Actions for the 2010 biodiversity target in Europe– how does research contribute to halting biodiversity loss?

Short report of an electronic conference, October 2006

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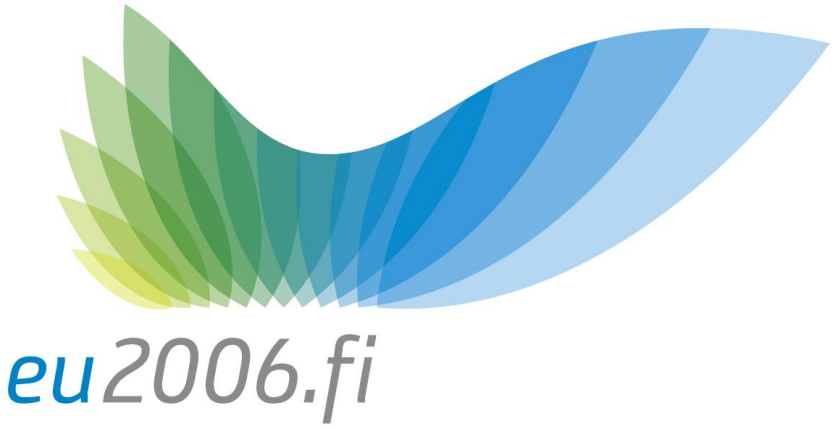

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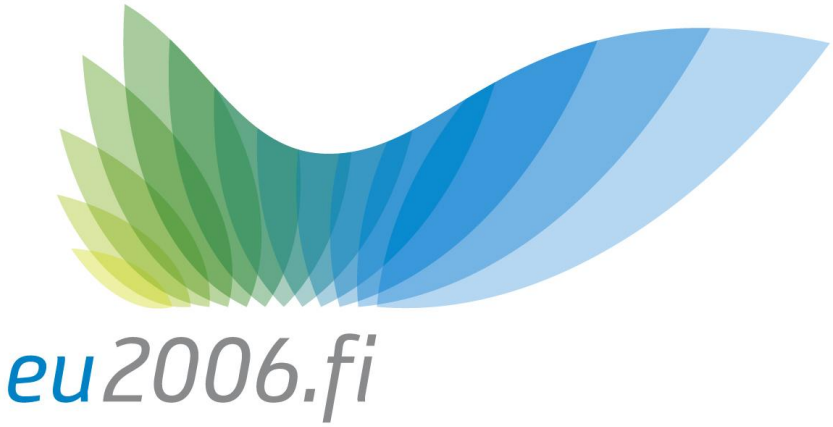
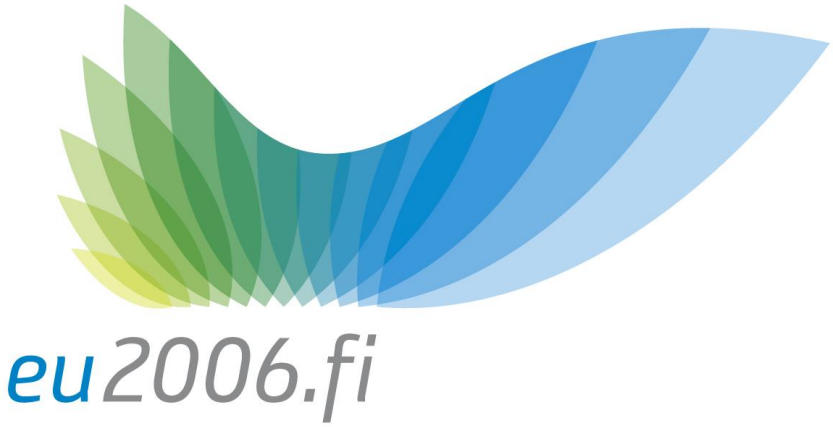


Preface

Research on biodiversity is essential to help the European Union and EU Member States to implement the Convention on Biological Diversity as well as reach the target of halting the loss of biodiversity in Europe by 2010.

The need for co-ordination between researchers, the policy-makers that need research results and the organisations that fund research is reflected in the aims of the "European Platform for Biodiversity Research Strategy" (EPBRS), a forum of scientists and policy makers representing the EU countries, whose aims are to promote discussion of EU biodiversity research strategies and priorities, exchange of information on national biodiversity activities and the dissemination of current best practices and information regarding the scientific understanding of biodiversity conservation.

This is a report of the E-conference entitled "Actions for the 2010 biodiversity target in Europe– how does research contribute to halting biodiversity loss?" preceding the EPBRS meeting to be held under the Finnish EU presidency in Helsinki, Finland from the 17th to the 19th November 2006.



Introduction

Jari Niemelä

Recent assessments of the status and trends of world's biodiversity indicate that biodiversity and consequently ecosystem services provided by biodiversity are in decline. However, there is hope that such negative trends can be changed. The EU has made significant commitments to reverse biodiversity decline by agreeing 'to halt the decline of biodiversity by 2010'. Although there are signs of slowing rates of biodiversity, the pace and extent of implementation has been insufficient (Halting the loss of biodiversity by 2010 – and beyond, COM(2006) 216 final). The Communication states that the achievement of the 2010 target is still possible but will require accelerated implementation.

The aim of the Finnish EPBRS meeting (in Helsinki 17-19 November 2006), therefore, is to provide material that will help the EU and international policy processes to accelerate the implementation of measures to halt the biodiversity loss by formulating more precise expectations on biodiversity research and policy. Science in support of the 2010 target should focus on research that will inform policy and practice relating to biodiversity conservation, agriculture, the built environment, water resources, and coastal and marine management. Enhanced collaboration between researchers and policy-makers is a key to success in halting the loss of biodiversity, and promoting such collaboration is one of the main goals of the Helsinki EPBRS meeting.

The Finnish EPBRS meeting is structured around one general issue and two focused ones. 'How to reach the 2010 -and beyond - target: research influencing policy' is the overarching theme of the meeting, while 'Youth and biodiversity' and 'Urban ecology and biodiversity' are emerging biodiversity issues important for the EU. This electronic conference is organized to discuss these three issues.

The e-conference chairman for the first issue 'How to reach the 2010 – and beyond – target' is Dr Terry Parr (CEH). The issue is further divided into three topics:

- Effects of research on biodiversity policy including examples of best practice
- Communication gaps for the use of biodiversity research to halt the loss of biodiversity
- Three most important research topics for halting biodiversity decline and their justification.

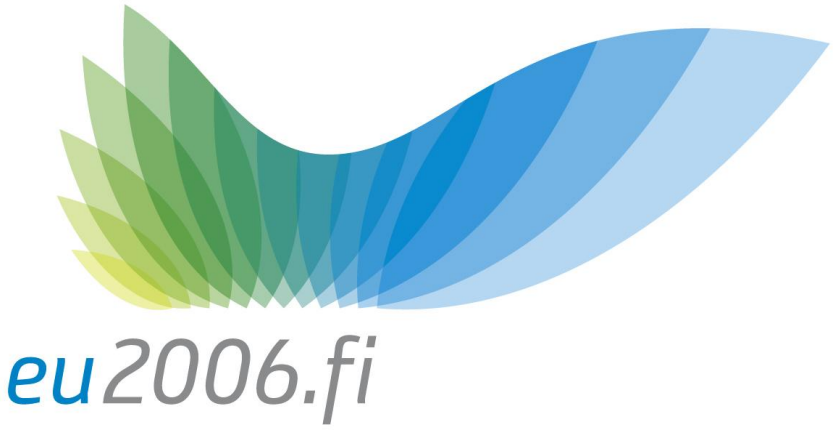
The second issue 'Youth and biodiversity' focuses on biodiversity in school education. The e-conference chairman for this issue is Professor Mauri Åhlberg (University of Helsinki). The session has two topics:

- Innovations to promote biodiversity by co-operation of teachers and scientists

- Schools as activators of the monitoring of environmental change.

The e-conference chairman for the third issue 'Urban ecology and biodiversity' is professor Stephan Pauleit (Centre for Forest, Landscape and Planning, Royal Veterinary and Agricultural University, Denmark). This session will focus on the status, trends and research needs in urban biodiversity in Europe.

I hope you enjoy and participate in the electronic conference which will feed into the November EPBRS meeting.



Summary of contributions

Terry Parr, Stephan Pauleit and Mauri Åhlberg

How to reach the 2010 target and beyond

The main aims of this E-conference were to identify the most important research topics for halting biodiversity decline and to explore knowledge transfer and communication gaps, particularly with policy. We will have to wait until the results are discussed at the EPBRS meeting in Finland in November for a complete analysis of the contributions in relation to the match between current research and policy priorities. However, the response to this E-conference shows that interest in biodiversity a research and policy has never been greater. This reflects an ongoing commitment to biodiversity conservation in protected areas but also a growing recognition of the role that biodiversity plays across many sectors of society and in the wider seascapes, landscapes and urban areas.

1. Priority Research Areas
Initial priorities for research were identified in the SYKE report summarising the results of an EPBRS/ALTER-Net questionnaire. Many of the contributions to the E-conference supported these main areas of research but there were some important shifts in emphasis emerging. These are summarised below.

Priority Research Area 1. Improve understanding of the major anthropogenic and natural drivers of biodiversity change, and their individual and combined impacts.
The E-conference provided a few mentions of key pressures on biodiversity, particularly climate change, but the main emphasis was on management of biodiversity inside and outside of protected areas. Inside protected areas the need was for more research to facilitate adaptive management. But with the recognition that only a relatively small proportion of land (15%) is in protected areas there was a great deal of interest in research to look at biodiversity in relation to cross-sectoral issues. In particular, actions to mitigate human effects on biodiversity and identify "win-win" options where biodiversity could benefit from policies in other sectors. The need for a better understanding and management of agriculture-biodiversity interactions was repeatedly stressed but other concepts such as "eco-enterprises"; "systematic conservation planning" and "creative conservation" were also put forward.

Several contributions made the general point that the fate of biodiversity inside and outside of protected areas depends ultimately on the feedbacks between ecological, social, economic and political systems and these are weekly covered thirdly. The research questions here are usually complex, often neglected, and must be handled in an inter-disciplinary way. More effort needs to be put into articulating appropriate research questions and building research capacity in this area.

Priority Research Area 2. Develop, test and evaluate indicators, including indicators of sustainable management of renewable resources, ecosystem goods and services, and public awareness, to deliver policy-relevant information.

The E-conference revealed a continuing interest in research on indicators. But there was a general dissatisfaction with simple indicators of state, usually because these rarely appeared to stimulate appropriate management or policy responses to prevent biodiversity loss. Hence, research on indicators that link more directly to management actions and policy responses was seen as the main priority and this included ideas in relation to indicators of biotic integrity, indicators of unfavourable status, indicators of ecosystem services and sustainable management, and indicators of the effectiveness of management and policy actions.

Research on the relationship between biodiversity and ecosystem services was also seen as a key issue in order to gain more public and political acceptance for action.

Priority Research Area 3. Further develop an accessible Europe-wide inventory of species and habitat distribution, status and trends, underpinned by significant new taxonomic effort, and support similar research in developing countries.

In relation to this priority, there were several calls to fill taxonomic knowledge gaps and for improved inventories of species and habitats and genetic biodiversity, particularly in the coastal and marine environments. In the marine environment the lack of systematic habitat survey information and a general under-sampling of the biodiversity was seen as a major barrier to preventing further biodiversity loss. On the positive side, there were statements of strong support to build on the work of Global Biodiversity Information Facility by improving its data coverage and exploiting its expanding database in research and policy.

2. Knowledge transfer, the policy interface and communication gaps

Early in the E-conference a provocative statement was made saying that we already know enough about biodiversity loss for policy purposes and that the priorities are now to develop cost effective management options, understand and find more effective methods for getting science to contribute to policy and develop incentives that turn awareness into action.

This debate simmered gently along throughout the conference without really coming to a boiling point. The general level of response to the question of research priorities (above) showed that there was still a perceived need to expand the knowledge base but equally there were many contributions that stressed the development and use more effective tools for translating knowledge into action. A quote from John Lawton: “conservation is not about science” further stimulated the debate.

This is a complicated area, but the suggestions fell into 3 broad areas:

1) Specific proposals to develop and make use of existing tools for biodiversity management and planning.
2) Research on public attitudes to determine what the main factors are that determine whether the public actively support, accept or ignore of particular policy or management measures.
3) Proposals to develop a more effective science policy-interface. Since any such interface would be complex, multi-directional, with many players at different levels

of interest, one proposal was to establish an effective co-ordination process across the whole biodiversity community. An on-line data-base linking research to policy (and vice-versa) might form part of this.

3. Does halting the loss of biodiversity begin at home?
This was a European E–conference so not surprisingly we had few contributions from outside Europe. More surprisingly there was little discussion of the impact of European policies on biodiversity in other parts of the world so perhaps this is a research-policy gap that needs further discussion.

Urban biodiversity

1. Status and trends of urban biodiversity:
This was not the main topic of the E-conference, which concentrated rather on research needs and priorities for action. Moreover, this topic was dealt with in the questionnaire action that preceded the conference and which was summarised by Jari Niemelä at the beginning of the conference. However, the following points were mentioned:

Status:
Urban areas can have a higher biodiversity than surrounding countryside which is often impoverished due to intensive farming. A study of German cities shows that they are often located in areas which are naturally rich in species due to geological diversity, and this pattern explained high urban biodiversity (see Ingolf Kuehn's contribution).

Within urban areas, there is a gradient from species poor inner urban areas to the urban fringe with a relatively high biodiversity. This is particularly due to the diverse mix of different land uses (with their distinctive open spaces), and remnants of encapsulated countryside which have survived in urban areas. Introduced species also contribute to urban biodiversity. However, the general model of the urban – rural gradient significantly differs between cities due to their history and the specific pattern of urban structures and land uses (see contributions from Jonathan Sadler and Robbert Snep). Therefore, a more detailed look at the urban mosaic is required to gain a better understanding of ecological pattern and process.

Pressures:
While urban biodiversity can be generally high, native and archaeophytic species are under pressure due to urbanisation and the consequent loss and fragmentation of natural and seminatural habitats. Moreover, T. Kucera explains in his contribution that remnants of seminatural habitats suffer from lack of traditional management. As a consequence, urban biodiversity may decline and species assemblages may become more homogeneous between cities due to the loss of locally distinctive (and rare) species, on the one hand, and the increase of common and introduced species, on the other. Further urban development will increase these pressures, e.g. through the intensification of land use within urban areas and urban sprawl.

Certainly, much more would need to be said to gain a more accurate and differentiated view on status and trends of urban biodiversity. However, a limitation is that comprehensive and comparable assessments of urban biodiversity are mostly missing, not to mention the lack of time series.

2. Needs for research and action:
In his introductory note, Jari Niemelä listed eight topics for research that were mentioned in the preceding questionnaire action via ENULE.
1. Development of standardized methods and indicators across Europe for comparative assessment/monitoring of urban biodiversity.

2. Functioning of urban ecosystems incorporating the human dimension.
3. Effects of habitat fragmentation, role of urban ecological corridors.
4. Can you build for biodiversity in urban areas?
5. How important are private gardens to biodiversity.
6. Urban ecological research in urban planning and design.
7. Relevance of urban green space for the urban dwellers.
8. Measures needed for halting the loss of urban biodiversity in Europe.

These topics served as a basis for the e-Conference. Contributions were particularly concerned with:

Comparative research in urban areas:
It was suggested to launch an EU-wide research project using a comparative approach by conducting similar kind of field work along urban-to-rural gradients in many cities across Europe based on standardized methods and common indicators. The GLOBENET project was mentioned as an example (see contributions from Jari Niemelä and Lyubomir Penev).

The proposal for comparative research was welcomed by several contributors. Susanna Lehvävirta made the point that such research should go beyond the study of general broad ecological phenomena/ patterns of urban areas (e.g. urban-rural gradients). The aim should be to identify causal mechanisms producing these patterns, and she suggested that such research should focus on particular, well-defined research questions and it can be undertaken on a smaller scale. Current research on the impacts of trampling and edge effects on biodiversity in urban woodlands in Finland was given as an example. This research should lead to planning and management guidelines, and the development of decision support tools (see contributions from Fabio Attorre and Jonathan Sadler).

Urban form, human activities and natural process: landscape ecology of urban areas:
There is increasing evidence on ecological gradients between urban and rural areas. However, urban areas are in reality a complex mosaic of distinctive urban structures that accommodate different urban land uses/ human activities (see contributions from Ingolf Kuehn, Robbert Snep, Jonathan Sadler). Jonathan Sadler pointed out in his key note that “it is now time to look past the (generic urban – rural gradient) and focus on the details of the mosaic” in order to understand the causal mechanisms that lie behind the occurrence of species in urban areas (and I would like to add: and other environmental process such as hydrology, urban climate etc.). Little is known on the role of the urban matrix (and its different land uses) as a habitat and in which way it enhances or hinders dispersal of species in urban areas. What are effective corridors for species dispersal in urban areas? Landscape ecology has mostly concentrated on rural areas, but it is still at the beginning in urban areas (see contribution from Robbert Snep). Consequently, there is a lack of guidance to apply landscape ecological principles in the planning, design and management of urban areas.

Integrated research:
Several contributions stressed that true understanding of the urban ecosystem requires close cooperation between natural and social sciences as well as between science and practice. Urban areas are the human habitat in the first place. They are developed and managed to meet human needs and fulfil functions for human society. Therefore, it is crucial to understand how and why humans behave and act in urban areas, what are the value structures behind (see, for instance Frank Waetzold’s contribution in the 2010 Target session), and link this to ecological process. In particular there is a need to understand planning/ design and decision making in order to produce knowledge, indicators, tools and guidance that are relevant to them (see contribution of Paul Opdam in the parallel session on 2010 Targets). For

planning, for instance, it will be important to better understand the ecological performance of urban land use types and how parameters that can be influenced through planning and design (e.g. urban density, green space provision, etc.) impact on natural process (biodiversity but I would also like to add hydrology, climate, among others). I would like to stress the need for close, and open minded collaboration with landscape architects, engineers and the managers of open spaces because it is them who translate goals into the physical design and management of open spaces. I felt during the session that more was said about understanding the attitudes of residents towards biodiversity but less so on the important role of this group of landscape architects, engineers etc.

Such integrated research is still the exception because it is so challenging. From a multidisciplinary project in Birmingham, Jonathan Sadler reported that it may take several years before researchers from different disciplines have learned to cooperate with each other and are able to interact with the network of actors in an urban redevelopment project.

Several other contributions underlined the need for integrated research, and gave links to projects (e.g. Sandrine Godefroid, Richard Scott).

3. Public involvement in preserving urban biodiversity:

It was noted that urban biodiversity can only be promoted when this ambition is broadly supported by the public. Urban ecology is until now still mostly based on "experts" knowledge whereas little is known about the attitudes of the citizens towards biodiversity. How is biodiversity perceived and valued? Research in Swiss urban areas showed that green spaces are assessed according to criteria such as access, stimulation and attractiveness but there is little direct interest in species per se (see contributions of Robert Home). Irina Herzon therefore asked to "improve understanding and appreciation of urban green space, and in particular biodiversity, by residents". Education was seen as important to raise the interest of the youth in biodiversity. Yet, much depends on how the public is engaged in conservation projects. Richard Scott from Landlife reports that "creative conservation" projects are very successful in England to raise the interest of citizens in wildflower landscapes, and increase the level of outdoor exercise. Unfortunately, these projects are not recognised in conservation policies such as Local Biodiversity Action Plans. It seems that national and local conservation policies are not sufficiently encouraging wider involvement of the public in biodiversity issues.

Thomas Elmquist too stresses in his keynote the important role of the public in the protection and management of green space and biodiversity. An impressive number of 69 NGOs are involved in the management of the National Urban Park, a large woodland area located within Stockholm. Analysis of these organisations demonstrated their important role in protecting the National Urban Park from urbanisation pressures, either through direct involvement in the management of the park or indirectly through awareness raising and providing legitimacy to the more directly involved groups. Moreover, the stakeholder groups are important for introducing new forms of adaptive management because they may be more open to experimentation and learning than government organisations.

Youth and Biodiversity

The title of our session of the e-conference "Youth and Biodiversity" was criticized for being too narrow and inaccurate. According to the digital Oxford English Dictionary, the word 'youth' has six main meanings, the most prominent one being: 'young people collectively', "more specifically, the period from puberty till the attainment of full growth, between childhood and adult age." It was suggested that all people, the whole of humankind, needed biodiversity education and learning.

The main results from the e-conference are presented in order of the seven issues discussed during the e-conference:

1. Innovations to promote biodiversity education through the co-operation of teachers and scientists.
At least the following concrete innovations including research priorities were presented:
(a) Use of competitions on European Biodiversity among schools (including the public) could promote our biodiversity learning and education. At least, it deserves to be tried, tested and researched.
(b) Use of the WAP Browser technology as part of Mobiles for future "public biodiversity monitoring"
(c) 'The Stack' is an e-learning environment that promotes basic and advanced skills in species identification – its primary objective is to improve the quality of biodiversity training of university students in biology.
(d) Use of Geographical Information System (GIS) in connection to biodiversity education, e.g.: How best to use Geographic Information System (GIS) and Geographical Positioning System (GPS) to promote biodiversity education?
(e) NatureGate, a project which integrates all above mentioned ideas, for lifelong biodiversity education, is in progress. It cooperates with ESRI, which is one of the leading commercial companies of GIS and GPS applications. NatureGate will include a network of servers with digital libraries of high quality photographs of organisms and their habitats, biotopes, ecosystems, and fast digital software for fast and easy identification of organisms. The organisms can be grouped in all possible ways, including any kinds of groups or stacks, including threatened, or keystone species etc. In Biodiversity Education, results of both competitions and collaborative knowledge building can be cumulatively stored, shared, used, distributed, and continually further developed using modern computer soft ware (1) for GIS, and (2) for collaborative knowledge building, e.g. CmapTools.

General hopes were expressed about for example, the need to develop (a) teaching methods focusing on interactions and processes; (b) teaching models where students identify keystone process species in the ecosystem, and build an understanding of the functioning based on these few but important organisms; and (c) better incorporation of conservation issues into teacher-training programmes. The last suggestion was made by a participant not involved in teacher education programs. The point is that those, who are working inside teacher education, know that there is no space for conservation issues in teacher education programs of modern knowledge societies. Biodiversity education has be a part of something bigger, e.g. Education for Sustainable Development (as a part of UN Decade of Education for Sustainable Development, 2005 – 2014), and even then mostly as extracurricular digital material in the WWW.

2. Schools as activators of the monitoring of environmental change and biodiversity
We learnt that schools are already activators of the monitoring of environmental change and biodiversity. They can be helped by innovations presented above.

3. What is the current position of biodiversity education in general education, in vocational education, and in adult education?
We learnt that there are some activities going on in each of these fields, but plenty of room for improvement. Above innovations outline how biodiversity education could be promoted in all of these fields of education.

4. Citizens as collectors, co-builders and users of biodiversity knowledge.
We learnt that citizens can be activated to take part and to promote biodiversity and biodiversity education. This is happening in the international Scout Association

movement, in the German NAJU (Naturschutzjugend) project and in the international NatureGate R&D program.

5. Co-operation with scientists, teachers, civil servants, policy-makers and schools in promoting biodiversity (problems and solutions of communication).
We learnt that, for example, the international ENSI-project (Environment and School Initiatives) is co-operating with scientists, teachers, civil servants, policy-makers and schools in promoting biodiversity. There are, however, most probably problems and solutions of communication yet to be researched.

6. What are the gaps in our knowledge and understanding of biodiversity education and learning?
One important gap in our current knowledge is how to connect urban life style people with biodiversity protection. Many young people are alienated from non-urban, rural nature. Does use of new communication technology provide any help?

We do not know the efficiency of three proposed theoretically ways to promote biodiversity education, namely inquiring learning, collaborative knowledge building, and their combination. They can be used in formal, informal and in non-formal education, in kindergarten, in schools, in universities and in adult education. But how efficient are they compared to other options, e.g. simply delivering information about biodiversity losses using mass media?

How do quantity and quality of nature education relate to understanding and appreciation of biodiversity? Does a week in the forest add more to the understanding and appreciation of biodiversity than a weekly program on school TV? How can the so-called “significant life experiences” be promoted? Probably the best way would be integrating inquiries in nature with learning from cumulative global knowledge from internet, and taking actively part in building knowledge on biodiversity, collaborating with biologist, using a shared dedicated servers like NatureGate. Everybody can make observations on organisms, take digital photographs of them, and upload them. Nobody knows. Everywhere biological nature in its various ways is very exiting for those who have time and the interest to experience it.

We do not know how good NGOs are in promoting biodiversity education and learning. An example is the Austrian Network for the Protection of indigenous Orchids, founded in 2005. The vision is that participating people will learn about the mechanisms of evolution, the global distribution of plants, the function of ecosystems, about modern systematics, including molecular phylogenetics, and about the importance of the preservation of all species and their biotopes.

How efficient are open-ended problems that engage deliberation and action in student? How useful are biodiversity problems that could connect with the conflicts of interest that students find meaningful to deliberate and act upon in biodiversity education?

How useful and efficient is it to present an integrating, collaborative knowledge building approach, search for balanced interests, and search for win-win strategies for the whole of humankind?

Some people are better at “reading nature” than other. There is a big variation. One important research issue and a gap in our knowledge is how to best teach people to identify and recognize important species and other taxons and their interrelationships in ecosystems, and how to develop best practice, and test competence of ‘reading nature’ in both urban and rural environments.

7. What is strategically important research that should be undertaken for promoting biodiversity education and learning?
We need both theoretical and empirical research on biodiversity education and learning, in order to promote the field. Confused or simplistic thinking results in

confused, and/or simplistic empirical research. Problems of biodiversity conservation and biodiversity education are really complex, and therefore research, both theoretically and empirically, has to be advanced enough to deal with this complexity. We always need collaboration of those people we are developing research on and with. If we want to say something meaningful about biodiversity education and teacher education, then it is best to ask relevant teacher educators to collaborate.

The first research priority should be: How can the Tree of Life, or any other global network of servers, be developed into real global network of biodiversity servers promoting biodiversity learning of all humankind?

If we agree that the most important issue is to activate the whole humankind, then the NatureGate type approach could be the focus of strategically important research that should be undertaken for promoting biodiversity education and learning.

Connected to the global network of biodiversity servers, we need cumulative research on what people learn and think about organisms, biotopes, and ecosystems, and all other aspects of biodiversity. Digital resources, photographs, documents and videos, they attach the servers, e.g. by using CmapTools, would be extremely revealing material for future research on biodiversity conservation and biodiversity education and learning

We need research on how people are conserving or promoting biodiversity around the world. What are they thinking, what are they learning when trying to conserve or promote biodiversity?

We know that digital storage space is becoming cheaper. Internet connections are becoming faster. Mobile technology, GIS, etc are improving. It is a very important research priority of biodiversity education to promote research on these issues and in particular how they can be used to promote the global, cumulative network of biodiversity servers for research on biodiversity learning, thinking and action.

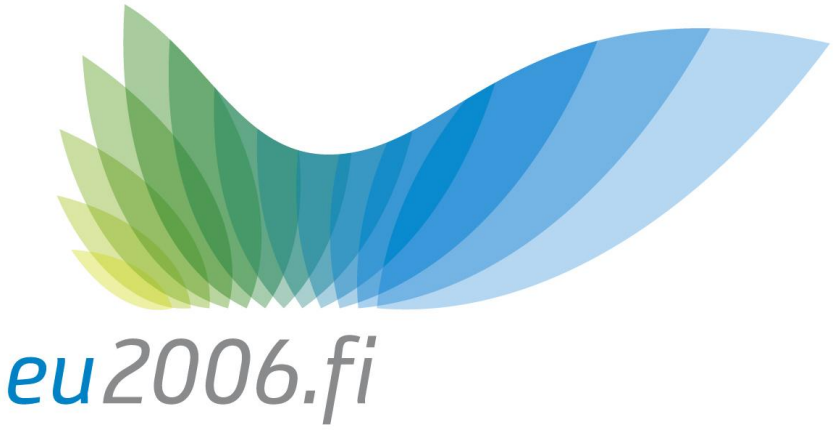
Research and development on creating integrated internet serves (E.g. NatureGate), in which GIS can be used as well as modern digital mobile technology. There data could be collected collaboratively by all citizens, and biodiversity knowledge could be collaboratively built. An important question is how people in practice integrate facts and values for real world decision-making in the face of factual and ethical complexity.

How could all the above described activities happen in reality, and how could biodiversity education be best promoted for the benefit of all humankind. This is strategically the most important research that should be undertaken for promoting biodiversity education and learning. In order to promote for biodiversity education research, it is strategically important to have both (a) local biodiversity research and education centres and (b) collaborative knowledge building, sharing and spreading centres that are using the Internet and the WWW, e.g. NatureGate.

Final suggestions

A particularly good idea, that deserves to be thoroughly discussed, is a proposal for a “UN Decade of Biodiversity” (2011- 2020) to promote biodiversity conservation and biodiversity education beyond the 2010 target. There ought to be plenty of research to monitor and continually improve quality of activities during this decade.

All this can be continually integrated using proposed network of Internet servers, e.g. NatureGate. The point is that lifelong Biodiversity Education needs integration of Biodiversity information delivering, sharing and collaborative knowledge building, integrating use of latest Information and Communication Technology (ICT). It needs plenty of biological and educational research to create this kind of network and continually improve it.



Research priorities

Juliette Young and Allan Watt

How to reach the 2010 target and beyond

1. Assessing species and habitats status and trends:

- Further develop an accessible Europe-wide inventory of species and habitat distribution, status and trends, underpinned by significant new taxonomic effort.
- Identify, harmonise and compile currently available long-term time series, inventories and taxonomic data with the aim of identifying gaps in data
- Develop methods to make existing data more widely accessible to all users.
- Promote detailed habitat mapping to support conservation and sustainable management practices.
- Develop a consistent European-wide system of habitat classification (i.e. European Union Nature Information System) as well as evaluation systems for the trends of Natura 2000 sites.
- Develop population ecology of threatened species including research on minimum viable population size and area.
- Promote research on the impact of the reintroduction of species and restoration of habitats
- Promote research on the genetic diversity of threatened species.
- Assess present losses of species diversity and restoration of ecosystems in view of selection of reference sites.
- Develop, test and evaluate indicators, including indicators of sustainable management of renewable resources, ecosystem goods and services, and public awareness, to deliver policy-relevant information.
- Promote the use of existing tools (Natura 2000 for the community-ecosystem level and Red List for the species level) as indicators of biodiversity trends.
- Using a selection of indicator species, assess population status and trends for species in the Birds and Habitats Directives.
- Explore the potential of GBIF in allowing countries to develop their own estimators of biodiversity loss, and compliance with the 2010 target.
- Improve estimators (“surrogates”) for overall biodiversity (including estimates of marginal gains/losses rather than estimates of total species numbers in a given place). Such approaches should include making best-possible use of museum collections data and integrating such information with environmental layers.

Estimation methodology would greatly help in eliminating the distortions in “real data” introduced by sampling methods.
- Explore how a rapid, large scale DNA barcoding program might be used for conservation planning for 2010
- Develop future scenarios by experiment and testing the adaptive potential of both individual keystone species as well as at the mesocosm level.
- Explore links between biodiversity or habitat loss and demonstrated loss or degradation of ecosystem services.
- Assess the roles of public beliefs, perceptions and attitudes in biodiversity loss.

2. Drivers of biodiversity change:
- Improve understanding of the major anthropogenic and natural drivers of biodiversity change, and their individual and combined impacts.
- Assess impacts of harvesting and other potentially unsustainable practices on ecosystems and their functioning.
- Evaluate the effectiveness of existing conservation policies and the impact of policies from agriculture and other sectors
- Evaluate the impact of key agricultural activities on biodiversity conservation. Based on these outcomes, models for land use scenarios can be validated.
- In the marine environment, increase research on the effects of local disturbance, fisheries and global climate change at the appropriate scales in order to understand resilience and adaptability of marine populations and communities.
- Understand how changing conditions (climatic, socio-economic) influence not only ecosystems directly, but also human demands on systems, services obtained, and values of those services.
- Explore how people and industry respond to different policy instruments aiming to address biodiversity loss, and how this interacts dynamically with ecosystem process and services.
- Promote research to develop adaptive measures for biodiversity and climate change in all terrestrial, coastal and marine areas within the jurisdiction of EU member states.

3. Values of biodiversity
- Develop methods for the valuation of biodiversity, including ecosystem goods and services and their contribution to livelihoods.
- Assess the role of biodiversity on health and disease incidence.
- Produce realistic estimates of opportunity costs of conservation, and their distribution, including ways to combine different costs.
- Estimate the values of coastal habitats to provide real estimates of the ecosystem services that they provide.

4. Biodiversity management:
- Assess the role of Natura 2000 in adequately protecting European terrestrial and marine biodiversity and accommodating expected climatic changes with resulting shifts in species’ ranges
- Develop methods to integrate environmental change into conservation planning and incorporate landscape and land-use dynamics into habitat management options.
- Compare habitat distributions with the existing protected areas to identify and fill gaps in protection.
- Identify ways to maintain viable species populations with large enough patches or connectivity.
- Develop methods to promote a more ecosystem-based management approach (for example Integrated Coastal Zone Management).

- Research on public attitudes to determine what the main factors are that determine whether the public actively support, accept or ignore particular policy or management measures.
- Develop methods to better incorporate stakeholder input in appraisal methods, including better consideration of winners and losers, and conflict resolution methods

5. Linking research with policy
- Increased research on the understanding of public attitudes and views on biodiversity and biodiversity management to develop and present arguments for a comprehensive approach for ecological outcomes that are both socially and environmentally effective.
- Develop methods to encourage direct and continuous dialogue with decision-makers (e.g. 'research ambassadors').
- Research into indicators and decision-support tools to translate knowledge on ecosystem services into useful measures for decision-makers. Research topics include: better methods of presenting and managing uncertainty; benefits transfer and aggregation issues; relative merits of (and synergies between) discursive and monetary valuation methods
- Investigate the role of environmental ethics in communicating the current risks to biodiversity.
- Develop methods to promote greater involvement by NGOs and community groups
- Develop methods to incorporate private as well as governmental actions engaging the private sector for areas such as agriculture, fisheries, marine shipping, tourism alternative and renewable energy.
- Identify ways to promote eco-enterprises and encourage biodiversity-friendly innovation
- Identify methods for the quantification of delivery of public biodiversity goods by companies
- Further develop mechanisms to promote interdisciplinary research between ecological, social and economic disciplines, as well as planning and design disciplines.
- Develop methods to design and implement coordination of EU-level stakeholders engagement processes in EU research projects and networks
- Develop mechanisms to include local knowledge into scientific generic tools.

Urban biodiversity

1. Relevance of urban green space for the urban dwellers.
- Improve understanding of the attitudes of urban residents towards urban green spaces, and in particular to biodiversity
- Develop methods to encourage urban green space (including urban aquatic zones) both as learning areas and for biodiversity per se.
- Improve understanding of the role of urban biodiversity in shaping people's understanding of global biodiversity conservation.

2. Functioning of urban ecosystems.
- Develop research on the role of connectivity and linkage in urban ecosystems.
- Identify current and potential native, natural and semi-natural habitats as well as their connection with the green structures and corridors to the surrounding nature.
- Promote research on habitat patch and habitat matrix.
- Understand how urbanisation affects interactions between species and the physical properties of landscape

- Determine which processes are scale invariant or scale dependent.
- Better understand the complexity of ecological interactions and how they vary in relation to urbanisation.
- Explore the potential for 'green engineering' the built environment in a manner that maximises its ecological function.

3. Effects of human activities, such as habitat fragmentation, on urban ecology and biodiversity.
- Establish the role of disturbance in urban ecology.
- Establish how the density of the built form affects habitat / ecosystem performance in terms of its effect on key processes (e.g. run-off retention, nutrient cycling and so on).
- Research on understanding social-ecological complexity

4. Development of standardized methods and indicators across Europe for comparative assessment and monitoring of the state and trends of urban biodiversity.
- Develop robust indicators, new ways of capturing and representing data (e.g. in GIS models), and modelling tools (e.g. decision support systems, spatially-explicit species models).
- Detailed studies on precise, spatially explicit patterns of distribution and species composition within cities and among cities using a common framework with finer resolution but larger extent (e.g. Europe)

5. Integrating urban ecological research into urban planning for the maintenance of biodiversity in urban areas.
- Exploring the role of adaptive capacity in light of environmental change
- Better understand the conditions needed for more effective ways to manage urban ecosystem services.
- Promote the development of an integrative view of the whole urban socio-ecological landscape.
- Develop adaptive governance systems to support practical management.
- Promote mechanism-oriented (instead of being taxon-oriented) research to further develop urban ecological theory and provide effective planning and management guidelines.
- Promote ways in which to encourage interdisciplinary research in urban ecology
- Develop methods to present scientific findings in a comprehensible and accessible way

Youth and biodiversity

1. Biodiversity education in schools:
- Develop teaching methods focussing on interactions and processes.
- Develop teaching models where students identify keystone process species in the ecosystem, and build an understanding of the functioning based on these few but important organisms
- Increase interest in biodiversity by using particular charismatic species (e.g. orchids) or habitats (e.g. rock pools and seashores) to encourage practical Biodiversity Education.
- Develop better incorporation of conservation issues into teacher-training programmes.
- Promote methods to foster the cooperation of the formal school system in biodiversity education.
- Study the circumstances that enable innovations in schools, particularly the role and participation of pupils in developing new models.

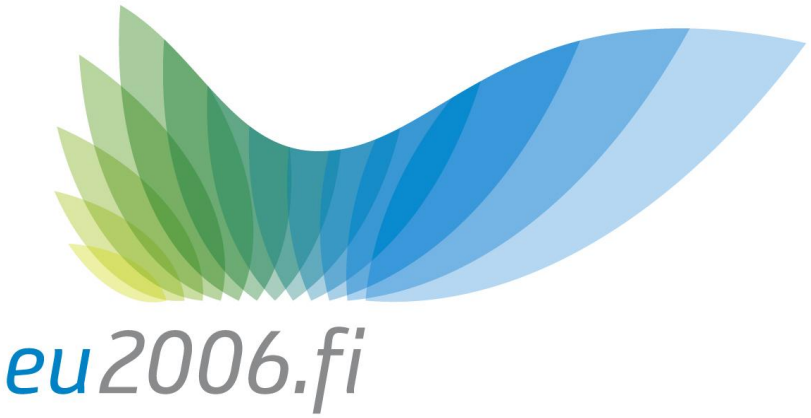
- Research to determine which pedagogical methods could best be applied to the teaching of GIS in schools.
- Provide more support to teachers through social recognition, better internet resources (e.g. databases) and material conditions
- Promote closer collaboration of educational scientists and teachers in developing, testing and evaluating biodiversity education tools.
- Promote the involvement of parents in Biodiversity Education
- Promote competitions on European Biodiversity among schools (including the public)
- Gather data on the state of alienation of young people from biodiversity in different parts of Europe and on the links between alienation and educational programmes.

2. Informal biodiversity education:

- Promote general informal biodiversity education through, for example, new virtual media (NAJU project) or the voluntary sector (the Scout Association)
- Promote the use of non-traditional approaches to Biodiversity Education, such as WAP Browser technology in mobile phones for mapping and/or species identification, GIS, the use of handheld GPS and the BioBlitz initiative of counting as many species from as many taxonomic groups in a 24-hour time period.
- Develop lifelong learning mechanisms
- Explore the potential for biodiversity education of involving school children in biodiversity management
- Develop methods to promote communication through intergenerational relationships and scientific actors in order to foster conservation.
- Promote biodiversity education through the integration of well-organised information resources with outdoor activities and re-connecting in multiple ways to nature
- Develop ways to encourage the “educational chain” between children, parents, family and business through practical field work/observations, collaborative knowledge building and the exchange of experiences.

3. Biodiversity education resources:

- Develop major, well-funded, long-term cumulative research programmes in order to promote biodiversity education.
- Promote the development of a of global network of biodiversity servers around the world building on existing networks to easily deliver and access biodiversity information for all users
- Promote the development of interactive tools such as websites with photographs and videos of species and habitats.
- Produce indicators of biodiversity learning, thinking and action
- Promote research on the potential of new media in biodiversity learning, thinking and action.
- Research on the identification of connections were human interests seem to collide, but where deliberation can help us find possibilities and solutions.
- Foster the concept of a “UN Decade of Biodiversity” to maintain momentum of biodiversity conservation beyond the 2010 target.



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