NPBR

Biodiversity Knowledge Programme for Ireland

CONTENTS

NATIONAL PLATFORM FOR BIODIVERSITY RESEARCH (NPBR)

The National Platform for Biodiversity Research (NPBR) operates under the auspices of the National Parks and Wildlife Service of the Department of the Environment, Heritage and Local Government, and the Environmental Protection Agency.

The aim of the NPBR is to:

> *facilitate biodiversity research in Ireland, taking into account the needs of the research community, stakeholders, policy makers and the public.*

The NPBR is composed of 40 members drawn from the research community, stakeholders, policy makers and the general public.

In November 2003 an NPBR subcommittee was established to develop a Framework for a Biodiversity Research Programme for Ireland. This framework document is the result of the subcommittee's deliberations.

THE LEGISLATIVE BACKGROUND

The Convention on Biological Diversity (CBD) was signed by Ireland in 1992 and ratified in 1996. By signing this Convention, Ireland has committed to develop a strategy on biodiversity conservation.

Ireland is also a signatory to a number of Conventions dealing with the conservation of wildlife and habitats. In addition, EU Directives such as the European Birds Directive, European Habitats Directive, Environmental Impact Assessment Directive, Strategic Environmental Assessment Directive and the European Water Framework Directive all have either a direct or indirect relevance to biodiversity, and place specific requirements on the State in that regard.

In April 2002, the Department of the Environment, Heritage and Local Government launched Ireland's *National Biodiversity Plan*. The Plan takes cognisance of the Conventions and Directives listed above, and sets out a series of 91 action points aimed at addressing Ireland's biodiversity obligations. The 'Message from Malahide' (which emanated from a stakeholders' conference held in 2004 during the Irish Presidency of the EU) proposes priorities, targets and implementation arrangements designed to meet the Gothenburg target of halting the decline of biodiversity in EU member states by 2010.

THE VALUE OF BIODIVERSITY

The biological communities in which we live, and their associated chemical and physical processes, deliver a variety of essential functions which in turn provide, either directly or indirectly, a range of benefits to people. These benefits range from the provision of food, pharmaceutical products, genetic diversity and industrial processes to employment, tourism and recreation. There is no doubt that Ireland's rich biodiversity also has an important aesthetic and heritage value.
In terms of ecosystems, species and genetic diversity, biodiversity provides a form of insurance against undesirable future change. It is also a valuable natural resource that we should understand, appreciate, preserve and cultivate for all of the reasons outlined above.

HALTING THE LOSS OF BIODIVERSITY

Although exact numbers and time-scales are difficult to determine, it is clear that biodiversity is declining. For example, the most recently published "Red List" from the IUCN (the World Conservation Union) identifies more than 15,500 species which are being threatened with extinction worldwide. It also notes that since 1996 alone there has been a striking increase in the number of animal species under threat. Moreover, there is growing evidence that a decline in species richness has the capacity to alter ecosystem processes – even in cases where their structure remains intact.

Factors such as the destruction or degradation of habitats, overexploitation, and the introduction of non-native species all play a part in the increasing loss of biodiversity that has now become evident. In the context of the situation in Ireland, perhaps the main issue is habitat loss or degradation resulting either directly or indirectly from population, planning and infrastructure, commercial activity and agricultural practices. In fact, it should be noted that agriculture was identified in the National Biodiversity Plan as the most important factor affecting terrestrial biodiversity.

The reform of the Common Agricultural Policy (CAP) will have implications for biodiversity issues. For example, the Single Payment regime will require farmers to comply with a range of European Directives (e.g. the Nitrates Directive, the Birds Directive and the Habitats Directive); it will also require farmers to maintain land in good agricultural and environmental condition. These developments, coupled with voluntary initiatives such as the Rural Environment Protection Scheme (REPS) and the Forestry Scheme (which take an increasingly pro-active approach to biodiversity issues), could have very positive effects on biodiversity.

THE NEED FOR RESEARCH

Along with every other nation, Ireland faces enormous challenges in terms of arresting biodiversity loss. The decisions that Ireland takes during the next few years will have far-reaching consequences for biodiversity. Therefore, decisions must be based on thorough knowledge of the various problems, interactions and dependencies involved. This type of knowledge will only become available as a result of carrying out appropriate and comprehensive scientific research.

There is currently a lack of understanding and knowledge about biological diversity. There is also an urgent need to develop scientific, technical and institutional capacities which would provide such knowledge and understanding.

The initiation, development and delivery of appropriate policies which are designed to meet national and EU obligations must be based on relevant and rigorous research knowledge. Additionally, the conservation, enhancement and sustainable utilisation of biodiversity must underpin all areas of environmentally-based legislation. It is vital therefore that scientific advice be integrated into policy making and delivery.

RECOMMENDATIONS

The NPBR has identified four broad areas of research and these are described briefly below. Also included are estimates of the funding required for this research. (Detailed cost estimates are set out in Appendix 4. Suggested mechanisms for funding are set out in Appendix 3).

AREAS OF RESEARCH

1. RESEARCH TO SUPPORT BIODIVERSITY POLICY
ESTIMATED COST: €2.1M PER ANNUM

A clear policy framework is a prerequisite for the delivery of critical and coherent decisions relating to biodiversity policy. In order to meet our national and international obligations, and in order to deliver improved information exchange between researchers and policy makers, there is an urgent need to ensure that environmental policy making in general and biodiversity policy making in particular are informed by well-founded scientific knowledge.

2. RESEARCH TO IMPROVE KNOWLEDGE AND SKILLS DEVELOPMENT
ESTIMATED COST: €20.24M PER ANNUM

There is an urgent need to identify and close key information gaps in order to create a scientific knowledge base that facilitates improved decision making and policy formulation at the highest government and sectoral levels. The NPBR subcommittee has identified the following areas of research which would address those needs:

- Taxonomic and systematics research and training
- Monitoring methodologies and baselines

- Long-term studies on biodiversity
- Fundamental biodiversity research

3. RESEARCH TO SUPPORT ECONOMIC, SOCIAL AND EDUCATIONAL NEEDS ESTIMATED COST: €4.44M PER ANNUM

The effective implementation of biodiversity policy depends not only on an understanding of the ecological science, but also on a wider appreciation and justification of the educational and social benefits of environmental and biodiversity protection measures that might otherwise be seen as inhibiting local interests and economic development. Key areas of priority aimed at addressing these issues should include:

- Quantification of the economic and social benefits of biodiversity, including generic and sectoral research
- Communication and education to gain public acceptance and justification of environmental policy

4. RECOMMENDATIONS AND FUNDING STRUCTURES FOR THE IMPLEMENTATION OF THE BIODIVERSITY RESEARCH PROGRAMME ESTIMATED COST: €3.3M PER ANNUM

Substantial resources and a number of management strategies would be required for the successful implementation and co-ordination of the research programme. A range of structures are necessary; the following have been identified as priorities:

- Overall management strategy
- Defined funding and institutional support
- Information management
- Research funding for students from developing countries

THE WIDER CONTEXT

The current level of interest in the earth's biological diversity is unprecedented. For example, at the Earth Summit held in Rio de Janeiro in 1992 more than 150 countries signed the Convention on Biological Diversity (CBD). This came into force in 1993 and was ratified by Ireland in 1996. Currently, 188 countries are parties to the Convention.

The Convention requires the State to take specific measures (including the development or adaptation of existing national strategies, plans and programmes) for the conservation and sustainable use of biological diversity.

The Convention defines biological diversity as:

> *"The variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems."*

Biodiversity must therefore be considered at three interdependent levels – ecosystem diversity, species diversity, and genetic diversity within species.

At the international level, the key policy agreements of relevance to biodiversity conservation and sustainable use to which Ireland is committed include:

- The CBD and associated policy decisions of the conference of parties to the CBD such as:
  - Decision VI/21 – Hague Ministerial Declaration
  - Decision VI/26 – 2010 targets to stem biodiversity losses
  - Decision VII/3 – Agricultural biodiversity
  - Decision VII/5 – Marine and coastal biological diversity
  - Decision VII/9 – Global taxonomy initiative
  - Decision VII/10 – Global strategy for plant conservation
  - Decision VII/11 – Ecosystem approach
  - Decision VII/12 – Sustainable use of biological resources
- The target set by world leaders in Johannesburg in 2002 to 'significantly reduce the current rate of biodiversity loss by 2010'
- The International Treaty on Plant Genetic Resources for Food and Agriculture
- Agenda 21
- The Kyoto Protocol and the UN Framework Convention on Climate Change
- Ramsar Convention on Wetlands of International Importance
- Convention on International Trade in Endangered Species of Wild Flora and Fauna (CITES)
- Bonn Convention on the Conservation of Migratory Species of Wild Animals
- Convention concerning the Protection of the World Cultural and Natural Heritage
- International Convention for the Regulation of Whaling

At the regional (i.e. EU) level, one of the major policies that has to be considered in terms of how it could beneficially impact on biodiversity and sustainable use of biological resources in Ireland is the reform of the Common Agricultural Policy (CAP) and how future Rural Environment Protection Scheme (REPS) measures can best support biodiversity conservation. Other regional policies of major importance include:

- The European Community Biodiversity Strategy and its four Biodiversity Action Plans (BAPS)
- The commitment 'to halt the loss of biodiversity by 2010'set by EU Heads of State and Government at Gothenburg in 2001, and since incorporated in various Community policies. This commitment was reiterated most recently during the Irish Presidency of the EU (2004), when EU Heads of State and Government called for accelerated action to meet the 2010 target.
- The 'Message from Malahide' [1]
- The European Union Common Fisheries Policy
- Council Directive 79/409/EEC on the conservation of wild birds
- Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora

[1] the outcome of a broad stakeholders' conference, held in 2004, on the actions necessary to achieve the 2010 biodiversity target

- Council Regulation (EC) No 338/97 on the protection of species of wild fauna and flora by regulating trade therein
- Bern Convention on the conservation of European wildlife and natural habitats
- Convention for the Protection of the Marine Environment of the North-East Atlantic (OSPAR)
- Directive 2000/60/EC establishing a framework for the Community action in the field of water policy
- Directive 2001/42/EC of the European Parliament and of the Council on the assessment of the effects of certain plans and programmes on the environment
- Council Directive 85/337/EEC on the assessment of the effects of certain public and private projects on the environment

At a national level, the key policy documents include:

- The National Biodiversity Plan (Action 40 in particular)
- The National Heritage Plan
- The Wildlife Act 1976
- The Wildlife (Amendment) Act 2000
- The National Development Plan (NDP)

RATIONALE

Biological communities and their associated chemical and physical processes are collectively referred to as ecosystems. They provide a variety of functions essential to mankind, including the regulation of climatic processes; breakdown of wastes and recycling of nutrients; maintenance of soil fertility, and the provision of natural resources. These functions in turn provide, either directly or indirectly, a range of benefits (ecosystem services) to humans which are currently estimated at US$33 trillion per year (Costanza et al, 1997).

Although exact numbers and time-scales are difficult to determine, it is clear that biodiversity in all its manifestations (genetic diversity, species and habitat richness and community complexity) is declining.

Recent research activity in the USA, UK and EU has addressed the question of whether the loss in biodiversity negatively impacts on the functioning of ecosystems (Naeem et al, 1996; Tilman, Wedin and Knops, 1996; Grime, 1997, Tilman, 1997; Tilman et al, 1997, Hector et al, 1999, Loreau, et al 2002). There is growing evidence that a decline in species richness can alter ecosystem processes, even if the trophic structure remains intact (Naeem et al, 1995 and references above). The additional value of diversity is that it provides an insurance against undesirable future change. There is now a general acceptance that *"biodiversity per se is a good thing, that its loss is bad and that something should be done to preserve it"* (Gaston, 1996). This is based on a number of arguments (Spellerberg and Hardes, 1992; Kunin and Lawton, 1996; Oksanan, 1997; O'Neill, 1997) including:

- Monetary and utilitarian value – through the provision of drugs, food, genes, industrial processes, tourism and recreation
- Ecological value – through the provision of ecosystem services including the maintenance of atmospheric composition and biogeochemical cycles, soil binding and soil fertility, decomposition and disposal of wastes, production, pollination, pest control and water purification
- Practical and scientific value – since biodiversity provides a uniquely integrated measure of the quality of an environment and of the probability of its sustainability
- Moral and ethical responsibilities to preserve life on earth
- Aesthetic reasons

BIODIVERSITY AND SUSTAINABILITY

If the livelihoods of people living in Ireland are to be maintained in the future, the sustainable management of biodiversity will be absolutely essential. The sustainable management of biodiversity will be a key contributor to future social and economic development across all sectors because many of Ireland's key economic sectors are either directly or indirectly dependent on biological resources. These sectors include traditional areas such as agriculture, food, forestry and fisheries as well as new areas such as pharmaceutical and agri-food biotechnologies, which are

considered critical to Ireland's future economic success.
The sustainable use of biological resources is now interlinked with a wide range of research areas in the life sciences – to the extent that such technological research will be increasingly dependent on access to well-characterised biological resources. For example, the isolation of natural medicinal compounds from diverse taxa, including microbial diversity, is likely to continue to be a source of novel medicines.

The sustainability of Ireland's biologically-based economic sectors for future generations will be largely dependent on how we address the conservation and sustainable management of biodiversity and biological resources. The CBD explicitly recognises the key importance of biological resources in meeting the needs of humanity. Thus, *"biological resources" includes genetic resources, organisms or parts thereof, populations, or any other biotic component of ecosystems with actual or potential use or value for humanity.* (Article 2 of the Convention).

IRISH BIODIVERSITY POLICY

At a national level, the key policy documents to be considered are Ireland's **National Biodiversity Plan** and **National Heritage Plan.** The National Biodiversity Plan contains 91 recommended actions, including the development of Biodiversity Action Plans (BAPs) within each sector of the economy, while the National Heritage Plan sets out a vision for the management of the Ireland's national heritage over the five-year period 2002-2007. (A key element of the process involved in formulating the National Heritage Plan was the requirement to prepare local heritage plans at both county and city level.)

Another document which has a particular relevance for Irish biodiversity is the **National Spatial Strategy** (NSS) – a coherent national planning framework for Ireland for the next 20 years. The NSS focuses on people, places and potential, and the structures that will be required in order to create a better living environment and quality of life for people in Ireland.

Finally, the national policy document which has the most overriding relevance for current and future impacts on biodiversity and biological resources conservation and use is the National Development Plan (NDP) 2000-2006. If the 2010 biodiversity targets are to be met, then the National Biodiversity Plan must be fully integrated with the NDP and other relevant policy instruments shaping the future of Ireland. Indeed, the conservation and sustainable use of biodiversity must become an integral part of sectoral economic development (e.g. agriculture, food, fisheries, medicinals, forestry, and coastal zone management). Therefore, biodiversity must become a mainstream issue and must be treated as such in all future NDPs drawn up from 2006 onwards.

The CBD imposes many obligations on member governments including:

- Conservation
- Impact assessment
- Identification and monitoring
- Sustainable use of ecosystems, species and other biological resources
- Adoption of incentive measures
- Research and training
- Public awareness and education
- Provision of financial resources to achieve the objectives

High quality research on biodiversity and biological resources will be required in order to help Ireland meet these and other obligations, and also to ensure that biodiversity and biological resources are managed in a sustainable manner for the benefit of current and future generations.

The initiation, development and delivery of an appropriate policy designed to meet national and EU obligations and needs must be based on relevant and rigorous research knowledge (either already in existence, or to be generated where knowledge gaps exist). Since the conservation, enhancement and sustainable utilisation of biodiversity and biological resources must underpin all sectors, there is a clear need for the integration of scientific advice into policy making and delivery, while simultaneously taking cognisance of the precautionary principle.

CONTEXT OF THE RESEARCH AGENDA

In outlining an agenda for Irish biodiversity research, and in making recommendations for the implementation of this research, the NPBR subcommittee has taken account of Ireland's obligations to the CBD and various EU environmental policies and Directives. The subcommittee has also taken account of the outputs from the May 2004 Killarney meeting at which Europe's research community agreed a set of recommendations on research priorities for sectoral biodiversity action plans, and the 'Message from Malahide'. (The latter was negotiated during the Irish Presidency of the EU in 2004 and was designed to deliver an integrated Irish and European approach.) The NPBR has sought (with the help of various government departments and agencies, NGOs, universities and individual researchers) to incorporate from these wider European perspectives those aspects which were considered to be of particular relevance and significance to Ireland's needs.

The National Biodiversity Plan has set out a number of commitments in relation to research; these cover both general and specific areas. Some of the actions outlined in the Plan are primarily knowledge/research focused; in the case of many other actions, research or the collation of knowledge has a critical role to play. These research commitments are not new; they are part of agreed government policy and must be fulfilled. The NPBR endorses these actions and strongly believes that their implementation is central to the delivery of the National Biodiversity Plan.

While elaboration on the various research actions detailed in the National Biodiversity Plan is not appropriate in the context of this document, the NPBR stresses the importance of addressing the following four action points which are contained in the Plan:

1. The current level of knowledge about many groups of organisms in Ireland is extremely inadequate – such that it is not possible to prepare comprehensive Red Data Books for these groups. Therefore, as a first step, some assessment of the status and conservation priorities for invertebrates and fungi should be carried out immediately.

2. As stipulated in Action 43 of the National Biodiversity Plan and the CBD decisions on taxonomy, the capacity to undertake taxonomic work in Ireland must be strengthened.

3. Key measures which must be implemented include the preparation of assessments, studies or strategies such as departmental biodiversity action plans; local biodiversity plans; national strategies on access and benefit sharing, and national strategies on genetic resources for food, agriculture and forestry. These measures should be implemented as a matter of urgency, using the assistance of the expanded Biodiversity Unit at the Department of the Environment, Heritage and Local Government. (Commitments on the implementation of these measures were given in the National Biodiversity Plan.)

4. There is considerable scope, merit and potential for synergy in joint work on biodiversity research with Northern Ireland.

While this document is primarily focused on addressing problems facing biodiversity in Ireland, we are acutely aware that certain species and habitats outside Ireland are in crisis and others are facing extinction globally. By way of example, all species of hominid apes are in imminent danger of extinction in the wild, due to illegal capture and killing, and habitat loss. The National Biodiversity Plan rightfully commits Ireland to contributing to the conservation and sustainable maintenance of biodiversity overseas. However, there is a need for Ireland to do much more in this regard.

This document complements and builds on the National Biodiversity Plan – in particular Actions 40, 43 and 44. Indeed, one of the key reasons for establishing the NPBR, and for initiating the elaboration of the framework for biodiversity research in Ireland, was to give effect to Action 40 and the related research actions outlined in the Plan. The framework set out here marks the first step in the devising of a prioritised and co-ordinated programme of specific research – as required by Action 40. While a preliminary indicative programme is contained in sections A, B and C of this document, further work will be required before the programme can be finalised.

In summary therefore, this document constitutes an agreed framework and programme for biodiversity research in Ireland – as envisaged in Action 44 of the Plan.

The NPBR subcommittee has identified the following four main themes as priority research needs:

(A) Research to support biodiversity policy
(B) Research to improve knowledge and skills development
(C) Research to support economic, social and education needs
(D) Recommendations and funding structures to implement the biodiversity research agenda

A. RESEARCH IN SUPPORT OF A BIODIVERSITY POLICY

The recommendation that a biodiversity research programme be carried out in Ireland is predicated on the need to develop and support a clear biodiversity policy framework; this comprises a number of key existing international, regional and national policies within which critical and coherent decisions have to be made in relation to the conservation of biodiversity and the sustainable use of biological resources.

If we are to meet our national and international obligations, we must improve information flows between researchers and policy makers. In fact, ensuring that well-founded scientific knowledge informs environmental policy, and specifically biodiversity policy, in all relevant sectors is now a major priority. The integration of scientific knowledge and best advice into the formulation and implementation of policy at both national and local levels is also urgently required. While some of these policy areas are specific to particular sectors (e.g. agriculture, fisheries, transport and tourism), others relate to broader national objectives and obligations.

A1. SPECIFIC RESEARCH NEEDS TO INFORM POLICY

The link between biodiversity and agricultural policy has already been referred to in this document. At an EU level, the most relevant instruments are the Common Agricultural Policy (CAP) and the Habitats and Birds Directives.

The CAP is one of the most significant (and recently fundamentally changed) areas of policy requiring development and implementation in terms of its contribution to the achievement of biodiversity goals and the sustainable use of biological resources in Ireland. Key to success in this area will be the future development of environmental measures which are capable of providing the necessary incentives to support farmers in their role as environmental managers. In particular, these measures will need to support farmers as they take on the challenge of conserving biodiversity on their lands, and as they become involved in the practical utilisation of biodiversity in environmentally compatible production systems.

The area of agricultural policy support would involve a mainly desk-based review of existing scientific knowledge and recommendations on the most desirable conservation practices and production systems likely to need support in the application of appropriate agri-environmental measures. Such a review should also identify specific knowledge gaps that would require further original research.

Specifically, and in line with the common theme of supporting policy development and implementation, the Biodiversity Research Agenda should, as a matter of urgency, commission scientific reviews in order to:

1. Evaluate **impacts, compatibilities** and **conflicts** between government policies and **biodiversity** objectives and **economic** practices. This review should be focused on the relevant sectors in the NDP namely: **agriculture; fisheries; tourism; urban** and **rural development.**

2. Identify policy **blind spots** and suggest methods that might be used to resolve policy conflicts.

3. Identify more effective ways of **integrating existing knowledge** from both fundamental and applied research, thereby facilitating evidence-based policy making.

4. Identify, develop and demonstrate appropriate **policy implementation tools** (e.g. recommend methodologies

for habitat identification, prioritisation and assessment, monitoring, use of indicators and evaluation tools).

5. Identify how **government policies** can be used as opportunities for **biodiversity enhancement** (e.g. habitat creation with road developments; biodiversity enhancement at local authority level).

PREDICTED OUTCOMES:

- The provision and use of scientific knowledge more directly relevant to the decision-making tools of policy makers
- Identification of priority scientific knowledge gaps
- Improved liaison and a common understanding between policy makers and researchers

B. RESEARCH TO IMPROVE KNOWLEDGE AND SKILLS DEVELOPMENT

Currently, the overarching requirement in the area of knowledge and skills development is to plug key information gaps and create a national scientific knowledge base that facilitates improved decision making and policy formulation at the highest government and sectoral levels. Within that context, the most urgent priority is to develop a strong linkage between the research effort and the practical needs of policy makers.

This linkage is necessary in order to ensure that the resources available for biodiversity research are clearly targeted at the most efficient use of existing information relevant to the most pressing management and conservation issues at hand. These include knowledge relevant to the identification of species and habitats most at risk; assessment of the wider environmental impacts of current planning, development, agriculture, forestry and other human activities, and the identification, protection and delivery of the vital ecological services provided by natural and semi-natural ecosystems.

B1.0. DEVELOPMENT OF MONITORING METHODS AND BASELINE INFORMATION

In order to achieve a strong linkage with policy needs, it will be necessary to focus existing knowledge and, where necessary, to acquire new knowledge and baseline biodiversity information that is specifically targeted at policy issues. In addition, in order to increase the availability and interpretative value of basic information and improve the value of baseline data, it will be necessary to support the following:

B1.1. TAXONOMIC AND SYSTEMATICS RESEARCH

The support and development of national taxonomic and systematics expertise and capacity (especially for key groups), including the training of specialists in both traditional and new taxonomic methodologies and the dissemination of this specialist expertise amongst the wider research community, should be key elements in the implementation of a National Biodiversity Research Agenda (see Section D). Priorities identified in this area include:

B1.1.1	Research on the biogeographic context of the Irish flora and fauna – including phylogenetic analysis of the origins of Irish biota – as tools for conservation decision making in Ireland
B1.1.2	Research to develop interactive web-based keys for taxonomy and systematics
B1.1.3	Strengthen the capacity of State institutions to undertake taxonomy (as per Action 43 of the National Biodiversity Plan)
B1.1.4	Completion of national inventories

B1.2. INVENTORY AND SURVEY

B1.2.1	Production of national inventories for less well-known taxonomic groups (including lower plants, fungi and invertebrates) and their distribution
B1.2.2	The status and distribution of rare or threatened species (in marine, freshwater and terrestrial ecosystems)
B1.2.3	Identification of hot spots that have a high biodiversity value in Ireland

B1.3 MONITORING AND INDICATORS

The development of usable, practical and effective indicator methods and survey protocols as tools for the assessment and regular monitoring of biodiversity in important habitats and ecosystems is a key priority. So too is the need to implement a national habitat/vegetation mapping/classification scheme. The latter should include the testing of existing methodologies (e.g. the UK National Vegetation Classification system) and the development of novel methods. Specific research topics would include the filling in of knowledge gaps relating to baseline information.

Specific protocols should be developed for:

B1.3.1	Indicators of biodiversity and ecosystem health
B1.3.2	Early warning systems for the identification and detection of non-native species
B1.3.3	Implementing and continuing to develop standardised methodologies for monitoring and evaluating biodiversity trends as CAP reform takes place. An example would be to use the indicators proposed by the European Environment Agency and adapted at the Malahide Stakeholders Conference in May 2004 and subsequently welcomed by the EU Council.

B1.4 LONG-TERM STUDIES ON BIODIVERSITY

It will be necessary to complete the strategically important national surveys that have already begun, and to establish longer-term national habitat and species surveys in terrestrial, freshwater and marine environments.

It will also be necessary to establish networks of long-term study sites for a programme of strategic larger-scale (spatial and temporal) monitoring and evaluation of biodiversity within nationally important conservation areas, threatened habitats and economic sectors. This should include agriculture, forestry and fisheries. (See comments on associated infrastructure needs in Section D2 Defined funding and institutional support). Specific topics for research in this area should include the detection of changes in the status of, and wider long-term impacts on, biodiversity particularly in relation to:

- Conservation of semi-natural habitats and biodiversity hot spots
- Habitats within intensively managed anthropogenic environments (agriculture, forestry and fisheries)

Specific areas that should be addressed in these long-term studies are as follows:

B1.4.1	The collation and analysis of existing data relating to specific environmental issues
B1.4.2	The establishment of networks of long-term study sites for larger-scale (spatial and temporal) monitoring and evaluation of biodiversity in national habitats in order to help integrate research and provide long-term baseline data
B1.4.3	The creation of a register of rare/unusual species
B1.4.4	The conservation of rare or threatened native species (including lower plants, fungi and invertebrates)
B1.4.5	The updating of the Irish Red Data books
B1.4.6	The undertaking of nation-wide surveys of those habitats of national and European importance that have not been the subject of previous surveys, or where such surveys have delivered insufficient information
B1.4.7	The undertaking of a nationwide survey of those species considered to be of national and European importance that have not been the subject of previous surveys, or where such surveys have delivered insufficient information

PREDICTED OUTCOMES:

- Improved baseline knowledge of the taxonomy and species distributions and status of Irish flora and fauna
- The development of assessment tools, especially indicators and survey methods for the detection and measurement of change in diversity (structural, biological and compositional) in nationally important environments
- Improved knowledge of evolutionary relationships and basic databases in order to facilitate assessment of the environmental impact on biodiversity and rare biological resources of major forms of land use such as agriculture, forestry and the planning of urbanised environments
- Improved methods for the identification and management of the threatened taxa and habitats at risk

B2.0 FUNCTIONS AND PROCESSES

B2.1 BIODIVERSITY AND ECO-SYSTEM SERVICES

There is a need to improve our basic understanding of how genetic, species and ecosystem ecology and processes influence the development and maintenance of biodiversity across a gradient of managed and natural ecosystems; this should include the processes underpinning the relationship between biodiversity and ecosystem services e.g. food production, maintenance of soil fertility, pollination, and natural pest control.

Specific areas to be researched are:

B2.1.1	Investigation into methods of preventing or mitigating habitat fragmentation (e.g. underpasses in road developments, wildlife corridors and so on)
B2.1.2	Further research into the interactions between fisheries and fish predators (mammals and birds)
B2.1.3	Relationships between diversity and ecosystem functioning in major systems (agriculture, forestry, freshwater and marine)
B2.1.4	Species interactions (such as pollination, predation and competition)
B2.1.5	Extent of functional plasticity in species
B2.1.6	Biodiversity production studies, importance of species complementarities and the extent of species redundancy
B2.1.7	Role of genetic and spatial/habitat heterogeneity
B2.1.8	Relationships between spatial-scale and biodiversity-ecosystem functions
B2.1.9	The influence of the biodiversity of some habitats on the functioning of other habitats
B2.1.10	The identification of keystone species and their potential effects on targeted species loss in nationally important ecosystems (terrestrial, freshwater, marine)

B2.2 VARIATION IN ECOLOGICAL PATTERNS AND PROCESSES ACROSS DIFFERENT SPATIAL AND TEMPORAL SCALES

Specific areas to be researched should include:

B2.2.1	Biodiversity patterns in space and time
B2.2.2	Variation in ecological patterns
B2.2.3	Interaction of biodiversity effects across habitat and ecosystem boundaries
B2.2.4	Natural variation in diversity and ecosystem function
B2.2.5	Minimum viable areas of species of conservation importance

POTENTIAL BENEFITS:

- Increased understanding of the significance of biological diversity and its relationship with ecosystem function and well-being
- Predictions of the possible consequences of environmental change (across a range of scales) on biological diversity and the likely consequent impacts on ecosystem function
- The development of sustainable environmental policies and effective conservation strategies

B3.0 PROTECTION OF ECOLOGICAL SERVICES

The successful implementation of biodiversity policy will be strongly dependent on our knowledge of how current management of the environment and the use of its natural resources impacts on biological diversity and ecosystem health, and how we can best protect the core ecological services which are vital for the sustainable utilisation of biological resources and for human well-being. In order to further our understanding of these influences, and in order to inform the processes of successful conservation, restoration and utilisation of biodiversity within Irish habitats and landscapes, we urgently need to develop knowledge of:

B3.1 MANAGEMENT OF BIOLOGICAL RESOURCES:

A key area of uncertainty is the longer-term impact on biodiversity that results from major environmental change brought about by resource management practices in areas such as agriculture, forestry, fisheries and urban development. This includes the effects of intensification and the abandonment of current management practices.

There is also a need to acquire knowledge relating to the development of alternative production systems which have the capacity to maximise environmental protection and make wider use of genetics resources that best match local conditions in agricultural systems, forestry and fisheries, while simultaneously protecting and utilising natural ecosystem processes.

Specific areas to be researched are as follows:

B3.1.1	Examine the role of ex-situ conservation in providing materials for the restoration of ecosystems
B3.1.2	Further research into suitable sites for the reintroduction of species at risk, or which have already been lost
B3.1.3	Fundamental research into the role of non-target species in ecosystem function
B3.1.4	Habitat and species action plans, particularly for habitats and species included within the EU Habitats and Birds Directives and the Irish Red Data books
B3.1.5	Landscape analysis of the impact of the abandonment of traditional patterns of land use and farming systems biodiversity in economically marginal areas
B3.1.6	Impact of intensification of agricultural systems, especially management of grasslands (including landscape-scale effects, eutrophication and water pollution effects)
B3.1.7	Impact of afforestation practices and production systems on biodiversity (including clear felling, afforestation and reforestation)
B3.1.8	Impacts of inshore and deep-sea fishing on marine food chains (including by-catch and discards, interaction with fish predators)
B3.1.9	Aquaculture impacts on biodiversity (including the effects of infrastructure, disease, genetic diversity, impact of cultivated and alien species)
B3.1.10	Impact of urbanisation and urban planning on biodiversity
B3.1.11	Impact of sustainable energy policy (e.g. wind energy) on biodiversity
B3.1.12	Research to investigate innovative habitat restoration and conservation practices within landscapes of conservation value affected by anthropogenic factors
B3.13	Development of plant breeding and crop deployment methodologies to conserve agricultural biodiversity while maintaining productivity
B3.14	Agronomic and silviculture studies to develop better husbandry systems that enhance and utilise biodiversity
B3.15	Impact of alien species (including introduced aquaculture species and GMOs) on genetic and species diversity of native populations
B3.16	Genetics and ecology of cultivated species (including disease resistance and interbreeding)
B3.17	Research into biodiversity impact assessment and mitigation (both at development project level and at strategic level)

B3.2 DEVELOPMENT OF CONSERVATION POLICIES:

We need to acquire knowledge about how to improve the effectiveness of environmental policy and modified management strategies in order to support the conservation and restoration of biodiversity within different environments. These environments range from general farmland and forestry to areas of high conservation value e.g. Natural Heritage Areas (NHAs) and Special Areas of Conservation (SACs).

Specific areas to be researched include:

B3.2.1	Effectiveness of specific environmental measures such as agri-environmental, forestry-environmental, transport, and coastal-zone management schemes
B3.2.2	Fisheries no-take zones
B3.2.3	Research to develop policy in support of low-impact fisheries and aquaculture
B3.2.4	Further research on marine fishing gear selectivity

B3.3 MODELLING THE IMPACT OF ENVIRONMENTAL CHANGE

The likely impacts of climate change, changing patterns of land use, habitat fragmentation, deforestation and so on, based on field experimentation and predictive modelling, should be addressed.

Specific areas to be researched as follows:

B3.3.1	Modelling of the effects of climate change on species and habitat distribution
B3.3.2	Experimental and modelling studies on the effects of climate change on ecosystem function in terrestrial, freshwater and marine ecosystems
B3.3.3	Development of rehabilitation techniques and approaches to degraded landscapes and habitats with residual or no conservation value.

B3.4 CONSERVATION OF RARE AND THREATENED NATIVE SPECIES

While a wide range of species merit individual conservation research, the NPBR believes that priority should be given to studies on the ecology and conservation requirements of species facing serious threats, or to species whose welfare is closely associated with nationally important habitats.

PREDICTED OUTCOMES:

- Identification of the positive and negative impacts of current land use and resource management practices in relation to the maintenance, conservation and enhancement of biodiversity
- Greater utilisation and enhancement of the benefits of biological diversity in managed ecosystems
- More informed planning and policy formulation for the enhancement of biodiversity within both intensively managed and semi-natural ecosystems
- Significantly wider environmental improvement, through emphasis on the requirements of rare and threatened species

C. RESEARCH TO SUPPORT ECONOMIC, SOCIAL AND EDUCATIONAL NEEDS.

The effective implementation of environmental policy depends not only on an understanding of the underlying ecological science, but also on a wider appreciation of, and justification of, the educational, economic and social benefits of environmental conservation measures – which might otherwise be seen as inhibiting local interests and economic development.

In order to investigate the economic and social value of biodiversity, and demonstrate the costs and benefits of measures aimed at conserving, enhancing and utilising biodiversity, there is need for the following research:

C1.0 QUANTIFICATION OF THE ECONOMIC AND SOCIAL BENEFITS OF BIODIVERSITY

A critical factor in the securing of public approval and support for new policies is the development of methods aimed at improving understanding of the various ways in which people frame, articulate and debate relationships between society and nature. The development of methods which quantify the social benefits of biodiversity is also critical. In the case of rural communities in particular, evidence-based data must be provided to prove the viability of a sustainability approach. Evidence of the value that biodiversity can contribute to the ecosystem services which are sustaining rural communities must also be provided.

The priorities identified in this area are as follows:

GENERIC RESEARCH

C1.1 Research aimed at quantifying the economic importance and relevance of biological resources and biodiversity in all sectors of the Irish economy should be undertaken. A baseline review and projections covering the next ten years and longer are also required.

C1.2 A sociological study of public attitudes and perceptions should be carried out in the areas of:

- Agriculture
- Food production systems
- Fisheries and aquaculture
- Food costs
- The interaction between agriculture, fishing, fisheries management, fish products and aquaculture
- Resource use and management practices (pollution prevention) including sectoral analysis

C1.3 Qualitative studies aimed at understanding how people think about nature, what changes they see taking place during their lifetime, and how they experience those changes in their daily lives should be undertaken.

SECTORAL RESEARCH

C1.4 FISHERIES AND AGRICULTURE SECTOR

The following research studies should be undertaken:

- Research to develop policy instruments that would support low-impact fisheries and aquaculture practices.
- A socio-economic interdisciplinary study of the application of an ecosystem-based approach to fisheries and aquaculture management (including the impact of different regulations e.g. property rights)
- Predictive tools for evaluating the likely impact of the Common Agricultural Policy, the Common Fisheries Policy, and other measures and policies on biodiversity
- A study to evaluate the social and economic impact of banning drift net salmon fishing

C1.5 ALL SECTORS

The following research studies should be undertaken:

- A socio-economic interdisciplinary study of stakeholders' attitudes, motives, awareness, values and behaviours in different farm typologies; information gleaned from this study would be used to develop more effective environmental protection measures across all sectors and to promote the role of producers as environmentally conscious managers.
- Cultural and historical studies of biodiversity

C2.0 COMMUNICATION AND EDUCATION

Environmental policies succeed only if they receive public acceptance and support. Key to this success is the effective dissemination of relevant information to a variety of audiences. Public and formal education has a key role to play in highlighting the significance of biodiversity in our lives.

In order to foster an improved awareness of major biodiversity issues in Ireland we need to undertake research which will:

- Identify and develop effective methods of communicating an improved awareness of biodiversity both to the public and to key stakeholders.
- Assess the impact of biodiversity measures on society. This would include issues such as how individuals/local communities can derive maximum socio-economic benefits from the delivery of biodiversity protection/ enhancement measures.
- Consider how best to develop and improve the teaching of biodiversity at primary, post-primary and third level. This could involve determining which curriculum support materials (including field and laboratory-based packs) would be most appropriate for the three levels of educational institution.
- Determine the reasons for the lack of participation in taxonomy and systematics courses at both undergraduate level and postgraduate level in third level institutions, and develop methods aimed at addressing this problem.
- Determine what formal and informal educational structures should be used to promote biodiversity.
- Investigate what resources the State requires in order to manage and communicate effectively about obligations relating to lands designated for conservation.

Predicted outcomes:

- Objective methods for the socio-economic assessment of environmental policy
- Justification of environmental policy in social and economic terms
- Provision of information leaflets and biodiversity awareness packs through public libraries, local media and other forums, in order to facilitate the dissemination of biodiversity information and general awareness of environmental issues
- Improved liaison with educational bodies such as the Department of Education and Science, the National Council for Curriculum and Assessment, the Irish Science Teachers Association, and third level colleges; this would in turn facilitate the integration of biodiversity topics across curricula at all levels
- A more informed and environmentally sensitive general public, which is more likely to understand, accept and support biodiversity policy
- Promotion of the benefits of enhanced biodiversity and heightened awareness of the consequences of a reduction in biodiversity to the quality of life on earth

D. RECOMMENDATIONS AND FUNDING STRUCTURES TO IMPLEMENT THE BIODIVERSITY RESEARCH AGENDA.

The implementation of the research agenda (as outlined in sections A, B and C of this document) would require substantial resources (see Appendix 4). In addition, a number of management strategies would have to be put in place in order to co-ordinate and maximise the benefits derived from the proposed agenda. In particular, resources and management would require a programme of long-term and on-going investment.

D1.0 OVERALL MANAGEMENT STRATEGY

D1.1 The NPBR recommends the establishment of a national advisory group on biodiversity research in order to implement fully a national research agenda. This group should comprise a relatively small number (i.e. eight to ten) of representative scientists, other specialists, stakeholder government departments, and policy makers who would be charged with responsibility for ongoing consideration of priority requirements for the delivery of a coherent programme and a sustained national effort to conserve and protect biodiversity on the island of Ireland.

D1.2 The NPBR recommends that the National Development Plan (2000 to 2006) should be evaluated and, where necessary, adjustments should be made in order to address conflicting policy issues. This process should be informed by the output of studies described in Section A1 of this document. Research should also be used to inform policy making, which will in turn influence the formulation of the next six-year NDP programme. (The second NDP programme

period would dovetail with the CBD's target of halting the decline of biodiversity in EU member states by 2010). This process will ensure that biodiversity concerns are integrated into the new Plan.

D2.0 DEFINED FUNDING AND INSTITUTIONAL SUPPORT (SEE ALSO APPENDIX 3)

In order to deliver the successful implementation of the biodiversity research agenda, it would be essential to establish dedicated funding mechanisms targeted specifically at biodiversity research in Ireland. While such biodiversity research funding mechanisms could operate as a common pool across all sectors, it would be preferable if they were established within the relevant government sectors (e.g. agriculture, marine, environment, heritage, enterprise, education). This option might not only serve to support specific sectoral BAPs, it might also prove to be the best way of meeting national commitments to integrate biodiversity concerns into all areas of national policy. In order to ensure co-ordination across sectors, the overseeing of resources devoted to biodiversity management should become the responsibility of the proposed National Advisory Group on Biodiversity (see section D1: Overall management strategy).

One of the prerequisites of these biodiversity funding mechanisms is that provision be made for different types and levels of competitive grant funding. This would include funding for small, medium and large-scale biodiversity research projects (see Appendix 3). In particular, it would be essential to bear in mind that:

D2.1 Traditional (usually short-term) funding mechanisms should be adapted in order to ensure the provision of sustainable funding for the maintenance of selective and strategic, long-term (i.e. minimum ten-year time-scale) monitoring projects, which would be necessary for the establishment of baselines and the tracking of ongoing changes in biodiversity status. (See section B1.3 for examples of such projects).

D2.1 Specific funding should be earmarked for biodiversity research and training at MSc, PhD and postdoctoral levels; the development of 'critical mass' in dedicated multidisciplinary biodiversity research groups should be encouraged.

D2.3 Greater resources and support for taxonomic services and the curation of national biological collections, coupled with increased use of such facilities in education, are required in order to increase public awareness of biodiversity issues.

In order to promote excellence in biodiversity research in Ireland, all funding mechanisms should have systems of peer review as well as clear criteria for the provision of research funding.

D2.4 The outputs of the research agenda should feed into, and be directly in support of, sectoral BAPs. This can best be achieved by the creation of institutional systems including:

- A national forum to translate biodiversity research into conservation and sustainable use actions
- The development of incentive schemes within research funding instruments, so as to ensure that the research outputs feed into policy and national level actions that meet the 2010 biodiversity target objective
- The translation of research outputs into lessons learned, which can in turn be conveyed to all stakeholders – in particular, politicians and policy makers – in order to allow evidence-based policy making in the area of biodiversity
- The provision of research lessons learned on a bi-annual basis to a cabinet committee on biodiversity as well as to the government's chief scientific advisor
- The development of strong links between research activities and the implementation of local level BAPs (i.e. at county level)

D3.0 INFORMATION MANAGEMENT

The effective application of scientific and socio-economic knowledge generated through research requires an effective system of information collation and management, such that research data can be made readily available to interested parties. The creation of a National Biological Records Centre (as proposed by the Minister for the Environment, Heritage and Local Government, Mr Martin Cullen TD, during the Malahide Conference held in 2004 during the Irish Presidency of the EU) represents a step in the right direction. A key purpose of the centre should be the development

of databases and an information management system that would maximise the use and availability of relevant information designed to inform policy decisions. The aim of the management of this data should be clear: it should maximise the use and availability of all information.

In order to provide a strategic management role, and in order to optimise the involvement of Irish researchers, policy makers and stakeholders at national and international levels, it will be necessary to:

D3.1 Identify and provide support structures for national and international networking and for the sharing of knowledge/best practice and the establishment of national databases.

D3.2 Establish mechanisms aimed at ensuring participation in international programmes – especially EU/European Science Foundation (ESF) institutions, instruments and funding programmes.

D4.0 RESEARCH FUNDING FOR STUDENTS FROM DEVELOPING COUNTRIES

The National Biodiversity Plan (Action 52) indicates that biodiversity will be made a specific objective of Ireland's overseas development assistance (ODA) and that Ireland will provide specific funding for biodiversity projects in developing countries and for the identification, assessment and monitoring of global biodiversity. Capacity building in biodiversity and biological resources research of relevance to developing countries could best be achieved by the provision of funding support within the Framework for a Biodiversity Knowledge Programme for Ireland for collaborative projects between Irish research groups and research institutions in developing countries, involving the sponsorship of research training (MSc and PhD) for overseas students in registered Irish research institutions. The focus should be on the provision of support for biodiversity research, training and projects needed in Development Cooperation Ireland's (DCI) bilateral aid priority countries (e.g. Ethiopia, Uganda, Tanzania, Zambia, Mozambique, Lesotho, Timor) in support of the Millennium Development Goals (MDG).

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APPENDIX 2

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APPENDIX 3

KEY CONSIDERATIONS RELATING TO THE DEVELOPMENT OF BIODIVERSITY FUNDING MECHANISMS IN IRELAND

1. It is necessary to make a distinction between two complementary funding mechanisms. These are (i) priority earmarked/targeted research identified by government departments and agencies e.g. the National Parks and Wildlife Service of the Department of the Environment, Heritage and Local Government, the Envionmental Protection Agency and the Marine Institute and (ii) open-call, competitive peer-reviewed funding for biodiversity research in the university and NGO sectors. A biodiversity research fund budget of €30.08 million per year would be required in order to address the various research areas outlined in the Research Plan, in order to support the existing Biodiversity Plan, or to maintain a vibrant biodiversity research community in Ireland. Such funding would have to be split equally between (i) and (ii) above (i.e. earmarked research and competitive open-call/thematic research). As biodiversity is a cross-cutting issue, and as the National Biodiversity Plan envisages the involvement of all government departments in the preparation of sectoral biodiversity plans, this would equate to a requirement for a contribution of €3 million per year for biodiversity research from each of the relevant government departments.

   These government departments are as follows:

   - Agriculture and Food: agri-biodiversity and agricultural genetic resources
   - Arts, Sport and Tourism: biodiversity as amenity
   - Communications, Marine and Natural Resources: marine biodiversity, biological resources
   - Community, Rural and Gaeltacht Affairs: biodiversity and cultural heritage
   - Education and Science: biodiversity and biological resource research training
   - Foreign Affairs: biodiversity in overseas development aid
   - Health and Children: dietary diversity
   - Enterprise, Trade and Employment: bio-based industry in Ireland; Science Foundation Ireland
   - Department of Environment, Heritage and Local Government: National Heritage Council
   - Transport: biodiversity impact assessment
   - Environment, Heritage and Local Government

   To put the funding of the national biodiversity research plan into the context of existing spending of public funds, the National Roads Authority Road Needs Study (1998) and subsequent reports have estimated the current cost of dual carriageway or motorway at €10.2 million per kilometre. The question we must ask is whether taxpayers would be willing to sacrifice the cost equivalent of three kilometres of motorway in order to fund research that would ensure that biodiversity and biological resources are maintained for current and future generations. Similarly, Science Foundation Ireland's annual budget for expenditure on the development of biotechnology and information and communications technology (ICT) is €130 million. Ireland's ability to fund such research is underpinned by a strong and successful economy, rooted largely in undervalued goods and services which are provided by the natural environment and biodiversity. For example, in 2002 tourism contributed €4.95 billion to the Irish economy; 78% of all visitors to Ireland participated in activities directly related to the natural environment.

2. In order to ensure the successful implementation of the biodiversity research agenda, it would be essential to establish dedicated funding windows and mechanisms targeted specifically at biodiversity research in Ireland. Such biodiversity research funding mechanisms could operate either across all sectors, or they could be established within each government department sector (e.g. agriculture, marine, environment, enterprise and education) by way of supporting each sector's Biodiversity Action Plans. Of equal importance is the need to establish a coordinating body to oversee the international peer review, assessment and allocation of such funds. (The National Advisory Group on Biodiversity, or subsidiary working groups within each sector, might be the most appropriate groups to take on this particular role). Within such biodiversity funding mechanisms it would be essential that provision be made for different types and levels of competitive grant funding.

3. There is a need for the elaboration or identification of a funding mechanism which has the capacity to manage competitive research calls for biodiversity research on the themes identified in the research plan,

APPENDIX 3

across all government departments that make a contribution to biodiversity research funding. This raises the issue of how to develop an institutional funding mechanism for biodiversity research that has the administrative capacity to set priorities for research themes, issue calls for proposals, receive and vet proposals and disperse grant funding across the various government sectors of relevance to biodiversity. While the earmarked project funding may be administered through existing internal and external tendering mechanisms in the public sector, there is a need to develop an institutional mechanism capable of managing the research funding windows outlined. It is likely that some of these windows (e.g. postgraduate and postdoctoral fellowships) could be managed by the Irish Research Council for Science, Engineering and Technology in a manner similar to their sustainable energy and other thematically-based fellowships.

4. The management of the remaining funding windows would require an institutional funding mechanism run along similar lines to that of SFI, or an analogous model. While the EPA appears to be the most suitable host for the implementation of the competitive funding windows, this would place an administrative burden on the organisation that would have to be addressed. Alternatively, a case could be made for the establishment of an environmental research council. One other matter that needs to be resolved is the issue of how different government departments could provide funding to a central body that administers such research funding in a peer-reviewed competitive manner; here the existence of institutional barriers requiring innovative solutions needs to be considered. One possibility is the separation of the peer-review process from funding provision/auditing functions in the same manner as that is applied by the European Science Foundation which centrally reviews research proposals using the peer-review system and then makes recommendations to EU member states' (departments) on whether or not project proposals merit the requested funding. The National Biodiversity Forum could play some role in overseeing the management of such a funding system.

APPENDIX 4

FUNDING

	Targeted funding	Competitive (peer-reviewed) funding offered as open-call for proposals on annual basis (includes 30% overheads for institutions)										
RESEARCH NEEDS	Funding earmarked for specific projects (e.g. NPWS)	Three-year biodiversity research project grant (€200,000 total/ project)	Five-year biodiversity research project grant (€500,000 total/grant)	Ten-year biodiversity monitoring research grant (€500,000 total/grant)	Three-year IRCSET biodiversity postgraduate fellowship (€60,000 total/grant)	Three-year IRCSET biodiversity postdoctoral fellowship (€150,000 total/grant)	Five-year biodiversity investigator programme (€750,000 total/grant)	One-year biodiversity visiting professor scheme (€100,000 total/grant)	Multi-institute biodiversity research grants (€500,000 total/grant)	Two-year NGO research project grants (€50,000 total/grant)	Three-year biodiversity postgrad fellowship developing countries (€180,000 total/grant)	**TOTAL €**
A. SPECIFIC RESEARCH NEEDS TO INFORM POLICY	€1.05m	n/a	n/a	n/a	€120,000 (two grants)	€300,000 (two grants)	n/a	€200,000 (two grants)	n/a	€250,000 (five grants)	€180,000 (one grant)	**2.1.M**
B. KNOWLEDGE AND SKILLS DEVELOPMENT												
B1. TAXONOMIC RESEARCH **B2. MONITORING METHODOLOGIES AND BASELINES** **B3. LONG-TERM IMPACTS ON BIODIVERSITY** **B4. FUNDAMENTAL BIODIVERSITY RESEARCH** **B5. PROTECTION OF ECOLOGICAL SERVICES**	€10.12m	B1-B5 €1m (five projects)	B1-B5 €1m (two projects)	e1m (two grants)	B1-B5 €900,000 (15 fellows)	B1-B5 €1.5m (ten fellows)	B1-B5 €2.25m (three programmes)	B1-B5 €500,000 (five visitors)	B1-B5 €1m (two projects)	B1-B5 €250,000 (five projects)	B1-B5 €720,000 (five fellows)	**20.24M**
C. ECONOMIC, SOCIAL AND EDUCATION												
C1. QUANTIFICATION OF THE ECONOMIC AND SOCIAL BENEFITS OF BIODIVERSITY	€1.3m	€400,000 (two grants)			€120,000 (two grants)	€300,000 (two grants)		€200,000 (two grants)		€100,000 (two grants)	€180,000 (one grant)	**2.6 M**

BENEFITS OF BIODIVERSITY												
C2. DRIVERS OF PUBLIC OPINION CONCERNING BIODIVERSITY	€0.36m				€60,000 (one grant)	€150,000 (one grant)		€100,000 (one grant)		€50,000 (one grant)		**0.72M**
C3. COMMUNICATION	€0.21m				€60,000 (one grant)					€150,000 (three grants)		**0.42M**
C4. TEACHING	€0.35m							€200,000 (two grants)		€150,000 (three grants)		**0.7M**
D1. OVERALL MANAGEMENT STRATEGY	€250,000	€250,000										**0.5M**
D2. DEFINED FUNDING AND INSTITUTIONAL SUPPORT	€550,000	€550,000										**1.1M**
D3. INFORMATION MANAGEMENT	€85,000	€85,000										**1.7M**
TOTAL ANNUAL COST OF IMPLEMENTING NATIONAL BIODIVERSITY RESEARCH AGENDA (across ten government departments)												**30.8M**

NOTES

Environmental Protection Agency
An Ghníomhaireacht um Chaomhnú Comhshaoil

AN ROINN COMHSHAOIL, OIDHREACHTA AGUS RIALTAIS ÁITIÚIL
DEPARTMENT OF THE ENVIRONMENT, HERITAGE
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