and managers of biodiversity should be done far more systematically. In my opinion current application and funding systems (nationally and at the EU) cause funding bodies and applicants to deceive themselves. Innovative methodologies require time; the results are yet unknown at the beginning, and thorough translations and training of users also take time. Therefore, they have to be organised in a follow-up of a research project (year 4 or 5) not within the main phase of the project if we really take them seriously and not just as a phrase to increase funding chances.

Given adequate assessment methods, there are also sophisticated statistical methods available for identifying indicators and linking them to driving factors of ecological processes e.g. co-inertia analysis and the software available for it. We used such methodology successfully to develop indicator systems for ecological changes in floodplain systems. Nevertheless, there are serious limitations. We started reviewing international literature on indicator systems for ecological changes floodplain systems. Most shockingly, none of the first 17 papers did make any justification for the selection of a particular multivariate statistical methods are seriously discussed the limitations and assumptions of the methodology! In our own project, we underestimated the amount of time required for testing assumptions in the synthesis and the reviewers even further underestimated the amount of work required for the synthesis and demanded considerable cuts. Now at the end of the project, we know that a small team of 3-4 scientists would require at least an additional 2-3 years to really take full advantage of the results gained and to translate them into tools for users. This experience is not unusual and I know EU applications that have been rejected among other reasons because they required too much effort in project synthesis. Also, unfortunately, the short funding periods make it extremely difficult to identify indicators in highly dynamic systems. Long-term ecological research is required here but funding in Europe is extremely difficult to get for such programs. Furthermore, such multivariate approaches to the development of indicator systems are promising but require intensive co-operation (lots of co-ordinated field work on-site, many co-ordinative meeting, and exchange of scientists!!) of different disciplines instead of a very loose co-operation that is still frequently the case in European projects. I would like to see response to the provocative question: -Are applicants, reviewers, and funding agencies (EU and others) really prepared to commit themselves to such concerted efforts? I doubt it and would like to be shown to be wrong!

To finish with a provocative statement on monitoring schemes, I think that the major problem of the dozens (hundreds?) of monitoring schemes suggested so far and those currently in development is that they rarely have specific objectives for monitoring and that they hardly ever start from a realistic organisation framework. So except for a few specific purposes (such as linking monitoring with population viability predictions) we should abandon research on yet another ecological monitoring methodology unless we first explore that a realistic financial and organisational framework is available.

4.2.2.1.19 Case-study: Establishment of methods to link present state and conservation objectives in a Danish heathland through environmental impact assessment.

Author: Knud Erik Nielsen, Morten Strandberg and Jesper Bak

Date: 20 November 2001

Introduction

We would like to present a case study from a heath area in the western part of Jutland. The project focuses on: "test of conservation objectives, methods to calculate critical loads and assessment of management strategies". In more specific terms the project aims at establishing a link between the present status of the heath and the pressures acting on the heath, i.e. nitrogen deposition and lack of management. From this point strategies to reach the more favourable state, which is expressed by the conservation objective, will be investigated. The strategies will include a selection of heathland management strategies and a reduction of pressures.

In the project a new guideline for assessment of ammonia effects in approval of large agricultural farms under the Danish VVM- regulation (the Danish implementation of the IPPC-directive) will be tested. Furthermore the project will draw on a proposal for conservation objectives in relation to the EU-Habitat directive.

We have chosen a larger heath area with different kind of management as our work area. The conservation status of the Danish heaths is largely uncertain. However the cover of mountain- and dune pine, aspen and juniper increases in major parts of the heathlands. A major threat towards the heaths is the increased deposition of nitrogen. Increased nutrient loading is expected to substantially elevate the nutrient level of the soil. While the elevated nutrient level may prove advantageous to many species, the same levels may become deleterious to several other species leading to their disappearance from the ecosystem. Disappearance of some species may disturb the ecosystem equilibrium because the survival of some species is often dependent on the survival of many other species present within the same ecosystem.

In the Netherlands, where levels of nitrogen deposition are considerably higher than in Denmark, observations have revealed extensive damage to lichens in the dry sand heaths, and a tremendous growth of mosses at the expense of lichens. Nitrogen-induced change from dominance of dwarf-shrubs to grasses has also been observed in heath and dune heath areas in the Netherlands. In Denmark current levels of nitrogen deposition lie close to or exceed the critical load for heathland and observations also point in the same direction as in the Netherlands.

Project periods
Project start: autumn 2001
Project end Report on the value guidelines of IPPCmanual and conservation objectives as scientific tools for biodiversity / habitat conservation - spring 2002

What are the objectives of the project?

We have made a suggestion for conservation objectives and a technical guidance for the practical monitoring program for heathland and coastal ecosystems. The aim of this project is to test the suggestions related to "dry heathland". As one of the criteria is: "Critical load must not be exceeded" we also test different methods of estimating critical loads both by use of the general chemical criteria and by use of ecological indicators such as vegetation-structure, -composition, N-content in litter and shoots. We will present a poster at the conference.

Thus the primary objectives of our project are:
* To test methods to calculate critical loads for a selected heath area.
* To expose the connection between conservation status and exceedance of critical load.

Secondly the scientific needs, which have to be assessed before relations between conservation status and exceedance of critical loads can be properly established, will be identified. For now the list of scientific needs is already long and is listed here below.

What kind of research is needed in relation to Habitat monitoring and assessment of conservation status?

So far we have identified the following areas, which has to be investigated before the suggestion for conservation objectives will be ready for use in monitoring programmes.

* The interactions of management, biodiversity and CL(nut)exc.
* A comparative investigation of heath areas with favourable and unfavourable conservation status to assess the variation in chemical and botanical parameters.
* The influence of phosphorous. The relation between conservation status, C/N-, C/P-status, former and present land-use, soil fertility.
* Identification of indicators of disturbances on the nitrogen cycle. An increase in deposition of nitrogen will have effect both on vegetation-, soil- and microbiological processes.
* A well-considered selection of indicators on favourable conservation status will be a main task in the following years. Some parameters will be difficult to measure and others might have large year-to-year variations and will probably not be operational. For example the use of botanical indicators will have a considerable time-lag response in relation to exceedance of critical load of nitrogen.
* The best candidates seem to be a combination of content and composition of amino acids, total nitrogen content in shoots combined with litter content.
* Development of methods to measure the local deposition of nitrogen - bulk-, throughfall-deposition and measurements of air concentrations in passive collectors.
* Calibration and validation of existing dynamic soil chemical models (SAFE, SMART) on a number of locations covering the dominant habitat types of both heathland and coastal heath. Sensitivity analyses for the parameters should be performed in order to optimise the monitoring program on the intensive monitoring stations.
* In order to validate these models the nutrient circulation on nutrient-poor habitat types have to be investigated.
* Adjustment and test of the biodiversity model MOVE on a number of locations covering both heathland and coastal heaths. It will be necessary to combine the vegetation model MOVE with models used in the critical load work in order to establish relations between critical loads and biodiversity.

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We have experience from different research and monitoring projects on heathland and as UN/ECE national focal centre for Critical Loads and Integrated Monitoring.

4.2.2.1.20 **Bioindicators for biodiversity evaluation**

Author: Pierre Devillers and Roseline C. Beudels   Date: 21 November 2001

ABSTRACT: Bioindicators have proved a powerful tool in implementation of policies of conservation of the natural heritage, at various scales of spatial resolution.

The main and most active threat to species, populations and biocoenoses is habitat destruction, habitat fragmentation and habitat degradation. In the short term it is thus inescapable to centre conservation strategies on the establishment of coherent networks of areas under diverse levels of protection, adapted to the conservation of the biological values targeted. These networks may be supplemented by overall conservation measures applied in the rest of the environment and which bring a complement of protection to less sensitive species and less fragile communities. This approach has been increasingly resorted to, and is embodied, for instance, in Directive 79/409/EEC on the preservation of wild birds, in the Bern Convention, in Directive 92/43/EEC on the preservation of fauna, flora and habitats.

Management has increasingly become an essential component of the administration of protected areas and other areas of importance for the conservation of the natural heritage. The prevalence of this requisite directly derives from the intrinsic characteristics of most of the sites that compose conservation networks:

1. Many habitats of great biological importance result from past agro-pastoral activities or represent stages of evolution that will no longer be attained by new sites in the highly regulated environment of today. Both kinds must be managed to mimic the effects of natural or exploitation-oriented cycles that are no longer extant if they are to retain their significance for the specialized species that they harbour.

2. In more natural sites management is often necessary to compensate an insularization-induced fragility that prevents communities or their most specialized components from surviving crises provoked by climatic vicissitudes.

3. Some sites or habitats, on the contrary, have suffered such past degradation that ecological restoration, defined as the process of intentionally altering a site to establish a

defined, indigenous, historic ecosystem, has become necessary. Management is undertaken to emulate the structure, function, diversity and dynamics of the specified ecosystem.

4. Species with large space requirements, dependant on the conjunction of several habitats and with an unfavourable conservation status or dependant on one or several very specific constituents of the habitat may not be retained on a site if their particular ecological requirements are not taken into account in detail. They require the preparation and implementation of large-scale conservation strategies and restoration or management plans.

Such management is only possible if its effects can be evaluated so as to be constantly corrected and reoriented. Moreover, conservation efforts in favour of species or habitats over extensive spatial areas often entail substantial costs and interference with the activities of various interest groups. They can be sustained only if their necessity, their adequacy and their success can be clearly and unambiguously demonstrated. In situations where it is necessary to resort to incentive instruments favouring rational use of non-protected space, these are effective only if their level of acceptance by targeted social groups is sufficiently high. This can rarely be fully evaluated a priori as it is dependent on a large number of economic, social, cultural, historical and psychological factors with complex interactions. Furthermore, the expected effects of most of them on biodiversity are indirect. Schemes can therefore fall in practice very short of their theoretical expectations if their impact is not closely watched, quantified and compared on a cost benefit basis with other conservation approaches.

In all cases the double necessity of orienting action and of insuring its acceptance makes monitoring and its communication to both deciders and the public concerned indispensable. The size of the territory over which those monitoring systems must operate and the diversity of the phenomena they must reflect impose an economy of material, effort and manpower in their execution. Nevertheless, a multi-criteria approach is in general unavoidable. Specialised indices, closely tailored to the targets are probably most useful to the managers themselves, as they lead most directly to orientation and correction of management policies and methodologies. Overall indices of the state of the environment, on the contrary, are the most satisfactory tool for the evaluation and communication of results to deciders and concerned parties.

Monitoring in the framework of site conservation efforts has a sense only if it allows a more or less precise evaluation of the extent to which management objectives are achieved. This in turn requires a very precise definition of these objectives. In general terms, these always entail the preservation, favouring or restoration of a landscape, a community, a part of a community, a seral stage of a community, a species or some of its components. The choice of the landscapes, communities or species to which the management efforts are addressed rests on a series of considerations which address cultural landscape preservation. conservation or reinforcement of flagship species, contribution to regional (gamma) diversity, preservation or augmentation of alpha diversity, maximisation of ecosystem stability, economic value, and political requirements

** Types of indicators **

Since the total biodiversity can never be inventoried, indices necessarily rest on surrogate variables. Conceptually they fall into five categories. Three of them directly monitor components of biological diversity. They evaluate the fluctuations in range or population size of indicator species or groups of species, the distribution, area or quality changes of communities and their seral stages, and the evolution of the conservation status of selected target species at various life stages. The other two measure pressures or risk factors, on the one hand, corrective actions on the other. In practice, simultaneous, successive or complementary use of combinations of all five sets can probably not be avoided.

Indicator species. -Indicator species are species whose spatial or temporal trends in distribution or abundance reflect the trends in the distribution or quality of a habitat or a community, the evolution of a phenomenon or the trends in distribution or abundance of another species. In particular, they are assumed to respond to management in ways similar to those of target species or habitats. The concept of indicator has a sense only if the presence or abundance of the indicator is easier to detect or measure than the presence or quality of the habitat or community represented, than the state of the monitored phenomenon or than the presence or abundance of the target species. Protected areas are not created and conservation measures not taken for indicator species. Their observation may, however, be a tool in the selection or management of those areas and in the evaluation of the success of those measures. Indicators species can be classified as: surrogate indicators, alpha-diversity indicators, beta-diversity indicators, and phenomenon indicators. These indicators can be used to measure spatial trends, thus to compare between them stations, sites, types of habitats or regions, or temporal trends, thus fluctuations in one place of the variables represented. The qualities required of the indicator may be different in the two cases.

Distribution and quality of communities. -Habitats constitute a reasonable approximation of biodiversity. The use of habitat typologies is thus a fairly evident tool for the evaluation of networks of protected areas. Two components must however be taken into account. The area preserved of a significant habitat type is a direct measure of the specific richness and the population size of species that can be harboured, thus of the resilience to extinction risks of small populations. This area is, however, meaningful only if it represents a genuinely representative habitat, thus of sufficient quality. It is sometimes, but rarely, possible to measure this quality through easily accessible physiognomic parameters. In general, its evaluation requires a recourse to indicators. The construction of indices based on communities thus amounts to combining two measurements of a multiplicative character. The surface of habitats may be obtained from global measurements, most often aerial or satellite imagery. The quality of the communities included in these surfaces can then be evaluated by bioindicator monitoring on sample surfaces or sites. The state of these sites can be characterised through one of the parameters that have been proposed to quantify the value of a territory with respect to one group of organisms. If the use of these values to compare sites between them, exercise for which they have generally been proposed is highly affected by the choice of criteria used for their definition, their evolution on one site through time, much less dependent on the definition of parameters, can be an integrated and faithful measure of the evolution of the quality of the site.

Target species and communities. -Indicators and habitat parameters cannot be expected to insure the preservation of 100% of the biodiversity. Satisfactory values of these indicators can be maintained with some modification in the composition of diversity. It is however unacceptable, in terms of conservation biology, for that modification to affect species or communities culturally or ecologically essential. It is thus indispensable to include in the indices a number of parameters directly related to trends in abundance, life table parameters or area coverage of target species or habitats that the restoration efforts aim at favouring. Among these need to be considered threatened and fragile species, characteristic species, patrimonial species, flagship species and keystone species.

Pressure and response indices. -For the evaluation of conservation policies over large regions pressure and response indices have the advantage of a direct relation to corrective action. Many of them can be relatively easily calculated from existing administrative statistics. Reliance on them assumes, however, that the relation between a particular pressure and damage to overall biodiversity is strong and that the subset of pressure factors that are monitored is a good surrogate for the total set of existing pressures. The first assumption is strongly dependant on the adequacy of the sample chosen to measure the pressure. Thus, even an intuitively strongly relevant indicator, such as the loss, damage and fragmentation of protected areas, is only valid if the network of such areas adequately covers the regional biodiversity. This is less likely to be the case for a set of protected areas than for a parallel but usually larger set of areas identified as of great interest for nature conservation, such as the CORINE site set. Indeed, in the designation of protected areas economical, social and political considerations not related to the conservation of biological diversity and potentially detrimental to it have entered. In either case, the choice of the initial set has necessarily included the use of criteria based on indicator species or habitat related indices. The validity of the second assumption may greatly vary in time and space. It requires, in any case, that the subset monitored be relatively large. Both assumptions are more likely to be valid if the sample on which the pressures are measured is structured along the lines of a biotic community classification such as the CORINE habitat typologies

INTEGRATION OF RESULTS

Whatever the choice of parameters, it is important that they be calibrated so as to permit combination into a limited number of indices describing in a clear, synthetic, timely, compatible and comparable way the global conservation status of the biodiversity or of some of its main components.

4.2.2.1.21 **Practical model on how to measure biodiversity**

Author: Rudi Suchant **Date: 22 November 2001**

I would like to propose to you a practical model on how to measure biodiversity. The model includes questions about the survival capacity of minimal populations, relationships between meta-populations and monitoring/evaluation of success of conservation actions. Compared to existing models, our new model has several decisive improvements: -it is not oriented towards the actual presence of rare (red list) indicator species, but towards the habitat of a regionally representative indicator species -it takes into consideration not only landscape ecological factors, but also status and change of local habitat structures -it proposes a link between different scales -it proposes measurable parameters for the conservation / habitat improvement as well as for monitoring of habitats of selected indicator species

The following procedure is proposed:

* Theoretical preparatory work
- Selection of one or few indicator species with a dependency on land use or landscape type. Example: the indicator species "Capercaillie" (*Tetrao urogallus*) for large, consistent forests in areas with cold winters
- Assessment of a minimum viable population. Example: Capercaillie: 500 or more individuals
- Assessment of spatial requirements for an mvp. Example: Capercaillie 100 hectares or more per individual à 50.000 hectares for a minimum viable population
- Assessment of the distance that the indicator species is able to cross between different "sub-habitats". Example: Capercaillie à 10 km

Application in a given landscape *

- Regional scale
  - Assessment of the habitat potential for an indicator species in a given landscape. Habitat potential = part of the landscape which is appropriate for the species because of particular landscape-ecological conditions Example: Capercaillie in the Black Forest à habitat potential 57.000 hectares
  - Assessment of the fragmentation of the potential habitat and of the distances between "sub-habitats" or habitat fragments. Example: Capercaillie in the Black Forest à distances between habitat patches are smaller than 10 km, i.e. the whole area of the habitat potential could be occupied. -Link between regional and local scale Assessment of the proportion of the potential habitat that should contain adequate habitat conditions. This proportion is deduced from the relationship between the size of the minimum viable population, its spatial requirements, the existing potential habitat and its suitability for the species. Principle: the smaller the proportion of potential habitat in a given area, the higher the necessary proportion of optimal habitat structures - or: the larger the size of a minimum viable population, the higher the proportion of area holding suitable habitat structures. Example: Capercaillie in the Black Forest à targeted proportion of potential habitat with suitable habitat structures: 30 %
- Local scale:

- Inventory of structural habitat elements required for a selected indicator species. Example: Capercaillie adequate structure à rather open forests, forest ecotones, abundant ground vegetation.
- Assessment of habitat suitability for each forest stand (complex evaluation matrix), or
- Assessment of minimum-/maximum values regarding the availability of structures within the forest stand mosaic of a given area. Example: Capercaillie: Minimum value for open forests à 10 %, for stands with open canopy à 20 %, for linear structures à 50 meters/hectares, for coverage of ground vegetation à 40-66%, maximum value for dense (dense thickets and pole stands) forest stands à 30 %.
- The monitoring of the indicator species itself is an important additional element of success control and validity of the species' habitat affinity under varying habitat conditions (predators, disturbance); the main element, however, is the availability of enough suitable habitat. Example : Black Forest : current population amounts to ca. 600 individuals; the current distribution corresponds to 75 % of the area mapped as the potential habitat.

These ideas are only a very short summary of the species-habitat model which has been developed on scientific grounds for the designation of Special Protection Areas under the EU-Birds Directive, as well as for the development of management plans, in south-western Germany. The model was notably developed and put into practice as part of the LIFE-Nature project "Integraler Habitatschutz für Rauhfußhühner im Schwarzwald" [Integrated habitat protection for forest grouse in the Black Forest].

An essential element of the model is the idea that not the whole forest area needs to be optimal for Capercaillie, but "only" a certain proportion of that in a certain spatial arrangement (mosaic of optimal stand structures). This model provides the basis for a successful combination of nature conservation objectives with other aims such as economically viable forestry, or tourism development in the target area. A spatial concept for tourism development was applied, which depends on the location of particular conservation of areas - so-called "focal areas" for habitat restoration (with a minimum proportion of 40-50 % of suitable habitat structures; each ca. 50 - 200 hectares in size). Tourism activities are deviated from these "focal areas" and/or concentrated in other areas where elaborated landscape views and particular recreation requisites favour the appreciation by the visitors.

The model is also planned to be put into practice within a new LIFE-Nature project called "Grindenschwarzwald". The application of the model within the LIFE-Nature project shall be used as an example for a wider application within the remaining distribution of Capercaillie outside previous study areas in the German Black Forest. Finally, the model provides an example, on how biodiversity assessment is not only based on the presence of indicator species (for e.g. species-rich environments like that of Capercaillie), but also on the monitoring of their habitats. The habitat conditions have to be measured on several independent scales, before being linked together through the species-habitat model. As a result, measurable parameters are available that can be used to re-direct land use practices, such as forestry in our example. Dynamic changes within the habitats can also be taken into account through this model.

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4.2.2.1.22 Biodiversity monitoring and adaptive management: more than just nice ideas?

Author: Nigel G. Yoccoz **Date: 22 November 2001**

ABSTRACT: Adaptive management is an efficient framework for developing closer collaboration between scientists and managers, but it will require better attention to the basic questions of "how", "what" and "why" we monitor biodiversity.

The idea of adaptive management has been exposed more than a quarter of a century ago, has been repeatedly advocated as one of the best ways of better integrating research and management, but practical (and successful!) examples of its use are extremely few. Adaptive management indeed provides a quantitative framework where science, in the form of a series of hypotheses or models of the impacts of different management policies, aims at answering the questions managers ask. The basic idea is that we start with an objective function measuring in quantitative terms what is desired: for example we may aim at optimising the harvesting of a given ungulate species, under the constraints that the diversity of other groups such as plants or insects is not negatively affected by more than a given amount. Then, we need to specify what are the management alternatives - e.g. how many animals can be harvested and how are the quotas defined, and when? Science intervenes in the definition of models describing the impacts of management: for the ungulate species, we may consider population dynamics models with different strengths of density dependence for reproductive parameters, and for plant diversity, different relationships between intensity of grazing and plant diversity (e.g., grazing may enhance diversity at low levels, but decrease it at high levels, or may always have a negative impact).

Monitoring links these two components - management and models - by providing the necessary data for assessing which models are "best" and should therefore be given more weight in order to find out which management action should be taken. The statistical tool used to weigh the different models is based on Bayesian analysis - we may start with assuming that we are ignorant (i.e. we give the same weight to all models), and use the monitoring data to update these weights. If the data obtained are very likely under one model, but very unlikely under another, it seems reasonable to give more weight to the former model. Note that the traditional approach of using hypothesis testing is unlikely to work: "all models are wrong, but some are useful" (George Box). Working with a set of models, some providing hopefully good approximations to the actual causes and processes, should therefore be preferred. There are some important aspects that have in my opinion been often neglected and that may be at least partly the reason why adaptive management is still seen as nothing more than a nice idea:

1) The objectives are difficult to define, and changing more or less continuously. Of course, adaptive management by requiring the definition of an objective function will make this very clear, and that is in itself useful. However, we may end up always lagging behind a changing objective.

2) Management is not used to learn about the system, and the natural variation in management actions is too small to provide any clear evidence for or against the different models. If there is for example very little variation in harvesting rates and population densities, it will be difficult to learn anything about density dependence. Learning will happen faster if we use management to learn about the system, e.g. by exaggerating the variation in harvesting rates so as to get large variation in densities.

3) Scientific models address questions at scales much smaller than those relevant for management - and it is believed that it is possible to extrapolate from a few, small-scale intensive studies, to large-scale phenomena.

4) Monitoring often does not result in data that can be used to learn about the models. To adequately assess the likelihood of observing some data, we need to know the different

sources of uncertainty: uncertainty in our estimates of ungulate population size and demographic parameters, uncertainty in our estimate of species richness, uncertainty due to the spatial and temporal variability in ecological patterns and processes (and therefore requiring adequate sampling designs). Very few monitoring programmes include the techniques and designs necessary to assess how large are these sources of errors, and therefore it is difficult to know how much information there is in the monitoring data.

Identification of a research axis: Develop sets of ecological models for the most important management issues, and assess how much we can learn from existing or planned monitoring programmes.

Question: Monitoring programmes often lack focus with respect to questions and methods/designs (it is of course important to distinguish here between monitoring and surveillance/survey programmes, see e.g. Gilbert et al. 1998; Yoccoz et al. 2001). Can adaptive management be a suitable framework for changing this, and therefore better integrating management and science?

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4.2.2.1.23 Biodiversity monitoring and indicators - how do we combine policy relevance with adequate scientific rigour?

Author: Erik Framstad **Date: 22 November 2001**

ABSTRACT: To know whether policies pertaining to biodiversity are approaching their objectives, some form of measurement by indicators will be necessary. This raises at least two questions: (1) Which aspects of biodiversity should be in focus for the various policy sectors and how can these be adequately represented by a limited set of indicators? (2) How can we ensure that such a limited set of indicators provide both adequate policy relevance and sufficient scientific rigour to trust the results as guidance to policy?

To ensure adequate sustainable management of biodiversity, it will be necessary with some form of measurement or assessment of how well policy objectives are met. An obvious approach is to develop policy-relevant indicators for biodiversity and some form of monitoring of the changes in these indicators over time or in response to changes in policy.

The various sectors of society and their policy instruments have different approaches to biodiversity. Some are targeting biodiversity directly (e.g., international conventions like the Bern and Ramsar Conventions, as well as the EU Bird & Habitat Directives), being mainly concerned with threatened species and habitats (e.g., as specified in annexes). Some have explicit objectives for biodiversity in addition to other aspects (e.g., EU Common Agricultural Policy, Ministerial Conference for the Protection of Forests in Europe). However, most sectors only cover biodiversity within general objectives for sustainable management. For such policy areas, concern appears to be focused more on maintaining structure and function of affected ecosystems.

In principle, it is easy to develop indicators and setting up monitoring to address the needs of policy instruments targeting biodiversity. Such policy instruments usually specify the species, habitats or ecosystems of their concern. Indicators may be developed which cover these specific concerns. However, with the large number of species and habitats specified, e.g., in the EU Bird & Habitat Directives, a very extensive set of indicators (in the order of hundreds of parameters) will probably be necessary to cover such needs adequately. To monitor such indicators with sufficient intensity and coverage in time and space, as well as with adequate statistical sampling procedures, so that we may trust the ensuing results, will require a tremendous (unrealistic?) amount of resources.

Other policy areas and their instruments present us with a more complex challenge. Their general references to biodiversity will not provide much guidance in the selection of indicators. We must first decide which aspects of biodiversity to cover, then how these may be represented by a (hopefully) limited set of indicators. Will it be possible to capture appropriate aspects of ecosystem structure and function with just a few indicators or will we need a very extensive set of such indicators? Or will we have to construct aggregated indexes 'to reduce the dimensionality' of the problem (e.g., the Natural Capital Index proposed by Ben ten Brink and co-workers)? In any case, the indicators must be relevant to policy and be readily understandable to the public and policy makers. Also, monitoring of such indicators must be conducted with adequate scientific rigour so that we may trust the reality of the results.

The challenges of providing indicators for biodiversity with appropriate policy relevance, adequate coverage of the complexity of biodiversity, as well as sufficient scientific stringency in monitoring to provide reliable data, have lead some people to propose more qualitative approaches. As experts we may tell fairly convincing stories about the states, trends and threats to biodiversity within given geographical or ecological constraints. However, in cases of conflict over policy issues or resources, other experts will be called upon to provide opposing views. Then we will need both the right coverage of biodiversity and the appropriate numbers to back up our arguments. Hence, a quantitative approach based on appropriate indicators will be required in most cases.

We may thus present the following propositions and questions:

§ To influence policy, indicators for biodiversity must be relevant to policy and readily understandable by policy makers. However, policy relevance will vary with sectors and policy instruments. Both conservation concerns and more general sustainability concerns will need to be addressed.

§ The complexity of biodiversity should preferably be represented by a limited set of indicators. However, will we be able to combine both adequate coverage of biodiversity and policy relevance with such a limited set or will we need a much wider set of indicators? Although attractive in terms of few parameters, will aggregated indexes be sufficiently relevant to policy and represent understandable aspects of biodiversity?

§ Monitoring states and trends of biodiversity by use of indicators will be an appropriate tool to underpin policy with relevant data. However, to trust the results, we will need adequate statistical sampling procedures. It is likely that this will require stringent organisation of and ample resources for monitoring. Is it at all conceivable that biodiversity indicators will be useful without such costly monitoring based on strict scientific methodology?

Proposed research axis:
§ To improve the usefulness and quality of policy-relevant indicators for biodiversity by investigating how major biodiversity-related policy needs best can be represented by minimum sufficient indicator sets based on scientifically adequate sampling procedures
§ how proposed aggregated indicators represent various aspects of biodiversity and how/whether such aggregated indicators may be based on data from scientifically adequate sampling procedures

4.2.2.1.24 **Small-scale field experiments**

Author: Wouter Vanreusel **Date: 22 November 2001**

Abstract: Small-scale field experiments designed to test specific hypotheses are helpful tools for identifying problems with restoration measures.

While measuring quantitatively the efficiency of restoration measures (monitoring) on different parameters and target species can be difficult and require a lot of time, money and volunteers, testing specific hypotheses on crucial aspects of the ecology of target species can be easily performed and give immediate answers to concrete questions and problems.

I believe that small-scale field experiments can contribute to the understanding of failure or success of restoration measures if clear hypotheses are tested (based on published research or field experiences) in a scientifically sound way. The information obtained can be used to adjust restoration and management practices on the short term and thus improve the chances on recovery of populations of target species.

An example.

Large-scale sod-cutting was performed in a Flemish heathland dominated by *Molinia caerulea* in order to restore the former wet heathland type with *Erica tetralix, Rhynchospora alba, Carex panicea, Polygala serpilyfolia*, ... One of the targets was to increase the population size of the Marsh gentian *Gentiana pneumonanthe* on the short term because the population of this species could be limiting the size of the local population of *Maculinea alcon*, the Alcon blue butterfly, a very rare species in Belgium which only oviposits on Marsh gentians. Although the site was known in the past for its optimal habitat for the host plant and germination conditions seemed optimal in the managed areas (bare ground, high water-table, direct sunlight, ...), in most places the species did not reappear although seed sources were available.

An long-term experiment for testing germination and rejuvenation conditions in different years after restoration measures, well designed with nested plots, control plots, replicas within and between plots, etc. took a long time to think over and set up but showed no results at all because the proportion of germinated seeds was too low to deliver statistical results.

If a monitoring scheme had been set up for this species, it would have cost a lot of money and at least three or four years of time before it would have been concluded that there was virtually no germination at all.

In discussions between scientists and field managers the hypothesis was raised that acidification might be the cause of the poor germination. Literature shows that most Belgian and Dutch heathlands suffer from acidification and that certain heathland plant species can have reduced germination under low pH values. A simple field test measuring pH on a sufficient number of sites with and without germination showed that there were large differences in pH between these sites (4,8 vs 3,8, $t= -5,4$, $p<0.001$). All sites with poor or no germination have a pH value under 4,1. These data show that there is severe acidification in most of the sod-cut areas in this reserve. Although it was not experimentally tested and other parameters like nutrient content and micro relief were not tested for, the perfect correlation between pH and germination indicates that the very low pH might very well be the main cause of the rejuvenation problems of the Marsh gentian.

Although no major scientific conclusions can be drawn from these data, the results can however be indicative and suggest directions for literature study and more detailed experiments (on the effects of liming on germination for example). Knowing that acidification may be the cause of the problems can make site managers aware of the fact that sod-cutting measures alone are not always successful and can stimulate them to think about counteracting these problems. It also shows that it can be useful to take standard measurements of pH after large-scale conservation measures.

If scientists were less reluctant to set up small and concrete field experiments and/or terrain managers were trained to perform this type of tests, the outcome of restoration experiments could be evaluated easier and hypotheses on encountered problems could be tested for and no longer be completely based on intuition.

4.2.2.1.25 Alternative strategies of forestry, or how to combine the biodiversity paradigm with an economic one (a modelling approach)

Dmitrii O. Logofet (a), Vladimir N. Korotkov (b) and Olga V. Feldman

Date: 23 November 2001

Conservation is generally believed (and practically appeared) to contradict exploitation, the long history of forest management in Europe serving a vivid example. Management strategies towards plantation of a commercially profitable monoculture (e.g., the spruce culture, Fig. 1) decreases drastically the diversity of forest types in a forestry area. Meanwhile, restoration ecology might suggest a long-term strategy of forest management in which the forest types rotate either with planting after clear-cut, or by natural forest succession (Fig. 2). In practical terms, it means a variety of forest types to be planted or naturally developed at the place of felled areas.

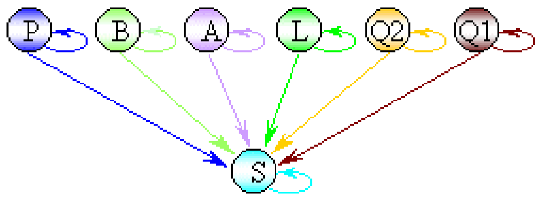

Figure 1. Graph-theoretic representation of the spruce-targeted strategy of forest management in Russkii Les Experimental Forestry (Near-Moscow Region, Russia). Vertices of the graph represent the forest types enlisted in Table 1; arrows correspond to changes of forest the type in time.

Vertex designation	Meaning	Age of maturity, felling, yr	Theoretical share of tree spp. in the coniferous-broad-leaved forest (Turkov, 1985, Smirnova et al., 1995), %
F	Mixed forest	∞	100
S	Spruce forest	81–90	30–40
P	Pine forest	101–110	
B	Birch forest	71–80	10–20
A	Aspen forest	41–50	
L	Lime forest	71–80	50–60
Q1	Oak forest of seedling origin	121–130	
Q2	Oak forest of coppice-growth origin	71–80	

Table 1. Age-aggregated types of forest typical to the coniferous-broadleaf forest zone.

Our modelling approach not only illustrates the controversy between the two strategies, but also reveals a way to incorporate an economic paradigm into an ecologically sound strategy. The both strategies are formalized in terms of the Markov chain models for long-term dynamics of changes in the forest type with time (Logofet & Lesnaya, 2000; Korotkov et al., 2001; Logofet & Korotkov, 2001). The spruce monoculture strategy yields logically an absorbing chain in which forest type S is the sole absorbing state. The alternative strategy yields, on the contrary, a regular Markov chain with a steady-state distribution (in terms of the relative area for the forest type) in which all the most types are present (Korotkov, 2000). It thus illustrates qualitatively the biodiversity paradigm in forest management and can be related quantitatively with geobotanic views of what should be the shares of small-leaved, coniferous, and broad-leaved tree spp. in weakly disturbed coniferous-broadleaf forest (Table 1).

The economics however prescribe a certain hierarchy of forest types in terms of their commercial values. If, for example, the forestry is aimed at getting valuable tree spp., then the hierarchy looks as folllows:

Q1 > P > S > B > L > A > Q2. (&)

Then at least two challenges appear to the model:

- Can the steady distribution of types follow the same hierarchy as their commercial values?
- Which policy of forest management can provide for the steady state with a hierarchy wanted?

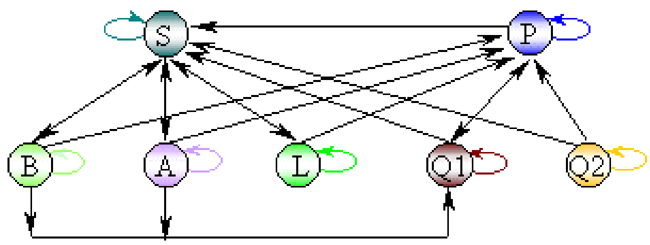

Figure 2. Graph-theoretic representation of the diversity-targeted strategy. Notation is the same as in Figure 1.

The "policy" means here a particular distribution of transition probabilities each time a choice arises among particular forest types to transit to after cutting the former forest.

Mathematical study of the whole class of Markov chain models corresponding to the transition scheme in Fig. 2 reveals a remarkable property in the model steady-state (interpreted as the relative area distribution among forest types): the distribution does follow the prescribed hierarchy of types if the policy (i.e., the ratio of alternative transition probabilities) follows the same priorities with certain quantitative differences.

Note that hierarchy (&) is quite compatible with the geobotanic view of quantitative ratio among forest types in the particular forest zone (the final column of Table 1). However, the commercial hierarchy of forest types is predetermined by the general goal of a particular forestry and it would be distinct from (&) for cellulose-paper industry or building timber. Therefore, the problem of biodiversity conservation in forestry requires the right choice of both the general strategy and adequate policy of forest management. The latter task can be substantially aided with the modelling approach mentioned, which enables comparison of alternative paradigms both in the qualitative and quantitative terms.

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4.2.2.1.26 The need for multidisciplinary approaches

Author: Helena Freitas **Date: 23 November 2001**

Montados are Mediterranean ecosystems dominant in the region of Alentejo, in the Southern part of Portugal, characterized by a savannah like physiognomy, and correspond to an open oak formation of cork (*Quercus suber*) and hoalm (*Q. ilex*) oaks in varying densities, combined with a rotation of cultures/pastures/fallow at the soil level. Despite being sustainable agro-silvo pastoral ecosystems, in recent years, these ecosystems are being threatened by intensification and extensification of land use, leading to soil degradation and of its microbiota.

Soil micro-organisms are crucial elements for soil stability, ecosystems processes as plant productivity and decomposition, and fitness. Among the huge number of soil micro-organisms, mycorrhizal fungi are now recognized as being important for soil stability, conservation and productivity, thus changes in mycorrhizal community structure or species composition can be an indicator to evaluate the impact of the disturbance. Fungi forming symbiosis (ectomycorrhizas) with oaks are Basidiomycetes and Ascomycetes, some of which also produce edible mushrooms.

The traditional montado management involves a low level of disturbance of the natural environment, which supports a greater overall biodiversity than the climax Mediterranean woodlands from which it was derived. Research on the ecological processes may provide a basis to preserve these ecosystems and to keep a sustainable agricultural land-use in the future.

Since the need to preserve Montado ecosystems is recognized by European and Portuguese policies, this area of research aims to be an original and multidisciplinary approach to their better knowledge and conservation, studying the relationship between a group of soil microorganisms, the fungi that establish ectomycorrhizas with oaks (ECM fungi), with land management and plant diversity.

Two different approaches were used and combined:

1) Understanding farmer’s choice of land use, its effects on rural economy and landscape ecology;
2) Evaluating the impact of the different land use systems (pasturage/fallow/agriculture) in cork oak mycorrhizas and sporocarp diversity.

We expect the results to have important management implications, aiming to improve rational strategies for sustainable management of Montados. After two year of collecting data we have been able to point out a few conclusions and taken some decisions in close dialogue with (our) farmers.

4.2.2.2 Science and Policy

4.2.2.2.1 **How to harmonise policy-driven needs and scientific tools?**

Author: Sophie Condé, Dominique Richard **Date: 14 November 2001**

New message to Session 2 - Monitoring and indicators

This second session on "Biodiversity conservation in theory" is dedicated to interest and validity of scientific tools. Some types of interest have already been mentioned such as scientific and management ones. We would like to insist on the political interest already presented by Ben Delbaere (12/11/2001). At different levels, policy initiatives and instruments clearly require tools in order to help the definition of conservation policy and action plans in a first step and the assessment of their efficiency in a second step.

But what are the main policy questions?
Among the series of questions driven by the model DPSIR (Driving force - Pressure -Status - Impacts - Response) policy makers have, most of them need scientific tools:
* What are the threat status and the trend of Europe's biodiversity (wild flora and fauna and their natural habitats)?
* Is use of biodiversity components carried out in a sustainable way?
* What is the status of information availability and understanding of biodiversity?
* What type of pressures are the main causes of biodiversity loss (agriculture, transports, tourism.)?
* What is the status of the main pressures on biodiversity?

And what types of answer do policy-makers need?
They need messages easy to understand and obviously policy-relevant but based on information scientifically sound and statistically valid. By consequence, the organisations in charge of producing information for policy makers (European Environment Agency, EUROSTAT, OECD.) need scientific tools providing factual and quantitative data and allowing the production of indicators, which must:
* Be normative (possibility to compare to a baseline situation);
* Be responsive to change in time/space;
* Be technically feasible and cost-efficient to use within acceptable limits (in terms of data collection);
* Be useable for scenarios for future projections;
* Allow comparison between member states;
* Allow aggregation at national and multinational level;
  - Take into account country-specific biodiversity;

What kind of scientific tools?
In order to assess trends and changes of biological diversity and its components, monitoring programmes are needed on a long-term basis at national and European levels with a biogeographic approach. In order to assess efficiency of the nature conservation policies, monitoring programmes are also needed but their goal and their definition are largely dependent of each policy instrument (evaluation should be made on specific geographic areas and according to a mandatory frequency, by i.e.). Several questions are pending: * Which spatial and time scales can be used to produce indicators relevant at European level? * A number of monitoring research projects to develop methodological tools are funded in the 5th Research programme. If some of these programmes can fit with the policy needs, how far

can the monitoring be effectively implemented after the end of the research project? It is not only a question of funds but also a technical question. Can the methods and protocols developed during the research project be easily used by no-scientist staff? Can the results be easily handled by no-scientist staff?

Policy-makers expect very much from predictive information in order to anticipate their action plans on a national and European scale. Development of models seems to be the only way to tackle this challenge. Models allow to extrapolate on the basis of a limited set of data considered as consistent and relevant for the given purpose. However, it is important for no-scientific users to trust the proposed model. What are the minimum datasets to produce strong models? What is the minimum time to spend on field work to evaluate or re-evaluate the model? How can policy time table fit with the research time table? Obviously the answers may differ according to the objectives of the models but it is really important that the researchers express the limits of the work which can be used to reaffirm the needs of monitoring and surveys activities to increase the efficiency of the models. In conclusion, in one hand, agencies in charge of information on nature conservation and biodiversity express the political needs in terms of monitoring and predictive models and in the other hand, research projects are more and more user-driven; however, the bridge between the two sides is still not enough developed and the two parties must discuss more closely in order to produce usable, valid and accurate scientific tools.

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4.2.2.2.2 Information nightmare

Author: Fernando Valladares **Date: 16 November 2001**

As a scientist aimed to contribute to the conservation of biodiversity I am overwhelmed with the amount of information and the variety of Facilities, Institutions and Organisations available, which have rather similar objectives. A relevant part of my job is to deal with information (generate, store, analyse, publish, read, understand), but I do not think that managers and many eventual end-users of the information relevant for the conservation of biodiversity will have the time or the training to go through all these overlapping and clearly redundant organisations and facilities in order to find out what is known on a specific subject or who are the experts to contact. Thus, I would encourage:

i) To avoid the creation of new organisations and facilities and to make better use of what is already available, which is probably more than enough. I totally agree with the recommendation of Ben Delbaere and Graham Drucker regarding the Clearing House Mechanism: there is no need to establish new systems.

ii) To enhance the coordination of the activities, and to centralise the information in a thematic, user-friendly structure. That is, to avoid that each country, and even each group or Institution within each country, has its own system or facility that claims a leading role or a new function

I would call your attention to the current e-conference as an example of the confusion that an excessive amount of information can create: lengthy and academic-style contributions are mixed with spontaneous, very brief assays or very specific messages in reply to previous contributions. It is very difficult to identify topics and information contained in the contributions unless the eventual reader has a lot of time so he/she can read everything and make his/her own selection and organisation of the information. Perhaps we are still in the need of adding crude material for discussion. I tend to believe that it is far easier to generate and gather information than to analyse and structure it. In my view, the challenge for this e-conference, as well as for the organisations and facilities involved in the conservation of biodiversity, is to digest the information and produce something qualitatively new. And I wonder whether this can be achieved by an encyclopaedic effort of collecting all case studies and all theoretical discussions at a rate that just a few can follow and with a structure that just a few can understand.

4.2.2.2.3 What is the role of conservation scientists?

Author: Lennart Hansson **Date: 21 November 2001**

ABSTRACT: I question the recent trend of scientists approaching biodiversity problems as stakeholders or engaging in decisions about applied research. We will lose the only independent source of ecological information, however imperfect.

In certain quarters the role of conservationists has recently been revised and reoriented. The journal Conservation Biology has had a long series of articles, and debate, on the need of a closer involvement of scientist in conservation policy; some recent papers state that it is appropriate for conservation scientists not only to do research but to propose directions in conservation conflicts. Some EU projects have considered conservation biologists to be one group of 'stakeholders' in conservation. The European Platform for Biodiversity Research Strategy has mixed scientists and policy makers without any distinct separation of roles.

This is a clear breakage with the old ideal of an objective science that provides knowledge and information to society but does not get involved in value-laden politics. It is certainly both appropriate and necessary that the scientists descend from the ivory tower, particularly with regard to tax-payer demands. They certainly should help conservation with all available and adequate data and relationships. However, I will argue that it is not appropriate for scientists to enter the political arena, as scientists.

Sets of professionals fulfil different tasks in society. There are medical doctors, teachers, lawyers and so on. For me the task of scientists is to provide knowledge and understanding of natural phenomena. This should be as objective as possible as involvement in politics would leave the public, that requires information, suspicious about the statements of scientists. It is quite obvious that there can be difficulties in being strictly objective but the goal for the scientist should always be to strive to be as objective as possible. If the scientist deserts this intent then there will be no other source in the society to provide independent information.

Scientist should also be able to inform in a general way about the extent of and limitation in available knowledge. For ecologists, in the present state of their discipline, it may be particularly important to clearly expose their limited capacity to make secure predictions. They should make clear that much knowledge is of a temporary nature. They should have both the right and the obligation to say 'I do not know'.

You may take law people as a corresponding example. A public prosecutor has to keep strictly to the law. She or he may have the (political) idea that the law is too harsh for certain crimes but in his official tasks he will not be able to ask for fines where the law states prison. He may instead objectively tell society about the deleterious effects of prison on young criminals so the political organs may act to change the law - if they wish so!

This certainly does not mean that either scientists or prosecutors should not have the right to have own ideas about value-laden topics in society. However, they have to draw strict borders between their professional tasks and their political ideas. Scientists and ecologists should not use their, sometimes, prestigious place in society to impose their political values on other people. They should clearly declare when they are talking as scientists and when they are talking as common citizens. They should always keep the distinction between 'is' and 'ought'.

We should observe subtle aspects of this problem when we suggest tools for conservation research. Suggestions about monitoring of indicators (e.g. species or structures) may lead to a valuation of either species or ecosystems as most important biodiversity components. An argumentation for population viability analyses places species in the centre. The type of models employed may be particularly relevant for genetic, population or large-scale systems. In order to ask scientist for tools, politically responsible organs should first delimit the type of biodiversity that should be conserved.

4.2.2.2.4 **The roles of conservation scientists**

Author: Allan Watt **Date: 23 November 2001**

ABSTRACT: I argue that scientists should be active in the conservation of biodiversity and should not just be providers of ecological information. I also invite the participants in this e-conference to give more examples of how the research you do makes a difference in conservation programmes.

Lennart Hannson discusses the role of conservation scientists and in most respects I completely agree with him (and I'll come to some of these points in a minute). However, I do not agree that scientists should not be directly engaged in the development of policies and practices to conserve biodiversity.

Scientists are frequently (but by no means exclusively) among the first to see (or suspect) worrying trends in biodiversity or in the drivers and pressures that may affect biodiversity. They should speak out. Scientists may also identify policies and practices that reduce conflicts affecting biodiversity. They should share that knowledge. Scientists can be active in the conservation of biodiversity in many other ways. To take a few examples from this e-conference: scientists should be free to criticise ineffective policies (Kleijn et al, quoted by Etienne Branquart), to identify opportunities for 'added value' from conservation policies (Roger Cummins) and to promote ways of integrating the efforts of scientists and non-scientists in conservation (Robert Kenward). Scientists even do a service by criticising the funding that supports them (Klaus Henle) (even though they may be accused of biting the hand that feeds them!).

But Lennart Hannson is right to say that there is a cost to be paid if scientists become engaged in the political arena as scientists. Unless they are very careful, they may be perceived to have lost their objectivity (in both their policy orientated and research activities). Lennart Hannson is also right to urge scientists to make secure predictions and to say 'I do not know' when appropriate. Exaggerated predictions do neither the reputation of scientists nor the conservation of biodiversity any good. One example is the estimates of species extinctions based on island biogeography theory. This was completely inappropriate, probably held up progress on the monitoring of biodiversity for many years and created a backlash against much-needed conservation efforts.

Scientists must get involved. But the problems that Lennart Hannson refers to are most likely to occur when scientists fail to engage with stakeholders. It is therefore encouraging to see so many people within this e-conference calling for greater dialogue between scientists, policy makers and other stakeholders.

However, I must add that I do not think that one major gap is being as well bridged as it could be - not enough is being done to bring practice and theory together within the conservation of biodiversity. This is, of course, the theme of this e-conference and as it draws to an end I am disappointed that so few people in Session 2 (with some notable exceptions) have shown how science can help with the practical problems associated with the conservation of biodiversity (see many examples in Session 1). This is your last chance to persuade the delegates of this e-conference that the research you do can make a difference in conservation programmes

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4.2.2.2.5 **The guts to act - Indicators, scientists and policy-makers**

Author: Eckhart Kuijken **Date: 23 November 2001**

ABSTRACT: More and better biodiversity research is an important tool for conservation and must be a goal for researchers now and in the future. However, what we really need is the political will to implement nature conservation programs as part of and in balance with actual society concepts and sustainable development.

Dear colleagues and participants,

During the past weeks I have been reading with interest the large number of contributions to this e-conference. I was not fully surprised to notice that there still is a considerable gap between researchers and policy makers, but it is my concern to bring both stakeholders of biodiversity closer together. Too many researchers still think their investigations on biodiversity issues have no direct importance for conservation, OR they consider their results as being of practical value immediately. It is my experience that all scientific outcome of research need careful 'translation' towards applications in policy (not only concerning biodiversity, this is a more general statement). Some items are of more direct value for the purpose of conservation that others, but at long term most of ecological experiences become part of understanding systems and thus can underpin ecosystem management and biodiversity conservation. Of course scientists should be able to give an objective view of their results without interference from governmental or non-governmental organisations. However, those scientists also have a responsibility to the society around them. At a certain moment they should have the guts to stand up and tell policy makers to act. Even more, they should tell policy makers how to act and when to act and assist or support them in that regard.

The development of indicators (and monitoring systems to set references and explore the possible indicators) is actually an important tool to reach this goal. But we must take care: offering policy makers applicable indicators, they should be scientifically correct. One of the contributors at this conference mentioned that we do not have to take into account their scientific value but their information value. Values are often subjective and less easy to defend from scientific point of view, but also this approach needs greatest objectivity. The development of indicators for sustainability, for instance, is a more recent challenge that needs more multidisciplinarity than we have experienced until now.

If an indicator is scientifically correct but too difficult to understand for policy makers or too difficult for application by administrations or managers, we have to find other ways of information and support. An approach with traditional data in the field of 'natural history' (with evaluation criteria and standards such as rarity, vulnerability etc. of species, habitats or processes) still belongs to possibilities. Indeed, those were the tools used to bring the nature conservation debate onto the political agenda during the past twenty years.

The actual biodiversity research is giving an adequate overview of the problems and -even more- must be able to offer solutions to many problems typically linked with modern society needs. Criticism on non-sustainable activities and developments is often based upon the same scientifically sound statements and results. Wise use and application of biodiversity knowledge, from genetics and taxonomy to community and landscape ecological level is a great need and must become a specific goal for a growing range of keen researchers leaving their ivory towers (if still existing). However, what we really need is broader communication in order to reach more public awareness and the political will to set up and implement nature conservation programs. Policy makers do not so much need additional indicators; they need the guts to act.

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