The mission of the European Platform for Biodiversity Research Strategy (EPBRS) is to ensure that research contributes to halting the loss of biodiversity by 2010.

Review of "Research, identification, monitoring and exchange of information" in the European Biodiversity Strategy

A report from the European Platform for Biodiversity Research Strategy (EPBRS)

Adopted by the EPBRS Meeting
under the
Irish Presidency of the EU
in Killarney 21-24 May 2004

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Introduction

The European Commission is reviewing the implementation, effectiveness and appropriateness of the European Community Biodiversity Strategy (COM (98)42) and the four Biodiversity Action Plans under it (Conservation of Natural Resources; Agriculture; Fisheries; Economic and Development Cooperation).[1]

The review is done in consultation with the various Commission services concerned (in particular DGs Environment, Agriculture, Fisheries and Development), Member States, Acceding Countries and civil society. It is designed to meet the dual purposes of:

1. preparing a report to Council and Parliament, based on the above assessment; and
2. building the necessary political momentum towards meeting the 2010 target – to halt the loss of biodiversity by 2010 – by outlining a 2010 Delivery Plan.

The European Platform for Biodiversity Research Strategy (EPBRS) was asked to review scientific progress and assess the extent to which biodiversity research has responded to the issues raised in Theme 3 of the Strategy (Research, identification, monitoring and exchange of information)[2].

This document was prepared on the basis of reports from National Platforms for Biodiversity. EPBRS volunteers compiled the reports on each of the bullet points included in theme 3. A drafting team[3] synthesised the compilations. In order to allow as many experts as possible to contribute to the review process, participants to the electronic discussion group *'EU Biodiversity Science'*[4] were invited to comment on this synthesis with respect to: (i) research progress in these areas; (ii) barriers, difficulties and outstanding issues; and (iii) recommendations for future research needed to achieve the 2010 target. Participants were encouraged to make additional suggestions, keeping the strategic objectives of EU Biodiversity policy in mind, in particular the 2010 target. More than 60 contributions were received, from experts from 16 countries.

The drafting team then revised the report based on the comments received. This review considers the research recommended in the EC Biodiversity Strategy under five thematic areas – (i) Inventory, Status, Trends, Drivers, Pressures and Conservation; (ii) Humans and Ecosystems; (iii) Tools and Methods; (iv) Science and Policy; and (v) Structuring European Biodiversity Research (See Table 1) – which cover all bullet points of Theme 3 of the EC Biodiversity Strategy.

The present report contains the review of work done under each of the five thematic areas as well as a presentation of barriers, difficulties and outstanding issues relating to those areas.

This report was adopted by the EPBRS plenary in Killarney on May 21, 2004. The information contained herein, together with the recommendations compiled during the review process were used to underpin the Killarney Recommendations. The recommendations and review will be presented to the Irish Presidency Conference *"The EU Biodiversity Strategy - Sustaining Life, Sustaining Livelihoods"*, May 25-27, 2004 in Malahide.

Science in support of the European Biodiversity Strategy should focus on research that will inform policy and practice relating to biodiversity conservation, agriculture, the built

[1] Full texts of the Strategy and Action Plans are available at: http://biodiversity-chm.eea.eu.int/convention/cbd_ec/F1067953781.
[2] See Annex I for the text of Theme 3.
[3] The drafting team consisted of: Ms. Eilís Nic Dhonncha, Dr. Martin Sharman, Dr. Isabel Sousa Pinto, Dr. Jurgen Tack, Dr. Rob Tinch, Dr. Sybille van den Hove, and Dr. Allan Watt.
[4] http://www.smartgroups.com/groups/BiodiversityScience

environment, water resources, and coastal and marine management. This review is focused on science for the conservation of biodiversity, just as the EU Biodiversity Strategy is itself a response to Article 6 of the Convention on Biological Diversity requesting Parties to implement strategies for biodiversity conservation. Good science can make biodiversity conservation measures more effective and timely. Uncertainty or ignorance of science is not an excuse for inaction, but science may help to stimulate and guide useful action. Conservation issues frequently relate more to human behaviour than to the natural world, and so social and economic sciences are often more to the fore than are natural sciences in the struggle to conserve biodiversity. But natural sciences provide essential understanding of the natural systems, without which social recommendations might be ineffective or even damaging. Biodiversity conservation goals must be socially relevant and acceptable, and the implementation of conservation activities is a matter of governance, regulation and culture. But the goals must be achievable within the limits of the living system, so the understanding of natural science is a necessary and vital keystone to the legislative arch.

The drafting team would like to thank all those who contributed to this document for their help.

Table 1: Thematic areas used in this report and their scope

Thematic Area	Scope
1. Inventory, Status, Trends, Drivers, Pressures and Conservation	The research considered under this topic includes fundamental research to understand changes in biodiversity and applied research into conservation. It covers the inventory, status and trends of biodiversity as well as the mechanisms and drivers of change.
2. Humans and Ecosystems	The research considered under this topic aims: to understand better the dependence of human life on ecosystem functions and the relationships between biodiversity and ecosystem functions; to investigate wider human values for biodiversity and equitable sharing of the benefits of biodiversity; and to improve management tools and better understand their impacts.
3. Tools and Methods	The research considered under this topic relates to the wide range of tools and methods of direct and indirect application in the conservation and sustainable use of biodiversity, including clean technologies and ex-situ conservation, conflict management, taxonomy and systematics, molecular methods, and monitoring and indicators.
4. Science and Policy	Ensuring that science contributes to the definition of, and is informed by, policy objectives. Establishing interfaces between science and policy to provide sound scientific basis for policy design, legislation, policy implementation, and policy assessment.
5. Structuring European Biodiversity Research	Creating more effective and durable research networks on biodiversity and ecosystems, to improve the structure of European biodiversity research, and hence to increase the effectiveness of research in biodiversity.

Review of work done, barriers, difficulties and outstanding issues

1. Inventory, Status, Trends, Drivers, Pressures and Conservation

Scope

The research considered under this topic includes fundamental research to understand changes in biodiversity and applied research into conservation. It covers the inventory, status and trends of biodiversity as well as the mechanisms and drivers of change.

Outline of work done

Inventory: Scientific work has provided about one third of the European countries with national checklists of flora and fauna, of variable reliability. Most of these checklists were produced before the strategy was published. The Europe-wide inventory of species diversity is nearly complete for some taxa, but still far from satisfactory for many others. A reasonably good understanding of genetic diversity has been developed for some economically important organisms, but little is known about the genetic diversity of almost all other organisms. There has been little or no progress on cataloguing recently extinct species in Europe, although useful global lists have been assembled for extinct mammals, amphibians and reptiles, and several European countries include an 'extinct' category in their Red Lists. There is inadequate knowledge of the inventory of invasive species in Europe, but an FP6[5] project has begun to deal with this issue. The inventory of European ecosystems is probably sufficient for many practical purposes. The results of the Millennium Ecosystem Assessment are not yet public, but it has helped to focus attention on ecosystem goods and services.

Status: Research into the conservation status of species is not strongly financed, and our understanding of the conservation status of selected species depends largely on many small species-specific studies, while our knowledge of the status of some habitats depends on the implementation of the Habitats Directive (Natura 2000). As a result our knowledge of the conservation status of species is uneven and patchy, and the quality of the information varies greatly from country to country. The status of flagship mammals and birds is typically among the best known, but for most organisms conservation status is generally either poorly known or unknown. Many countries will have to improve their national inventories and extend them to other taxonomic groups if they wish to improve their assessment of species status. They will also have to apply the new IUCN regional methodology to make it possible to compare and integrate the information nationally, across Europe, and globally. In some cases, rather than having national surveys that contribute to the IUCN inventories, countries have no adequate national data, leaving them with little option but to depend on the IUCN red data lists to help them to identify species that are threatened within their borders. Some countries, however, find the criteria used to establish IUCN red data lists difficult to apply in practice and do not use the lists.

Trends: If most countries know little of the conservation status of most species, they know even less about the magnitude and direction of recent change in that status for almost all species. Several countries have identified this as the key challenge in efforts to conserve biodiversity. Funding for such research often depends on *a priori* knowledge or belief that the target species is threatened. Where research has been carried out in this field, most attention has been paid to, and therefore most is known about, target species in the Biodiversity Action Plans. In some Member States research is being undertaken to assess the impact of

[5] Sixth EU Framework Programme for Research and Technological Development.

Biodiversity Action Plans both on the species targeted by the plans and on some non-targeted species.

Much of the research that has been carried out to assess changes in biodiversity has been on highly specific changes – either in terms of restricted locality, simple and specific ecosystems, or select sets of species. There has been much less research designed to detect, monitor and understand changes at landscape or regional scale. Soil biodiversity loss and soil monitoring are key issues for the (2002) Thematic Strategy for Soil Protection. Understanding of biodiversity in the soil has advanced significantly but below-ground biodiversity remains less well understood than above-ground biodiversity – as is the case for marine biodiversity. Research has focused more on terrestrial than on marine ecosystems, and in general less is known about changes in marine than in terrestrial environments.

Drivers and pressures: Considerable scientific attention has been focused on the various drivers of biodiversity change. At a global or regional scale, some general drivers (including pollution or climate change) have been shown to be responsible for large-scale changes in biodiversity. Research has also identified how some species have responded to specific threats, pressures and drivers (such as how populations of cod have responded to over-harvesting). The relative impact of different threats, pressure and drivers is, however, poorly understood. As yet there is no unifying theory that will predict how any species that has not been specifically studied will respond if subjected to any particular set of pressures.

Research has shown that a key element in species or ecosystem conservation is often to identify conflicts between various human uses of landscape. These conflicts, stemming from diverging human values over land use or the use of components of biodiversity, must be understood, managed and where possible resolved if society is to gain the capacity to slow or halt biodiversity loss. There has been little progress on merging research on identifying and resolving conflicts with research on the effects of drivers such as fragmentation or disturbance.

Conservation: Scientific effort has contributed a considerable body of results intended to support conservation, but existing work has mainly been focused on single species, or small assemblages, while wider ecosystem-level interactions are not sufficiently addressed. Meta-population dynamics are extremely important for biodiversity conservation, but our understanding of this issue depends on the work of a small number of researchers and the subject is in general insufficiently studied. Similarly, research incorporating economic or social elements is generally missing. There has been limited progress nationally towards evaluating the relative importance of various areas for the protection of particular species, and to use these evaluations to set priorities. This approach has not been implemented on a European level. There has been little attempt to assess the efficiency and effectiveness of NATURA 2000.

Barriers, difficulties and outstanding issues

Collaboration between the social and natural scientists is more common than it was a decade ago. Nevertheless, it has proved difficult to integrate economic and social research with ecological research to explore drivers, changes and conservation issues as well as for biodiversity research in general. This stems, at least in part, from difficulties in communication between and mutual uncertainty about widely different world views, training, methods, vocabulary and paradigms. Integrating economic and social research on the one hand and ecological research on the other is difficult because: it takes time; funding for integration is not readily available nationally or within organisations, and where they are available, national funds are vastly over-subscribed; inter-disciplinary teams often try to

combine the concerns of each discipline rather than by bringing their applied insights to bear on practical conservation problems; and applied work is not rewarded in academia.

Biodiversity conservation has not been high on the agenda of most social sciences. This is regrettable since almost all drivers of biodiversity loss are anthropogenic, and without a better understanding of human values and motivations our policies are likely to fail. Where we understand human motivations, and where they give rise to conflicts over options for land use, the instruments of conservation are often weak. There is therefore a need for a more visible and effective contribution of science to legislation and governance (see Section 4 below).

Drivers of biodiversity change often operate in combination, and it has been difficult to disentangle their effects, leading to lack of progress in understanding how individual drivers impact biodiversity.

The lack of scientific work into conservation status and trends reflects perhaps not so much the lack of interest as the difficulty of acquiring the information and the limited scientific recognition given to work of this kind.

Some of the Member States suffer from a lack of specialists on, or experience in, the evaluation of trends, drivers and pressures on species and ecosystems. There is a significant need for technology transfer from Member States that have well-established communities with this experience. Insufficient national funds effectively prohibit long-term studies, or studies that depend on specialised and expensive equipment. In general, if funds for short-term research are not always easy to obtain, they are frequently much easier to find than funds for monitoring, which is seldom seen as "research".

2. Humans and Ecosystems

Scope

The research considered under this topic aims: to understand better the dependence of human life on ecosystem functions and the relationships between biodiversity and ecosystem functions; to investigate wider human values for biodiversity and equitable sharing of the benefits of biodiversity; and to improve management tools and better understand their impacts.

Outline of work done

The functioning of the biosphere and its constituent ecosystems is a vibrant and vital field of research in Europe and elsewhere. Much of the research is, however, focused on detail and on isolated elements. As a result our understanding of the key issues remains partial and incomplete. For example, we do not know if there is a general rule that links the diversity of organisms within an ecosystem to the capacity of the system to deliver goods and services.

There are two main areas of global-scale biodiversity research. One examines how the main ecosystem compartments and processes interact with each other, and with climate and other abiotic processes, to form the earth's life support system, and how they are affected by human drivers and pressures. The second examines how species are affected by global change. Major progress has been made in both areas over the last 10 years, especially on the first.

Several regional- or landscape-scale projects across Europe focus on processes in major ecosystems. The approaches often combine detailed (often experimental) studies of mechanisms with larger scale comparative studies. They may also design and construct models that are intended to allow the results to be generalised. The regional and landscape

level effects of climate change and long-range pollution have been extensively examined; the effects of land-use change at these scales have been less studied.

Probably the most active area of local ecosystem research has focused on nutrient cycling, energy flows and plant-animal interactions and the mechanisms involved (including anthropogenic pressures) in soils and in many terrestrial, freshwater and marine ecosystems. Much of this research is of very high quality.

There has been relatively little work on public attitudes towards biodiversity or of values people place on biodiversity. Other than research into monetary valuation of biodiversity, there has been no systematic research on societal valuation of biodiversity itself, although individual case studies are often included in interdisciplinary projects with a link to decision making. There is a shortage of research on the legal and governance aspects of biodiversity, particularly important in the context of access rights, patenting of genomes and introduction of genetically modified organisms, though this is beginning to be addressed.

We have made significant progress in understanding human interactions with single species and single ecosystem functions, and the ways in which humans rely upon, value and influence them. But our understanding of wider-scale interactions, and of the role of diversity in supporting ecosystem function, is still at an early stage. Most of the research addressing the functioning of the biosphere and ecosystems has moved us closer to the objectives of the EU Biodiversity Strategy and Action Plans.

There has been a trend towards increasing emphasis on interdisciplinarity in biodiversity research. This is not as complete as it should be, with some attempts at interdisciplinary projects resulting in little more than thematically-linked monodisciplinary workpackages, with limited exchange of ideas.

Barriers, difficulties and outstanding issues

Much of the finance and effort has gone into research carried out by teams of exclusively natural or social scientists. Our understanding of how humans interact with and influence their ecological support systems has developed significantly only in recent years. Over the past decade, the recognition of the importance of social science has increased considerably, and there is now widespread acceptance that more interdisciplinary research is required, focusing on the interdependence of human life and ecosystem health, and building on our existing ecological and social knowledge. However, the neoclassical framework that currently dominates economic science is too narrow to provide a satisfactory understanding of human attitudes and valuation of biodiversity. Increasingly, research also needs to incorporate legal and governance aspects, and to be conducted in a participatory fashion, in particular where practical management applications are envisaged.

Some of our understanding of global-scale issues in ecosystem processes and changes in biodiversity remains uncertain. Imperfect knowledge of ecosystem properties and the regional and local drivers and pressures affecting them, coupled with the problems of down-scaling global patterns to regional or local levels, make it difficult to predict exactly how global changes will affect Europe's biodiversity and ecosystem processes. Progress in scenario-building for policy making helps deal with this constraint, while highlighting the potential benefits of research aimed at resolving key uncertainties.

Very little is known about the effects of land-use change at regional scales. Regional studies of ecosystem processes are necessarily partial and focused, and therefore leave considerable gaps in thematic and ecosystem coverage. There are also significant difficulties in linking empirical results to theoretical general models. The effects of land use change at regional and landscape scales have received less attention than work at this scale to look at climate change

and long-range pollution. However, this is changing as remote sensing and GIS-based technology advances and modelling approaches are used.

Research into local ecosystem processes is, by its nature, local. This limits our ability to generalise the results to other sites and ecosystems, or to other spatial and temporal scales. In general, it has proved difficult to generalise research results from one spatial scale to another or to predict how ecosystems will behave in the future. There are, however, some general changes, such as habitat fragmentation, that affect most ecosystems in the same way. As a result, some ecological theories and approaches – including the meta-population framework – can be used in a variety of ecosystems.

3. Tools and Methods

Scope

The research considered under this topic relates to the wide range of tools and methods of direct and indirect application in the conservation and sustainable use of biodiversity, including clean technologies and ex-situ conservation, conflict management, taxonomy and systematics, molecular methods, and monitoring and indicators.

Outline of work done

Tools and methods for conservation: Over the past decade much research has been directed towards the conservation of threatened species and habitats in Europe. This has included the development of procedures to select protected areas and techniques specifically designed for particular species and habitats. The development of *ex-situ* conservation technologies for the conservation of European species has been poor, perhaps because this is seen to be a greater priority for threatened species outside Europe. European scientists do, however, play a major role in the *ex-situ* conservation of global biodiversity through zoological and botanical gardens and gene banks. "Clean technologies" such as the generation of electricity by wind power have been seen to offer opportunities to avoid technologies harmful to biodiversity. There has been little or no research to assess their advantages and disadvantages. Methods for facilitating decision-making in areas of conflict directly involving biodiversity have been developed in several EU projects in the last few years. Modelling is an increasingly important tool for many aspects of research on biodiversity.

Taxonomy, systematics and informatics: Not only do we need to know the names of the species we want to protect or use, but we need a thorough inventory of organisms present, or likely to be present, in various habitats and ecosystems if we are to make good choices about areas to protect or methods to use to manage these areas. Modern taxonomy has been used in the conservation and sustainable use of biodiversity through the (combined) use of new morphological (e.g., transmission and scanning electron microscopy) and molecular tools for the analysis of taxa; the application of new paradigms for the reconstruction of phylogenies and construction of classification schemes; and the development of identification and bioinformatics tools (interactive keys, DNA microarrays, relational databases linking varied information - e.g., taxonomy, nomenclature, biogeography, bibliography, and protection and conservation status). Important efforts by national and supranational authorities have been directed towards the development of structures enabling storage and access to existing biodiversity information. The number of projects and their focus vary greatly, from local initiatives on specific taxonomic groups (e.g., providing access to Museum collections) to databases covering diverse taxa on a European or global scale (e.g., Fishbase, Fauna Europaea, Euro+Med Plantbase, ENBI, GBIF, EuroCat/Species 2000, ERMS).

Molecular methods: There has been rapid development in molecular tools from the use of isoenzymes and relatively coarse molecular methods (like Restriction Fragment Length Polymorphisms) in the 1980s to finer DNA-based methods (specifically locus-based or fingerprinting-based) in the 1990s. Molecular methods have been increasingly used in biodiversity measurement and genomic tools are increasingly being applied to biodiversity research. Molecular tools have often been promoted, not for studies on biodiversity *per se*, but in studies on applied aspects such as the detection of pathogens and the diversity of economically important taxa (cattle, wood, etc). The target of promoting the use of molecular methods in biodiversity measurement has, nevertheless, been reached, although its potential application to research on biodiversity has not yet been fulfilled.

Monitoring and indicators: Several research projects, at national and European scale, have both evaluated existing indicators and provided the scientific basis for developing novel indicators and ways of using them. These projects have focussed on both terrestrial biodiversity and the biodiversity associated with the seas, lakes and rivers, and have explored a range of approaches including the use of Earth observation. Related research has been done on cultural landscapes. Sets of indicators have been proposed and, in some cases, implemented in Member States and at the European scale. This has not, however, been driven by research but by the urgent need to quantify change in biodiversity or resources (as in fisheries) so that action can be taken to address negative trends in biodiversity and so that the result of these actions can be evaluated. In some cases, notably in the development of indicators of forest biodiversity, strong research-policy links have been established.

Barriers, difficulties and outstanding issues

Increasingly, NGOs have become responsible for much of the research on the conservation of species and habitats. As a result many studies may go unreported and their potential remains unrealised.

Many initiatives are aimed at storing and providing access to biodiversity information. This activity brings with it the risk of duplication of effort, and hence a need for integrated management of the work. An apparent scarcity of research opportunities hampers the development of taxonomic science, let alone the integration of modern techniques and approaches in taxonomy. It is concerning that both education in taxonomy and taxonomic research are declining steadily, with an ongoing loss of taxonomic expertise in Europe as an inevitable consequence. The decline in taxonomic research and training must be reversed.

Despite considerable advances in research on genetic diversity in recent years, our current understanding of genetic diversity is inadequate to be of any practical use for conservation.

Research in the marine environment is hampered by the lack of ocean-observing capabilities for timely prediction and assessment of the state of the marine environment

Information collected in the monitoring on biodiversity is obtained by a variety of methods. It is unreasonable to expect that standard approaches to monitoring will be widely used in the short to medium term but this should be a long-term goal. An integrated approach to the monitoring of biodiversity is required, establishing close links between monitoring and research, science and policy. In particular, much more research on the impacts of natural and anthropogenic drivers of biodiversity change is required before robust indicators can be developed to measure and attribute cause to trends in biodiversity.

4. Science and Policy

Scope

Ensuring that science contributes to the definition of, and is informed by, policy objectives. Establishing interfaces between science and policy to provide sound scientific basis for policy design, legislation, policy implementation, and policy assessment.

Outline of work done

At the European level, and in most EU and associated countries, research of relevance to policy definition, design and implementation is conducted on sustainable land use, agriculture, forestry and fisheries.

More research projects explicitly aim to address policy and legal issues by integrating natural and social sciences in policy-oriented research and by linking research processes to stakeholders and policy-makers in an attempt to reinforce the science/policy interface. This is a new and promising trend which needs further development.

Most research on ecosystem functions and biodiversity carried on in the last decade is relevant to the EU Biodiversity Strategy, but it appears to have played a role mainly in the definition of general policy objectives rather than in the formulation of practical instruments for policy design, implementation, and evaluation. Too little of the existing body of knowledge is used in policy development, implementation and assessment. Very few countries have done explicit research on the effects and efficiency of their policies.

Research results are increasingly – although still insufficiently – used in the design of conservation and restoration strategies (including suggestions for alternative practices), in the selection of marine and terrestrial protected areas, in land-use planning and management, and sometimes in evaluation of conservation programmes. Yet many useful scientific results have not yet been translated into effective conservation measures or adopted in management. The area in which research results have been most applied is in forestry.

Newer developments such as 'evidence-based conservation' bridge research and biodiversity policy goals, in this case seeking to improve techniques of conservation by providing scientific evidence to conservation managers enabling formulation of evidence-based conservation strategies. Through both original research in conservation biology and systematic review of existing research and dissemination of results to practitioners and policy makers, this approach is providing systematically reviewed scientific evidence to support decision-making in conservation management. Adaptive management, explicitly involving experimentation in the management process resulting in improved scientific knowledge, is often called for, but rarely practised.

In some EU and associated countries, biodiversity scientists are increasingly involved in decision-making processes but their participation remains far from systematic.

Development of biodiversity research has helped to raise awareness and to remind society of the importance of biodiversity. In this respect, it may contribute to a change of attitude towards research and policy.

It is hard to estimate the intensity and scope of theoretical and applied research into conservation and use of biodiversity in the context of economic globalisation. This applies particularly to research on sustainable uses and management of biodiversity in transition economies, emerging economies and developing countries. Many funding sources are involved, including institutions which are not primarily research oriented (e.g. development cooperation agencies, bilateral aid programmes, international organisations).

Barriers, difficulties and outstanding issues

Economic considerations rather than policy needs are still driving many biodiversity studies. For instance, molecular tools are mainly developed when there is an immediate economically important aspect.

Difficulties in connecting research to political processes are due in particular to the different logic of research versus decision-making, in particular differences in time scales and in ways of dealing with uncertainty, and the fact that scientific input is only one factor affecting policy-making and implementation processes.

Generally, research has contributed more to advancing ecological knowledge than to improving our understanding of the economic and social dimensions of biodiversity. This probably contributes to the fact that research input into policy and management remains insufficient.

Linking science with policy, and working on policy-oriented research is still a process that many scientists are not familiar with or not willing to endorse. There are several reasons for this, including lack of time (policy related tasks are not rewarded in an academic or research career), lack of resources, lack of awareness of the wider political and societal framework, and lack of experience in communication with decision-makers and other non-scientist stakeholders.

Where envisaged, the science-policy interface is often added to a research project when the work has already been done and the natural science researchers are 'packing to go'. For research projects to develop functioning links to end-users, it is vital that end-users participate in the formulation of research questions and in research planning.

In new and candidate EU Member States, the interface between science and policy has weakened to a point where often science has a limited influence on biodiversity policy. Causes for this are multiple: financial cut-down for research; rapid accession process which resulted in policy going far ahead to reach EU targets and science lagging behind; flood of policy information to be digested by scientists who lack the time for it; damaged link between administrations and scientists due to loss of confidence in one another, and many other factors.

International conventions, government commitments, and legislation can all be viewed as attempts to impose order, or at least a classification, on a dynamic set of systems. The systems have not been party to this process of imposing order and will continue to be dynamic. Governance institutions will only survive if they are designed and interpreted in ways which take account of the potential of organisms and communities – including human societies – to change in response to major perturbations of their environment.

5. Structuring European Biodiversity Research

Scope

Creating more effective and durable research networks on biodiversity and ecosystems, to improve the structure of European biodiversity research, and hence to increase the effectiveness of research in biodiversity.

Outline of work done

The establishment of networks between centres of excellence has been achieved, in part through the many projects established by the scientific community and funded by the European Community. Successive EU Framework Programmes have encouraged networks

between scientists and organisations working in biodiversity research. Most of these research networks were, however, unable to survive beyond the end of Community funding. Despite this, a significant number of partners in networks have continued to collaborate in work carried out after the end of the network.

Through the use of new instruments in FP6 and the European Research Area the European Commission seeks to create a more effective and durable network structure. FP6 can contribute significantly to the establishment of more effective and durable networks, especially through the Networks of Excellence and an ERA-net.

European, national and regional sources of finance have helped to create or maintain networks that contribute to international initiatives. Of these, the Global Biodiversity Information Facility[6] and the Global Taxonomy Initiative[7] stimulate the exchange of biodiversity related information and data, and are supported by a major EU project called the European Network for Biodiversity Information[8]. The objectives of the international global environmental change research programme DIVERSITAS[9] are supported by many large EU-funded projects and networks, thus contributing not only to improved European structure, but also to the global effort to focus research on particular issues.

At present, the only self sustaining European network in the field of biodiversity research is the CONNECT/PEER-network (European Network of Environmental Research Institutes active in the field of biodiversity research), created in 1988.

Several networks have recently been set up to link biodiversity research infrastructure (e.g. Marbena[10]). Also the great collections –museums, botanical gardens, culture collections and seed banks– have established information networks (e.g. Biocase[11]).

The European Platform for Biodiversity Research Strategy (EPBRS) was established to improve the flow of information between biodiversity researchers, science policy makers and environmental policy makers. It also strives to identify key strategic issues for which research is needed to support policy in Europe, for the benefit of European, national and regional research programmes. EPBRS provides science-oriented comments and input to the Conference of the Parties and the Subsidiary Body for Scientific, Technical and Technological Advice of the Convention on Biological Diversity. EPBRS is also catalyzing the formation of National Platforms for Biodiversity that represent National networks and that can link smaller research groups, NGOs and environmental practitioners, as well as policy makers.

Barriers, difficulties and outstanding issues

The finance-bounded lifespan of research networks limits their effectiveness. The newly developed networks of excellence, integrated projects and ERA-nets are designed to overcome this problem and should lead to more effective and durable networks. The means of maintaining these networks beyond the initial funding remain a key challenge to the effectiveness and durability of collaboration in European research.

Increased emphasis on very big projects may lead to favouring older, better-established and larger institutions. This may result in focussing research on biodiversity in places where it is already relatively well known, hence increasing the geographical imbalance of biodiversity

[6] http://www.gbif.org
[7] http://www.biodiv.org/programmes/cross-cutting/taxonomy
[8] http://www.enbi.org
[9] http://www.diversitas-international.org
[10] http://www.vliz.be/marbena
[11] http://www.biocase.org

knowledge. Care should be taken to ensure that the establishment of networks of excellence and integrated projects in Europe does not exclude new, potentially dynamic but less well-known organisations and teams of researchers.

Annex I: Communication of the European Commission to the Council and to the Parliament on a European Community Biodiversity Strategy

Theme 3. Research, identification, monitoring and exchange of information

1. It is widely recognised that the current incomplete state of knowledge at all levels concerning biodiversity is a constraint on successfully implementing the Convention. This should not however slow down ongoing activities based on the existing state of knowledge. It is therefore necessary to strengthen efforts to identify and monitor the most important components of biodiversity as well as pressures and threats on them, paying special attention to the indicative list of categories of important components set out in Annex I of the CBD. It is also necessary to strengthen basic research into biodiversity, its principles, concepts and fundamental mechanisms.
2. Tasks and targets identified in the Action Plan and other measures in this area should be incorporated in the activities within the Framework Community Programme on Research and Development. The importance of data held by the NGO community, Member States, their agencies and private collections should be taken into account .
3. Research initiatives should build in particular upon the work of the Ad hoc European Working Group on Research and Biodiversity (EWGRB) established in the framework of the European Commission DG XII "Environment and Climate Research Programme" and could focus on:
   - establishing a network between European centres of excellence in biodiversity research in order to foster basic research into the importance and functioning of biodiversity on all levels.
   - promoting the implementation of appropriate research activities concerning the functional mechanisms of the natural evolution of biodiversity, including tools and methods needed to implement the biodiversity policy objectives.
   - increasing knowledge about how to safeguard biodiversity in nature, agriculture, forestry and fisheries and its wider role in life-support systems;
   - increasing the understanding of how the biosphere functions at different spatial scales: global, regional and local level and understanding of the effect of human activities on life-support systems.
   - assisting in identifying the necessary changes in legislation, programmes and political actions for the conservation and sustainable use and equitable sharing of the benefits arising from the use of biodiversity. This should include addressing the policy, organisational and management factors affecting the sustainable use and conservation of biodiversity in Third Countries, in the context of economic globalization.
   - promoting research activities using molecular methods in biodiversity measurement and validation of these technologies.
   - promoting the creation of tools and choices for partners in the conservation and utilisation of biodiversity, including research on clean technologies and on ex-situ conservation technologies.
   - promoting the evaluation of the various forms of biodiversity from the perspective of all societal actors.
   - supporting the development of a global interface with Third Countries, addressing in particular the sustainable use and management of biodiversity in transition economies, as well as in emerging ones and developing countries.
4. With respect to identification the Community will promote further support activities by the European Environmental Agency and its Information and Observation Network (EIONET) including tasks to:
   - develop a baseline study to identify and catalogue important components of biodiversity that exist -*in situ* or *ex situ*-, or that have become extinct in the last 50 years.
   - identify the conservation status and trends of components of biodiversity.
   - identify relevant pressures and threats, together with their causes, on components of biodiversity.
   - apply modern taxonomy to build scientific tools for policy on conservation and sustainable use, aiming , inter alia, to fulfil gaps in taxonomy knowledge.
5. As the monitoring and continuous assessment of all the components of biodiversity in the Community, as well as of the pressures and threats that may affect them would be impractical, it

is proposed to promote the development of a system of indicators based on a species and ecosystems approach[12].

6. The Community will support research on this system in its research programme and such work will be included in the new Multi-annual Work Programme of the European Environmental Agency and its Network. In addition, Eurostat is developing indicators of pressures affecting biodiversity in the context of its Pressure Indices Project[13]. The identification of these indicators and the monitoring of their evolution is an essential element of this strategy because it will provide the required information to assess the performance and impact of the Action Plans and other measures. They should therefore include:
   - the identification of a set of indicators to assess how components of biodiversity are affected by the sector and assess progress on the implementation of the strategy.
   - the mechanisms for monitoring the evolution of the indicators having regard, inter alia, to activities causing habitat degradation, unsustainable harvesting, emission of pollutants and release or spread into the environment of alien species and genetically or living modified organisms.
7. The importance of assessments and of international exchange of information for achieving the objectives of the CBD is underlined by the cross-border nature of many ecological processes, the interdependence between ecosystems, the migratory behaviour of various wild species, the need for international collaboration to maintain genetic pools of crop varieties and domestic animal breeds as well as the cross-border nature of many pressures and threats affecting biodiversity. The strengthening of cross-border co-ordination in between Member States as well as with other Parties to the CBD, on a bilateral or regional basis, is therefore an important objective.
8. This includes support for consolidation and further development of the Clearing House Mechanism[14] (CHM) which is established as the prime vehicle for international information exchange on biodiversity. The European Environmental Agency and its Information and Observation Network (EIONET) should consolidate and further develop the Community CHM in order to become an efficient vehicle for promoting and facilitating technical and scientific co-operation. This should be needs-driven, decentralised and allow for provision of information useful for meta-data levels of analyses. The provision of information by the CHM is of particular importance for the compilation of national and Community reports and for information on progress in implementing concrete measures for biodiversity. The Community CHM will establish links to the Member States CHM focal points.
9. Consequently Action Plans and other measures should help to :
   - identify and review existing mechanisms to facilitate the exchange of relevant information through the Community Clearing House Mechanism.
   - establish or strengthen systems for the exchange of information at national and international level and make existing knowledge of biodiversity available and useful to the public and decision makers.

[12] Examples of indicators at local level could be decline of a species, use of pesticides or change in pesticide use. Examples of indicators at Community level could be percentage of threatened species per known species, fragmentation of habitats by linear transport infrastructure or sites designated under NATURA 2000.

[13] Described in the Communication from the Commission to the Council and the European Parliament (COM(94) 670 final). Directions for the EU on Environmental Indicators and Green National Accounting: the Integration of Environmental and Economic Information Systems.

[14] The concept, aims and objectives of the Clearing House Mechanism are established in article 18 of the CBD and developed through the decisions I/3, II/3 and III/4 of the Conference of the Parties.