

Work Programme for the Environment 2015 Programme – Norwegian Environmental Research Towards 2015 (2006- 2016)

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1 Summary

Background

The Environment 2015 programme is a comprehensive, cross-disciplinary research programme designed to generate knowledge about key environmental questions and create a foundation for designating future policy. The Environment 2015 programme was established in the wake of assessment process conducted in 2005-2006, in which the research community, government administration and other users took part.

The natural and cultural environments comprise an essential part of the framework for social development at the regional, national and international level. Knowledge about

changes in the quality of the environment, causes of these changes, and measures and instruments for preventing or alleviating environmental damage is vital to framing more effective environmental policy. It is therefore necessary to foster greater multi- and cross-disciplinarity in environmental research. Research under the Environment 2015 programme is intended to provide a deeper understanding of processes at higher system levels – ecosystems, watersheds and landscapes – in order to integrate knowledge about physical, chemical and biological processes with social and cultural aspects. By strengthening multi- and cross-disciplinary research and encouraging extensive contact with the users, the Environment 2015 programme will seek to enhance the role of environmental research in setting the political agenda and providing a foundation for framing future policy.

The structure of the Environment 2015 programme consists of one overarching research area: CROSSCUT, and four specific thematic areas: SOCIETY, LAND, WATER and POLLUTION.

Overarching research area:

Cross-cutting research topics: system-oriented research (ecosystem-based management, extended life-cycle analyses), and development of models and methods (CROSSCUT).

Thematic priority areas:

1. Societal framework conditions and governance and policy options (SOCIETY)
2. Landscapes, terrestrial ecosystems and biodiversity, outdoor recreation, and the cultural environment (LAND)
3. Ecology of freshwater, wild salmon and limnic biodiversity (WATER)
4. Pollution and biogeochemical cycles (POLLUTION)

The programme board will receive input and support from advisory groups for the individual thematic areas. Members of the advisory groups include user representatives and researchers.

Objectives

The Environment 2015 programme is designed to generate new, research-based knowledge to promote the sustainable use and management of the natural and cultural environments. Research activities will provide greater knowledge about the impact of various factors on the environment, as well as facilitate a more accurate understanding of critical limits regarding the use of natural and environmental resources, how to balance respect for these limits with other considerations, and how to designate and implement policy and instruments that will provide lasting solutions to environmental problems.

The programme encompasses research-related questions covering entire environmental causal chains: causes of pressing environmental problems; physical/chemical, biological and societal processes of change; and knowledge for solving or alleviating environmental problems. Research will primarily focus on landscape changes, terrestrial ecosystems and resources, freshwater and pollution. The programme has an international orientation;

research will address environmental questions at the global level, and the programme will encourage greater collaboration between Norwegian and international research groups.

The programme's primary objectives are:

1. The Environment 2015 programme will cultivate new knowledge about key processes in our biosphere and society that are relevant to the sustainable use and management of the environment. Further, the programme will provide a deeper understanding of the causes and impacts of environmental problems, giving priority to both national and global challenges.
2. The Environment 2015 programme will acquire knowledge for action – knowledge about which forms of action and regulation may help to improve the environment and how these can or should be generated. Research activities will have both a national and international focus, and will examine Norway's relationship to and participation in the formulation of international framework conditions.
3. The Environment 2015 programme will promote cohesive, high-calibre environmental research. The programme is intended to build and maintain a dynamic Norwegian research community and enhance the role of Norwegian researchers as partners in international cooperation, as well as to secure the basis for effective environmental observation systems.

Strategic secondary objectives

The Environment 2015 programme will give priority to:

- Basic and applied research
- Interaction and cross-disciplinarity
- Relevance and benefit to users
- International perspectives and internationalisation of research

Users

The Environment 2015 programme is designed to meet the knowledge needs of politicians, government administration, trade and industry, organisations and educational institutions. Most of the government ministries will benefit from the research conducted under the programme, also those that are not currently providing programme funding. Key users of research findings in the private sector include primary industry, the industrial sector, the aquaculture industry and the tourism industry. Research will also have broader areas of application in relation to community planning, infrastructure development and efforts to create an environment-friendly society.

Implementation plan

Established in 2006, the Environment 2015 programme will span the period 2007-2016. The start-up for the first projects will be in 2008, and annual calls for proposals will be issued if budgets are increased as intended.

Budget

The Environment 2015 programme has a budget of NOK 67.4 million for 2007. The primary sources of funding for the programme in 2007 are the Ministry of the Environment (NOK 44.55 million), Ministry of Agriculture and Food (NOK 14.15 million), Ministry of Education and Research (NOK 5.04 million), Ministry of Fisheries and Coastal Affairs (NOK 1.5 million), Ministry of Foreign Affairs (NOK 1.5 million), Ministry of Trade and Industry (NOK 0.5 million), and Ministry of Finance (NOK 0.2 million). The programme's long-term target of an annual budget of NOK 100 million has been set after an assessment of the realistic funding opportunities that will facilitate adequate goal achievement. The programme board would like to point out that an annual budget of more than NOK 100 million will be required to meet the actual knowledge needs.

In order to meet the long-term budget target, efforts will be made to secure co-financing from ministries and industrial sectors that are likely to benefit from research findings, but that are currently providing little or no programme funding.

2 Background: challenges facing environmental research

Society is facing major challenges relating to developments in the state of the environment and environmental management. It is a national aim to ensure that social development is sustainable. In order to move in a more sustainable direction, it is essential to gain insight into how the state of the environment – the state of the natural and cultural environments – is evolving and how this is linked to economic, social and cultural processes of change. We must understand the conditions that affect the choices made by various stakeholders in different arenas and the role played by cultural, institutional and economic framework conditions in this context. Research must provide insight into the fundamental processes that deter sustainable development, and identify what needs to be done to remedy the situation. To do so, environmental research must employ knowledge from a wide range of scientific disciplines.

The state of the environment is of great importance for most industries and sectors, as good quality soil, water and air, as well as well-functioning ecosystems and landscapes are among the factors that enhance quality of life. They are also essential for ensuring long-term sustainable development. While the environment is clearly crucial in the context of trade and industry, social development and welfare, it is also important to note that the prevention and restoration of environmental damage also requires a major focus. A number of environmental problems are linked to overexploitation of resources, environmental damage caused by certain production processes, or certain types of waste. So far the approach to solving environmental problems has been characterised by implementing mitigation measures after incidents or events have already taken place.

Research is crucial to reversing this trend. Knowledge about nature's critical limits, ecosystem processes and responses, the significance of landscape structures, and the options and limitations of the involved players will make it possible to take advance

action. The emergence of ecosystem-based management and the move towards framing policy based on the system limits set by nature and the environment also entail new demands for research. The same is true for the increased focus on the cultural environment. Investment in environmental research is therefore vital to acquiring knowledge about the circumstances underlying the development of the society of today and tomorrow.

Knowledge needs to be met by the Environment 2015 programme

The Environment 2015 programme is a comprehensive, cross-disciplinary research programme designed to generate knowledge about key environmental questions and create a foundation for designating future policy. The programme was established in the wake of an assessment process conducted in 2005-2006 in which the research community, government administration and other users took part. The work programme builds on the main themes identified in this assessment.

Up to now, environmental research programmes at the Research Council have generally been organised according to specific thematic areas: pollution research (the PROFO programme); research on biological diversity (the Biological Diversity programme and the Wild Salmon programme); research on landscape changes, resource management, outdoor recreational activities and cultural environments (the Changing Landscapes programme); social science-related and legal environmental research (the RAMBU programme on framework conditions and governance for sustainable development, including an initiative on environmental law). Nevertheless, it is obvious that the scientific questions regarding the use and conservation of biological diversity, pollution, management of natural resources, outdoor recreational activities, the cultural landscape and cultural environments are often closely related. A main strategy of the Environment 2015 programme is to examine various environmental problems in context with each other. At the same time the programme must take into account the need for specific, basic research within individual disciplines, as well as on research problems of more limited scope. An effort will therefore be made to link research on specific thematic questions to research that provides a more overarching perspective, to highlight the interconnectedness of various environmental problems.

The programme boards of previous environmental research programmes have identified knowledge needs that should continue to be addressed. Within pollution research the PROFO programme board emphasised the need for knowledge about the distribution of hazardous chemicals and their effects on the environment in order to support regulatory efforts and secure the basis for implementation of measures. There is a particular need for greater knowledge about the interacting and synergetic effects of various hazardous substances. Pollution research must be placed in a wider ecological perspective and generate insight into the impacts of these substances at different trophic levels and at the ecosystem level. High priority must be given to examining the benefit and relevance to society of pollution research as well as the significance and relevance of measures.

Within ecosystem-related research – on biological diversity and landscape changes – there is a need for new knowledge about the functions of biological diversity and

ecosystem dynamics, which are very basic research questions. There is also a need for knowledge about priority ecosystems with regard to targets for halting the loss of biological diversity and supporting ecosystem-based management. For example, few of today's conservation areas are actually areas with the greatest biological diversity. It is therefore vital to improve knowledge about impacts on and optimal management of biological diversity, also outside conservation areas. Under the Wild Salmon programme (research on wild salmon can be considered a sub-topic of biological diversity) there have been limited opportunities to carry out research related to measures and management. The implementation of the EU Water Framework Directive, which has given rise to new challenges with regard to learning about ecosystem processes in water, management at the watershed level and achieving sound ecological status, means that research on wild salmon must be carried out within a more comprehensive framework.

Norway is also facing major challenges relating to wild game management, including population conditions, use of land area and application of policy instruments. A great deal of effort has been invested in research on biological aspects of wild game research. While such research must be continued, further connections must at the same time be established between research in the natural sciences, social sciences and humanities. This is an area characterised by controversy, and there is a need for insight into framework conditions and capacity for change in relation to management and policy instruments, knowledge about the impact of various instruments and practices, and the various stakeholders' options and room to manoeuvre.

In Norway cultural heritage and cultural landscapes fall under the sphere of responsibility of environmental management authorities. Thus, the environment is a concept that has a scope that extends beyond the traditional ecological focus and generates a need for research that provides insight into the relationship between humans' use of nature, the characteristics and processes of change in the cultural landscape, and the significance of cultural elements for the quality of the environment. The approach taken under the Changing Landscapes programme, based on a view of landscapes that extended beyond purely ecological aspects, has proven fruitful in bringing together knowledge about ecosystem processes, cultural landscapes, cultural environments and social conditions. The conditions for and social significance of outdoor recreational activities is an important topic that builds links between ecological, social science and cultural heritage research.

Developments in the environmental sphere are giving rise to a variety of questions that require and are conducive to social science and legal research. Threats to natural resources and a large number of ecosystems are approaching critical limits despite the fact that the legislation and instruments intended to prevent this are more comprehensive than ever before. There is also a considerable lack of knowledge about how social and cultural processes affect the development and implementation of various measures. The main components of the research activities under the RAMBU programme and the environmental law research initiative have therefore been incorporated into the Environment 2015 programme. It is essential to gain insight both into international –

including the EU – regulations and controls for the specified environmental topics, as well as into national options for creating optimal solutions.

Delimitations and organisation

The main strategy of the Environment 2015 programme is to meet new research challenges relating to system understanding and questions that extend across various systems, while continuing to address knowledge needs identified by previous environmental research programmes. Research activities under the programme will not encompass all topics that fall under the term “environmental research”, but will be limited to research questions associated with terrestrial ecosystems and landscapes, limnic ecosystems, cultural heritage, cultural environments and outdoor recreation, as well as pollution research questions related to these systems. The programme will also encompass research on more general social questions linked to the environment and environmental management.

The Environment 2015 programme will not include research on the marine environment beyond research on the marine stage of wild salmon’s life-cycle, nor will it include research on pollution in the marine environment and research on climate change. These thematic areas will continue to lie within the scope of the HAVKYST programme, the NORKLIMA programme and the RENERGI programme at the Research Council.

Nevertheless, it is vital to explore research questions that create links between, for example, terrestrial, limnic and marine pollution or between climate policy and other environmental policy. In order to carry out research in such areas of overlap, the Environment 2015 programme will maintain close contact and coordination with other research programmes at the Research Council. The delimitation of programme boundaries and development of areas of cooperation will be specified in action plans and through collaborative efforts between the programmes. See the chapter “Steps to ensuring satisfactory distribution of tasks and cross-disciplinary cooperation at the national level”.

The comprehensive scope of the Environment 2015 programme has necessitated a scientific structure consisting of one overarching research area: CROSSCUT, and four specific thematic areas: SOCIETY, LAND, WATER and POLLUTION.

Overarching research area:

Cross-cutting research topics: system-oriented research (ecosystem-based management, extended life-cycle analyses), and development of models and methods (CROSSCUT).

Priority thematic areas:

1. Societal framework conditions and governance and policy options (SOCIETY)
2. Landscapes, terrestrial ecosystems and biodiversity, outdoor recreation, and the cultural environment (LAND)
3. Ecology of freshwater, wild salmon and limnic biodiversity (WATER)
4. Pollution and biogeochemical cycles (POLLUTION)

The intention behind bringing together such a wide range of thematic areas under one single programme is to facilitate the development of research projects that extend across traditional boundaries as well as to identify research questions that would otherwise fall outside the scope of programmes with a more traditional structure. The Environment 2015 programme board is expected to issue strategic, cross-cutting calls for proposals to promote the implementation of larger-scale projects that encompass several ecosystems or topics and that seek understanding of processes at higher system levels.

Programme users

There are many users of environmental research: trade and industry, organisations, government administration, and citizens/individuals. To ensure that knowledge reaches the relevant groups and research findings are implemented, it is vital to actively target and promote dialogue with current and future users. The Environment 2015 programme is designed to meet the knowledge needs of politicians, government administration, trade and industry, organisations and educational institutions. Most of the government ministries will benefit from the research conducted under the programme, including those that are not currently providing programme funding. Key users of research findings include primary industry, the industrial sector, the aquaculture industry and the tourism industry, as well as government administration. Research carried out under the programme will also have broader areas of application in relation to community planning, infrastructure development and efforts to create an environment-friendly society. Future environmental managers will mostly be recruited from the types of institutions (universities, independent research institutes) that are expected to participate in the programme. Research-based teaching at universities will therefore be of major importance in the longer term.

3 Main perspective: a programme that sets agendas, promotes cross-disciplinarity, and is system-oriented and relevant

By strengthening multi- and cross-disciplinary research and encouraging extensive contact with users, the Environment 2015 programme will enhance the role of environmental research in setting agendas and providing a foundation for the designation of future policy. Research under the programme will be carried out in a cohesive perspective. It is intended to generate an understanding of processes at higher system levels – ecosystems, watersheds and landscapes – and to integrate knowledge about physical, chemical and biological processes with social and cultural aspects, including strategies and instruments that can be implemented in the effort to ensure sustainable development. The aim is to increase knowledge about the interaction between various processes, thereby developing knowledge of greater relevance, not least for understanding the constructs within which policy is framed and resources are managed.

4 Objectives for the Environment 2015 programme

The Environment 2015 programme is designed to generate new, research-based knowledge to promote the sustainable use and management of the natural and cultural environments. Research activities will provide greater knowledge about the impact of various factors on the environment, as well as facilitate a more accurate understanding of critical limits regarding the use of natural and environmental resources, how to balance respect for these limits with other considerations, and how to designate and implement policy and instruments that will provide lasting solutions to environmental problems.

Given such a broad range of perspectives, the Environment 2015 programme will encompass research-related questions covering entire environmental causal chains: causes of pressing environmental problems; physical/chemical and biological processes of change; societal and cultural aspects; and knowledge for solving or alleviating environmental problems. Within the scope of its thematic areas, the programme is intended to provide knowledge about which factors are of major significance for environmental change, and about how to avoid or reduce negative impacts and promote positive environmental trends. Attention will primarily be focused on landscape changes, terrestrial resources, freshwater and pollution, although more basic research questions will be addressed in cases when it does not seem natural to limit research to specific categories of resources or specific types of pollution. This is particularly true for more basic research on ecosystems and certain aspects of social science-related environmental research carried out under the Environment 2015 programme.

4.1 Primary objectives

1. The Environment 2015 programme will cultivate new knowledge about key processes in our biosphere and society that are relevant to the sustainable use and management of the environment. Further, the programme will provide a deeper understanding of causes and impacts of environmental problems, giving priority to both national and global challenges.

2. The Environment 2015 programme will acquire knowledge for action – knowledge about which forms of action and regulation may help to improve the environment and how these can or should be generated. Research activities will have both a national and international focus, and will examine Norway's relationship to and participation in the formulation of international framework conditions.

3. The Environment 2015 programme will promote cohesive, high-calibre environmental research. The programme is intended to build and maintain a dynamic Norwegian research community and enhance the role of Norwegian researchers as partners in international cooperation, as well as to secure the basis for effective environmental observation systems.

4.2 Strategic secondary objectives

Basic and applied research

Relevant environmental questions comprise basic processes in nature, general societal processes and specific issues linked to solving current problems. Research activities must therefore encompass the entire range of research, from basic to highly applied research, in order to cover the short and long-term needs of society and the government administration. Basic research and competence-building are crucial to improving the scientific basis for applied research relating to the sustainable use and management of the natural and cultural environments.

Interaction and cross-disciplinarity

A cross-system and cross-sectoral approach to environmental challenges involves a cohesive view on measures and effects in the various sectors and an overall assessment to identify the most effective measures. This requires contributions from the natural sciences, social sciences and humanities, so multi- and cross-disciplinary research is essential. Such research is a means of generating higher quality research findings, and should be encouraged when it can be expected to create added value. There is no general requirement that all research conducted under the Environment 2015 programme must be multi- or cross-disciplinary. The programme is intended to build ties within and between the natural sciences, social sciences and humanities and between various research groups in Norway. Scientific exchange and collaboration will be encouraged within individual disciplines as well.

Relevance and benefit to users

To ensure that research-based knowledge reaches relevant users and research findings are implemented, it is essential to engage in constructive dialogue with current and future users. The Environment 2015 programme is designed to address the perspectives and interests of various users, which requires targeted activities and the development of well-functioning arenas. Efforts will be made under the programme to incorporate users into the research process in order to benefit from their perspectives and experience.

International perspectives and internationalisation of research

Environmental problems are increasingly taking on a regional and global character – pollution crosses boundaries and species are intentionally or unintentionally dispersed over ecosystem boundaries. The international aspects of this are related to framework conditions, processes, effects and measures. Many environmental problems cannot be solved at the national level. This has long been recognised and addressed in a number of international agreements and regulations that have been established to provide guidelines and limitations for individual countries and for countries to work together to solve environmental problems collectively. Understanding environmental problems and acquiring relevant knowledge is dependent on research that employs international perspectives with regard to drivers, processes of change, policy designation and players in the environmental sphere.

International agreements and processes also spawn new research needs and challenges both in Norway and abroad. We must acquire in-depth knowledge about how global processes affect the state of the environment in Norway, and we must employ knowledge to strengthen and improve international cooperation for solving environmental problems, whether at the European level or under UN conventions. Thus, we need knowledge about environmental changes and policy in other countries, about the drivers and interests that govern environmental policies elsewhere, and about what is needed to foster more binding cooperation. Research on and in developing countries is particularly important for two reasons: 1) the environment of the future will to a large degree be shaped by developments in developing countries, and 2) the quality of the environment and management of natural resources are essential components of human welfare and social development.

The Environment 2015 programme has therefore a clear international dimension. In order to ensure optimal results, internationalisation of research must be promoted through targeted efforts to increase international participation in projects, enhance cooperation with international research communities, and support research activities in other countries, including developing countries.

Knowledge about the Northern Areas

Anticipated changes in the structure of trade and industry, population patterns and transport activities in the High North entail a growing need for knowledge about the impact on the state of the environment, as well as for insight into how to prevent environmental damage, the legal and social framework underlying the designation of policy in the region, and potential instruments that incorporate environmental considerations into future growth strategies. Research activities under the Environment 2015 programme address the following priority areas under the Research Council's Focus on the Northern Areas initiative: "The environment and marine resources", "Petroleum activity in the north", "Living conditions in the north", and "The interests and rights of indigenous peoples".

4.3 Scientific secondary objectives

Key components of environmental research have been merged into a single research programme to exploit potential synergies between the various disciplines and between studies of different subsystems and topics. In this context the establishment of the overarching research area CROSSCUT was an important step. It must, however, be emphasised that there is a clear intention to allocate funding to multi- and cross-disciplinary projects within the specific thematic areas SOCIETY, LAND, WATER and POLLUTION as well. CROSSCUT was established to secure analyses that focus on overarching system levels and to examine research questions and dynamics which extend across two or more thematic areas.

4.3.1 Overarching and cross-cutting research questions – CROSSCUT

Objective: The area for overarching and cross-cutting research questions – CROSSCUT – is designed to provide basic knowledge about the interactions between nature, society and culture. One aim is to ensure that multi- and cross-disciplinary research is conducted on overarching system levels to gain both basic knowledge and knowledge for use in policy designation and by administrators. Research will primarily focus on the types of resources and ecosystems encompassed by the programme, and is also intended to link insights across various ecosystems, sectors and/or administrative boundaries. Ecosystem-based management is a key topic here. Further aims are to enhance the development of models and methods for more comprehensive systems studies as well as methodologies for environmental monitoring and indicator development, and to gain insight into how this knowledge is utilised in the decision-making process.

In the past, most of the research in the fields encompassed by the current Environment 2015 programme has been relatively discipline-oriented. Knowledge about overarching system levels and knowledge that takes adequate account of the complex reality in which we live is essential in the political and administrative arenas. Under CROSSCUT, the programme will thus support projects that:

- Cultivate knowledge about the interrelations between various nature systems and between nature systems, society and the cultural environment.
- Identify problems that arise due to fragmentation of administrative and research activities and because our systems of production are not organised with the aim of viewing environmental challenges in an overall perspective.
- Identify problems that arise when there is a lack of correspondence between the complexities of the nature systems, the cultural environments and the administrative governance systems selected.
- Propose solutions to the problems created by fragmentation and a lack of overall perspectives.
- Promote collaboration across disciplines and institutions, not least between the natural sciences and the social and cultural sciences.

CROSSCUT represents a new type of research initiative. Successful results are dependent on the creativity of the research groups involved and the opportunities for collaboration. Therefore, in this work programme, CROSSCUT is organised into two main areas – system-oriented research and development of models and methods – within which choice of topics are left relatively open.

1) System-oriented research

a) Ecosystem-based management

Ecosystem-based management is gradually making inroads into environmental policy (cf. the EU Water Framework Directive and the development of cohesive management plans for ocean areas). The idea is that decisions should be taken on the basis of an overall

analysis of key pressures on a defined area, including the effects of various measures on human welfare, nature and the cultural environment. This type of management regime requires thorough knowledge about the interactions between species, the climate, hazardous chemicals, aspects of the landscape, and cultural, industrial and social factors. The following types of research questions are relevant in this context:

- What are the links between the structure of biodiversity and the dynamics of ecosystems? How is the interaction between them affected by changes in: a) biogeochemical cycles, and b) various pressures, such as hazardous chemicals and habitat fragmentation resulting from human activity? On which scales in time and space do these various factors interact? How are changes in species distribution affected by the above-mentioned factors, and what are the strategies that can prevent further loss of biodiversity?
- How can we describe the interrelations between ecosystems' production of goods/services and human welfare? How are the biological and cultural dimensions of the landscape connected? How are the many variations of ecological and cultural processes linked together, and how has this created the landscape we know today? What challenges do we face with regard to conserving and/or further developing the interaction between ecological processes, cultural-historical factors and landscape-aesthetic factors?
- What kinds of opportunities and challenges may arise during the transition to a more ecosystem-based approach to management? What are the institutional conditions that must be present to successfully apply such an approach, particularly in relation to current area management? What are the problems associated with collaboration across sectoral and administrative dividing lines? Under which conditions will ecosystem-based management be perceived as legitimate and democratic at the different levels of society? How are the possibilities for ecosystem-based management affected by characteristics of the relevant ecosystems/landscapes, and the organisation of the public administration at the different levels of society? How can principles from the UN Convention on Biological Diversity, the European Landscape Convention, various EU directives, etc. be implemented in local management models?

Projects that address these research questions may be organised in a number of ways. They can, for example, extend across various ecosystems, with analyses of the structural dimensions at the generalisable level. They may also follow the boundaries of watersheds or larger landscape regions, with analyses that cross ecosystems, environmental problems, sectors and administrative boundaries. The EU Water Framework Directive and cohesive management of semiurban areas are two of many examples that illustrate the need for this type of research.

b) Extended life-cycle analyses

Material flows through society represent another important dimension. The increase in resource extraction and the growing material flows that are creating more and more emissions and waste, are giving rise to significant problems. As a result of globalisation, the distances between resource extraction, production, consumption and the management

of waste are increasing. Problems are arising not least due to a lack of coordination between players involved in the various parts of the cycle, from the extraction of the raw materials to the final emissions:

- What are current obstacles to and options for reducing the volume of material flows through society? Why do environmental problems arise during the life-cycle of various products, and what are the technological, economic, political and organisational changes that could contribute to reducing these? What can we do to enhance product shelf-life and incorporate a greater degree of recycling into products?

2) Development of models and methods

Under CROSSCUT, there is a need for method development, not least in relation to analyses at overarching system levels and across various physical, biological and societal systems. Method development should preferably be carried out in association with projects in which the methods are to be used in concrete analyses (cf. 1a and 1b above). However, projects that focus solely on method development will also be of relevance. The following topics are of particular interest:

- The development of modelling tools that make it possible to: a) address several ecosystems and tie together different levels in the same system, b) create links across natural and societal processes, and c) develop evaluation models that integrate insight into these processes and the consequences of potential measures. Mathematical modelling is a means of ensuring consistent communication across disciplines and systems. However, not all important and relevant knowledge may be processed in mathematical form – not least within the social and cultural sciences. It will be challenging to find ways to incorporate this knowledge into larger-scale systems studies. Experience from activities with the Millennium Ecosystem Assessment may be useful in this context.
- Development of methods that make it possible to extrapolate in time and space. A vital question is: How can we make the transition from point-based information on species/biological diversity to area-based information that can be utilised in system-overarching and multi-disciplinary analyses?
- Development of new methods to assist in monitoring pollution and the state of the environment, such as methods for data analysis and for the development, testing and operationalisation of persistent, communicable indicators and key figures. This may encompass methods that utilise remote sensing for ecosystem and landscape studies, as well as biotechnological and genetechnological methods for research on pollution and biodiversity. Studies of how such knowledge may be used in various decision-making processes are also important.

Research findings are intended to facilitate the implementation of measures, the evaluation of goal achievement and efficacy of measures, and the dissemination of information to national and international users. The development of modelling tools under the programme must therefore incorporate an action-oriented perspective.

4.3.2 Thematic area SOCIETY

Objective: The thematic area SOCIETY is designed to cultivate knowledge about basic societal conditions that prevent and/or promote the sustainable use and management of the natural environment. Research is intended to generate insight into both formal and informal societal framework conditions and how these affect environmental development. It is also intended to shed light on the national and international conditions for political action as well as to acquire knowledge about the interests and value choices of different national and international players. Action alternatives will be further developed under this thematic area through the provision of knowledge about sectoral and cross-sectoral strategies and instruments and insight into the considerations and obstacles of significance for satisfactory goal achievement. The thematic area SOCIETY is designed to generate greater insight into various perspectives on environmental problems, as well as into the factors that affect strategy development and implementation of problem-solving instruments and measures. This is elaborated in the points below:

1) Societal and cultural perspectives on environmental problems

- Sustainable development and technological changes: What is the significance of the globalised economy and globalised markets for sustainable development? What characterises the interplay between economic growth and sustainable development? What are the effects of new products and production methods? What has an impact on “green” innovations and the phasing-out of products and technologies? How does market competition function in relation to environmental problems – as a component of policy solution models and/or as encouragement of short-term harvesting?
- Institutions: There is a need for knowledge about the interrelations between the organisation of economic activity, economic growth and sustainable development. In this context, what is the significance of how the government administration is organised and interprets these issues? What are the roles played by globalisation, international agreements and regulations? How are responsibilities for commercialisation or public administration of common benefits shared and exercised? What are the characteristics of various environmental strategies in trade and industry versus non-governmental organisations (NGOs)? How is trade and industry’s social responsibility for environmental problems followed up? What is the significance of this for the implementation and results of environmental policy? What is the role played or what could be the role played by local management?
- Cultural conditions: How do cultural conditions – particularly issues of identity and status and consumption norms – affect current environmental problems? What is the role of tradition in business and industrial practice, design of environmental policy and technological development? What is the relationship between humans and nature in various cultures – multicultural societies/perspectives relating to the Sámi people? What are the cultural prerequisites for sustainable development?

2) **Strategies for sustainable development – institutional reforms and instruments**

a) Articulation of values:

- Which methods are effective or desirable for the articulation of values with regard to the environment – the general public's versus experts' assessment?
- How are values shaped and preferences formed with regard to the environment?
- What is the impact of trust and mistrust on the interaction between experts, politicians and the general public when environmental policy choices must be made? What should these relationships be like?

b) Instruments and changes in institutional and policy framework conditions:

- How can the use of various instruments – economic, legal and informational – promote more environment-friendly choices and adaptation among individuals and business enterprises? What characterises environment-oriented behaviour among these players?
- What motivates different players' actions in relation to environmental problems? What motivates their actions in relation to the actual use of instruments and their adaptation to this use of instruments?

c) International strategies and frameworks:

- How can changes in international treaties and regimes as well as EEA legislation create conditions that promote sustainability? How can Norway best safeguard its interests and fulfil its commitments in relation to these types of agreements?
- How can Norway effectively fulfil its commitments in relation to developing countries as set out in multilateral agreements?

d) Knowledge, knowledge certainty, risk assessment and the burden of evidence:

- What is the normative basis for different methods of institutionalising risk assessment and the burden of evidence? What are the effects of various types of control of decision-making processes, risk assessment, the burden of evidence and responsibility with regard to environmental impacts and economic development?
- Which requirements and limitations are posed by international and EEA legislation with regard to risk analysis and options for burden of evidence, and which conflicts exist between the various legal principles?
- What is required to give scientific findings status as knowledge and to use them as a basis for decision-making and practice in public administration and industry? What characterises the balance of power and interactions between scientific knowledge and experience-based, lay knowledge with regard to various environmental problems and management challenges?

e) Changes in economic systems:

- What effect can changes in the more basic principles for organisation of the economy on the ability to realise sustainable development?

3) **Towards sustainability in practice**

- Which changes in production and consumption patterns are needed to counteract environmental problems, and how can these changes be implemented? How can rebound effects be counteracted?
- What are the key conditions needed for the development and phasing-in of environmental technology and environmental practices? How can substitution

opportunities be generated and exploited with regard to hazardous substances and environmentally damaging processes?

- How can political and management strategies in key environmental areas facilitate goal achievement? What is the significance of political, legal and economic frameworks in this context? Which contributions do or can civil society and NGOs make, and how can legal frameworks and other types of frameworks promote participation? Studies of decentralised management responsibility, expanded participation, and local management schemes when these are established at, for example, the industry level.
- What is the significance of the decision-making process itself for the level of conflict and ability to find solutions to environmental problems? How can processes aimed at achieving a balance between use and conservation and processes for handling conflicts between various interests be improved?

4.3.3 Thematic area LAND

Objective: The thematic area LAND is designed to enhance the knowledge base for long-term, cohesive use and management of the landscape and its natural and cultural assets and values. Research will encompass basic research questions relating to landscapes, terrestrial biodiversity, cultural heritage and outdoor recreational activities at all levels in a unified perspective. There is a need for knowledge about the processes, effects and instruments at various scales of time and space and along ecological gradients. Research will cover natural diversity, semi-natural ecosystems and genetic resources in agriculture. It is intended to provide a basis for designing strategies for sustainable development and for enhancing value creation within a sustainable framework. Research will also explore the interactions between various stakeholders, players and drivers with regard to management of resources and changes in these. Research is intended to generate knowledge about how global drivers and processes of change affect the state of the environment, about the framework conditions and opportunities that are inherent in international policy and agreements in this area, and about how research can contribute to the design of more effective solutions to environmental problems, also internationally. This is elaborated in the points below:

1) Basic knowledge about resources and diversity – systems, processes and assets/values

- What are the dynamics of the dominant terrestrial ecosystems? Which ecosystem functions can be identified, and what is the significance of biological diversity for these? What are the functions of the various species in these ecosystems? How do patterns of diversity vary as a result of different variables? What is the genetic variation within and between populations, and what are the processes that govern this variation?
- What characterises the population dynamics of wild game and what are the roles of game in ecosystems? What are the interactions between various species of game and trophic levels – for example, between species of large carnivores, between large carnivores and prey, between large carnivores and mesopredators,

- between species of ungulates, between ungulates and domesticated animals, between ungulates and vegetation, smaller herbivores and biodiversity in general?
- How can the assets and values of the landscape be identified, and what are the synergies and dynamics between them? What is the social significance of the landscape and the cultural environment as arenas for cultural interaction and identity, and how can the assets and values of the landscape be incorporated into the societal development process? How can biological diversity and cultural heritage together contribute to an in-depth narrative about the landscape – yesterday and today?
 - Development of mapping methods and vulnerability analyses of cultural environments under pressure in the north, along the coastline and fjords, in the mountains, and in semi-urban areas as the basis for integrated management.
 - What characterises the cultural environments and cultural landscapes of the Sámi people and the complex, dynamic cultural environments in the north, and how are business combinations and interrelations reflected in these? What are the past and present multicultural perspectives on the cultural environment, and what is the effect of different variables and framework conditions on understanding these? What is the significance of gender as a variable for understanding, management and use?
 - Changes in participation in outdoor recreational activities in time and space; trends. What is the significance of outdoor recreation for the quality of life, as a factor in shaping attitudes, and as a condition for environmental policy measures? How is opinion formed, and how does socialisation occur with regard to outdoor recreation, including obstacles to participation?

2) Causes/pressures/drivers

- What is the significance of various national and international drivers for changes in landscapes, ecosystems, cultural heritage and the cultural environment?
- Which pressures are ecosystems and biological diversity exposed to, what is their relative significance, and what are the direct and indirect causes of these pressures?
- How do different production practices, forms of use, and cessation of use affect biological diversity and cultural environments in various ecosystems, at the ecosystem level and for individual species and types of cultural heritage?
- How do economic and social processes of change affect environmental management in traditionally resource-dependent areas? Is it possible to identify social mechanisms of a more general character?
- How do urbanisation processes affect the landscape, the natural and cultural environments, and outdoor recreation at various scales of geography and time, including impacts on the built environment and cultural layers in cities?
- How do various forms of outdoor recreation affect participants' views on nature and the environment? What are the environmental and societal prerequisites for maintaining the breadth and quality of outdoor recreational activities? How does increasing commercialisation affect outdoor recreation and its relationship to the landscape, and how can common access rights be affected by commercialisation?

3) Effects

- What are the effects of the dispersal of harmful non-native species and organisms and genetically modified organisms on ecosystems? What are the means of dispersal and dispersal potential?
- How effective are various management measures – including strategies for hunting and harvesting, use of financial instruments and regulation of land use – for ensuring the conservation and sustainable use of various types of nature, populations and endangered species, with particular focus on carnivores and ungulates?
- What are the effects of large-scale processes of change and the cumulative effect of a variety of pressures on the viability of environmental resources – landscapes, ecosystems, species, types of nature and cultural environments? There is a need for greater knowledge about the effects of grazing, changes in land use, and infrastructure and industrial development, among others.
- How do changes in agricultural and off-farm economies, views on nature, attitudes and opinion forming affect the development of the natural and cultural environments?
- What are the effects of various forms of decentralised authority on management of the natural and cultural environments, and how does the delegation of authority contribute to reducing management conflicts?
- What are the effects of urban development and growth on the landscape and its natural and cultural assets and values in cities and city peripheries, including the built environment and conserved assets and values in cultural layers in cities?
- What are the effects of providing physical facilities for outdoor recreation and implementing information measures with regard to patterns of use, problems with wear and erosion caused by recreational activities, and reducing conflicts?

4) Strategies, measures and instruments

- Which strategies for the sustainable use and conservation of the landscape and the safeguarding of landscape assets and values are viable for implementation? What are the institutions, players and sectors that these would involve? Which interaction models, characterisation systems and management tools can improve the implementation and follow-up of the European Landscape Convention?
- What do effective measures and management strategies for maintaining biological diversity comprise, and what are the prerequisites for the implementation of these?
- Which measures can reduce the risk of dispersal of harmful non-native species and genetically modified organisms?
- What is the political and institutional position of outdoor recreation in society? How can we resolve conflicts between outdoor recreation and other interests, between different recreational activities and user groups, and between commercial and non-commercial outdoor recreational activities?
- What characterises satisfactory planning of areas for outdoor recreation, including conservation areas? How can outdoor recreation be incorporated into physical planning at the local and regional level? How can we facilitate outdoor

- recreational activities for different population groups with different needs and backgrounds?
- How can we restore previously developed areas and areas under heavy pressure, making them healthy areas for nature and outdoor recreation? Which factors are important for gaining the acceptance of such measures from among the relevant parties?
 - How can hunting be understood and further developed as a management tool, a meaningful cultural phenomenon, and a form of sustainable use of resources in wilderness areas?
 - What are the interconnections between the roles of environmental quality, cultural heritage and cultural environments in the context of value creation? What is the overall impact of management ideology and practice with regard to cultural heritage?
 - What are the most effective ways of securing the conservation and preservation of cultural heritage and its materials?
 - Which perspectives should be employed with regard to the use and management of landscapes in the Northern Areas and their natural and cultural assets and values?
 - What types of policy and which models for management, use of instruments and allocation will promote coherence between local governance and other (extra-local) interests and needs, between use and conservation, and between private value creation and the public good? Which payment models are of relevance relative to the common benefits in the landscape?
 - What types of guidelines do international agreements provide for Norwegian use of wilderness areas? What forms of interaction and conflict arise in the interface between international framework conditions and national policy? How can we develop management models that can balance the relationship between international commitments with local participation and autonomy in a sustainable manner?

4.3.4 Thematic area WATER

Objective: The thematic area WATER is designed to enhance knowledge about ecosystem processes, including freshwater aquatic ecosystems, and the effect of pressures on limnic ecosystems. Research is intended to facilitate knowledge-based management of limnic ecosystems and sustainable multi-species management, with particular focus on wild salmon. The Environment 2015 programme encompasses research on all stages in the life-cycle of wild salmon, including the marine stage. Both basic research on biodiversity and more user-oriented research on species management play a key role. Research is intended to shed light on the diversity of interests and opposing interests linked to different uses of water in a recreational, economic and cultural perspective. Research will also address the knowledge needs relating to the requirements of the EU Water Framework Directive.

1) System and process understanding

- How can the dynamics of the aquatic ecosystems, including the biological systems, be described and analysed? What characterises non-linear threshold responses and how can these be predicted?
- What are the critical factors in turnover and biogeochemical cycles in freshwater systems?
- Development of models and methods for the upscaling of process understanding and observations of the whole river basin and watershed, including the relationship between hydrological and ecological process interactions.
- What are the necessary conditions for maintaining and renewing strong, productive stocks of wild salmon in time and space? Which mechanisms of stock regulation are crucial for freshwater and seawater salmon? What are the dominant threats to stocks of wild salmon?

2) Direct and indirect causes of changes in environmental status

- What are the direct and indirect causes of increasing quantities of nutrients and physical intervention in river basins and watersheds?
- What are the direct and indirect causes of dispersal of harmful non-native species?
- What are the overall effects of multiple simultaneous environmental pressures?

3) Effects on resources

- What are the ecological and economic effects of dispersal of harmful non-native organisms in freshwater systems, and what is their impact on biological diversity?
- What are the effects of various physical interventions and other changes in river basins and watersheds?
- Development of models that can generate greater understanding of the effects of different levels of remedial action.

4) Measures and instruments

- Contribute to the knowledge base for the implementation of the EU Water Framework Directive in relation to biological diversity, ecosystem processes and anthropogenic influences in freshwater.
- Identify suitable biological indicators and classification systems for sound ecological status in freshwater bodies.
- What is the relationship between measures for freshwater systems and the environmental effects of these measures?
- What are the effects of restoration (by limestone dissolution) on acidified bodies of water, with particular focus on key organisms such as fish?
- What are the necessary conditions for sustainable management of harvestable freshwater fish stocks and use of freshwater resources for outdoor recreational activities?
- Which measures and instruments can be implemented to limit and prevent damage caused by dispersal of harmful non-native species in freshwater systems?

- Which measures and management strategies will effectively conserve viable stocks of wild salmon and enhance value creation?
- What characterises various players' conditions for action and motives with regard to management measures for freshwater systems, with particular focus on wild salmon management?

4.3.5 Thematic area POLLUTION

Objective: The thematic area POLLUTION encompasses basic and applied research questions relating to the entire pollution chain, from sources (including waste) to distribution, exposure, and effects of pollution on mechanisms, individuals and ecosystems, the cultural environment and outdoor recreation, through to measures and instruments. Research will cover air pollution, groundwater pollution, freshwater pollution and pollution of terrestrial environments. Activities will include documentation, distribution mapping, and evaluation of the effects of environmentally hazardous substances. Research on the growing influx of natural substances with damaging effects also lies within the scope of this thematic area. Research is intended to generate greater knowledge about the cumulative effects of pollution over time, as well as to strengthen the scientific basis for risk analysis and for management regimes that safeguard a clean natural environment in Norway, also in the Norwegian Arctic. Research is further intended to provide knowledge about the effects of measures and instruments, to contribute to reducing exposure to pollution and to develop tools for this purpose, as well as to acquire knowledge about the links between drivers and framework conditions with regard to the origin and distribution of pollution.

1) System and process understanding

- Which levels of various pollutants cause damage to organisms and ecosystems? What is the recovery time needed for environmental damage caused by pollutants?
- Development and verification of methods and models for predicting distribution, levels and effects of pollution, also in an ecosystem perspective.
- What is the significance of long-range transboundary pollution versus local and regional distribution, also in the Northern Areas?
- Development of methods for documenting and mapping distribution of new hazardous chemicals, including food chain transfer.
- How do changes in biogeochemical cycles interact with distribution and release of hazardous chemicals and other substances with regard to pollution?

2) Direct and indirect causes of changes in environmental status

- What are the direct and indirect causes of the origin and distribution of pollution? Which underlying economic, cultural and societal conditions can play a role in reducing levels and distribution of pollution?

3) Effects on resources

- Effects of pollution in an ecosystem perspective, transport and accumulation of pollutants in the food chain: What are the effects of the pollution stress (both individual substances and mixtures) on various ecosystems, and what are the interactions between pollution and other environmental pressures (for example, eutrophication and other natural and anthropogenic stress factors)? What are the long-term effects of hazardous chemicals and other pollutants on organisms, populations and ecosystems?
- What are the pollution risks in agriculture associated with the use of pesticides, the accumulation of pesticide remnants in the food chain, and pollution in wet organic waste used as fertiliser?
- What are the effects of distribution of nanoparticles and other environmental impacts of nanotechnology, and how can these be dealt with?
- What is the significance of various sources of radioactive pollution? What are the most important transport and distribution mechanisms, modes of uptake, and biological effects of this type of pollution?
- Research on the development and verification of methods for evaluating chemical substances without using experimental animals (particularly with regard to the EU REACH system).
- Development of methods for documenting pollution effects for use in ecologically-based risk assessment.

4) Measures and instruments

- Development of prognosis models, observation methods, and risk and consequence analysis that can facilitate policy design and improve management.
- Development of improved tools to determine the value of resources, pollution effects, uncertainty, and the precautionary principle, including the definition of threshold limits for nutrients and natural harvestable resources.
- What is the significance of environment-friendly crop production methods and organic production for pollution in agriculture? What is needed to increase the use of such methods in agriculture?
- Which regimes and specific instruments are best suited to motivate the implementation of cost-effective measures and development of new technologies?
- How can we achieve effective international agreements, including EU regulations, to prevent the spread of hazardous chemicals?
- What impacts do the various sectors and industries have on the distribution of pollution and on the natural and cultural environments? Which strategies can be implemented to limit these impacts, including strategies focusing on ethical and environmental issues? What characterises the interaction between players in the private sector and the use of instruments in the public sector with regard to pollution?

5 Steps to ensuring satisfactory distribution of tasks and cross-disciplinary cooperation at the national level

Collaboration with other programmes at the Research Council

The knowledge needs for several key, high-priority thematic areas, such as biological diversity and hazardous substances (health and environmentally hazardous chemicals), are addressed under other research programmes at the Research Council as well. Certain activities under the Environment 2015 programme will also be relevant in the context of the Research Council's Focus on the Northern Areas initiative. Therefore, a major task for the programme board will be to encourage close cooperation with programmes that share an interface with the Environment 2015 programme. This is particularly relevant for the following programmes:

- The NORKLIMA programme (Climate Change and its Impacts in Norway) shares an interface with regard to the importance of climate development and climate change for the research topics under the Environment 2015 programme. This is an important interface because climate change will affect the ecosystems, landscapes and pollution processes studied under the Environment 2015 programme. As a general rule, research with a primary focus on climate change and its impacts will lie within the scope of the NORKLIMA programme. Research on the interplay between climate change and other pressures may be addressed by the Environment 2015 programme as well.
- The RENERGI programme (Clean Energy for the Future) shares an interface with the Environment 2015 programme on research on wild salmon and freshwater systems in relation to hydroelectric power plant development and climate policy. The RENERGI programme has the primary responsibility for research on the environmental impact of hydroelectric power plants and for social science research on international climate policy. Coordination will be needed to ensure satisfactory delimitation of boundaries between the two programmes.
- The AREAL programme (Area and Nature-based Industrial Development) shares an interface with the Environment 2015 programme with regard to area management, environmental questions and industrial activity. The AREAL programme encompasses research on the sustainable use of area for industrial purposes, use of nature facilities and the role played by cultural landscapes. The AREAL programme also emphasises the need for research on management that creates a balance between industrial development and conservation. Addressing these research questions will require good coordination of strategic activities and calls for proposals between the two programmes.
- The HAVKYST programme (The Oceans and Coastal Areas) shares an interface with the Environment 2015 programme with regard to research on pollution and wild salmon in particular and ecosystems in general. The most important areas of overlap are related to relevant general research on pollution, research on the marine stage of wild salmon's life-cycle and research to meet knowledge needs generated by the EU Water Framework Directive.

- The HAVBRUK programme (Aquaculture – An Industry in Growth) shares an interface with the Environment 2015 programme with regard to research on wild salmon.
- The MILGENHEL programme (Environment, Genetics and Health) shares an interface with the Environment 2015 programme with regard to research on pollution and genetically modified organisms (GMO). The MILGENHEL programme addresses some of the same research questions on pollution, but from the perspective of impacts on human health.
- The DEMOSREG programme (Democracy and Governance in Regional Context) shares an interface with the Environment 2015 programme with regard to local and regional planning and decision-making processes.

The Environment 2015 programme board will initiate contact with these programmes in connection with the development of action plans and calls for proposals to promote adequate coordination with regard to scientific objectives. In general research programmes at the Research Council must avoid issuing double or overlapping calls for proposals and ensure that research activities complement those of other programmes. The Environment 2015 programme is also open to cooperation with other programmes on conferences, meetings and other dissemination activities.

Links between basic and applied research

It is essential to improve interaction between basic and applied research, and encourage closer cooperation between researchers conducting basic and applied research respectively. In this context the Environment 2015 programme will promote more extensive collaboration between various scientific and research communities in Norway. Priority will be given to researcher projects and competence-building projects with user involvement. Specific measures will be indicated in each individual call for proposals and will be adapted to the relevant research questions.

Recruitment

It is vital to maintain and further develop existing national expertise in individual areas of environmental research. This is also true for cross-disciplinary expertise in environmental research. (See the following chapter.) The Environment 2015 programme will utilise doctoral fellowships as a means of training new researchers, and will offer post-doctoral fellowships as a means of further developing the expertise acquired by newly educated doctorate holders.

6 Budget, with distribution among primary activities

The initial budget for the Environment 2015 programme is NOK 67.4 million for 2007. This will give an overall budget of NOK 677 million in the period 2007-2016.

The following ministries have contributed funding to the 2007 budget (in NOK 1,000):

Ministry	Environment	Agriculture and Food	Fisheries and Coastal Affairs	Education and Research	Foreign Affairs	Trade and Industry	Finance
Total	44,550	14,150	1,500	5,040	1,500	500	200

Environmental research under the Environment 2015 programme has a broad scope and encompasses a wide variety of research questions. The knowledge gained under the programme will be relevant for a large number of players in society, including trade and industry as well as the government administration. The long-term target of an annual programme budget of NOK 100 million has been set after an assessment of the realistic funding opportunities that will facilitate adequate goal achievement. The programme board would like to point out that an annual budget of more than NOK 100 million will be required to meet the actual knowledge needs, and emphasises that even with a budget of NOK 100 million, the programme will fall short of satisfactory goal achievement with regard to the overarching research area CROSSCUT. In the event of smaller allocations, the programme will not be able to meet its targets relating to coordination and integration of environmental research across disciplines and sectors. Further, there will be insufficient funds for enhancing recruitment, internationalisation and long-term competence-building, or to meet the new research needs generated by the Focus on the Northern Areas initiative. It will therefore be impossible to fulfil the aspirations and meet the objectives of this work programme without considerable growth in the programme budget.

Several ministries serve as important sources of funding for the Environment 2015 programme. Allocations are provided from the ministries' posts in the national budget. The primary sources of funding are the Ministry of the Environment (some NOK 45 million) and the Ministry of Agriculture and Food (some NOK 14 million, which includes NOK 5 million allocated under the Agricultural Agreement). Other ministries have also granted allocations, including the Ministry of Education and Research (some NOK 5 million), Ministry of Fisheries and Coastal Affairs (NOK 1.5 million), Ministry of Foreign Affairs (NOK 1.5 million), Ministry of Trade and Industry (NOK 0.5 million) and Ministry of Finance (NOK 0.2 million). In light of the broad consensus that environmental perspectives must increasingly be made an integral component of the development of society as a whole, the need for a substantial increase in public sector funding as well as funding from private sources must be recognised.

Environmental research carried out under the Environment 2015 programme will be important and relevant to a number of ministries and their spheres of responsibility, as well as to trade and industry. It is an established objective to cover a substantial share of the proposed budget increase through larger allocations from the ministries currently providing funding as well as through allocations from other ministries. A substantial increase in allocations from the Ministry of Education and Industry, Ministry of Fisheries

and Coastal Affairs, Ministry of Trade and Industry, and Ministry of Finance will be actively pursued. The Ministry of Transport and Communications, Ministry of Defence, Ministry of Health and Care Services, and Ministry of Local Government and Regional Development should also provide funding to the programme, as it will meet crucial knowledge needs relating to the public administration and trade and industry within these ministries' spheres of responsibility.

6.1 Distribution of funding among primary activities

The Environment 2015 programme continues the efforts of five existing and former research programmes and addresses the priorities of several ministries. The structure of the programme, with four thematic areas and one overarching research area, makes it possible to distribute funding among the thematic areas when issuing calls for proposals. Pre-determined distribution of funding among the thematic areas included in a call for proposals will help to ensure a strategic focus, and will facilitate the grant application assessment process. When distributing funding the programme board will take into account not only the guiding principles established by the individual ministries, but also the allocations that have already been granted over the programme, as well as how to best promote the overall objectives of the programme and the strategy of the Research Council.

Priorities and guidelines may be subject to change over time. In particular, budget increases may facilitate a focus on new research topics. There is therefore no fixed distribution key for funding among the various thematic areas and CROSSCUT. In general the main guidelines below will apply for 2007 and the next few years.

- CROSSCUT: funding redirected partly from the Biological Diversity programme, and possibly from the RAMBU and PROFO programmes.
- SOCIETY: funding redirected from the RAMBU programme.
- LAND: funding redirected from the Changing Landscapes programme and partly from the Biological Diversity programme.
- WATER: funding redirected from the Wild Salmon programme and partly from the Biological Diversity programme.
- POLLUTION: funding redirected from the PROFO programme.

6.2 Level of ambition for the programme and priorities at various budget levels

Three budget scenarios have been evaluated: high-level growth, mid-level growth and zero growth (which should be considered a worst case scenario).

6.2.1 High-level growth (NOK 100 million)

A budget of this magnitude would enable the Environment 2015 programme to fulfil its ambitions and achieve the objectives set out in this work programme, thereby creating new constellations of cooperation, enhancing scientific excellence and promoting broad user involvement in environmental research. Keeping in mind the need to promote new

expertise in areas such as biological diversity, it is first at this budget level that the programme can ensure adequate competence-building. The scope and quality of grant applications submitted to existing environmental research programmes indicate that the Norwegian research community has the capacity to carry out environmental research of high calibre and relevance at this budget level, which would make it possible to issue calls for proposals with budgets in the order of NOK 45 million per year under the programme until its final phase (2014-2016).

6.2.2 Mid-level growth (NOK 80 million)

For the most part research under the Environment 2015 programme will address the knowledge needs of the government administration and other users, and research of this type will be given priority. With a budget of this size, the programme will to a large degree be able to fulfil the intention of consolidating specific thematic areas and an overarching research area under a single strategic environmental research programme. It will allow adequate focus on new knowledge needs, and create a basis for initiating more social science research on, for example, pollution-related topics.

Nevertheless, it will not be possible to address a number of research questions that are vital to innovative and long-term research on sub-topics and across the dividing lines between thematic areas, which in the long run will diminish applied research. At this level, calls for proposals with budgets of about NOK 35 million per year could be issued under the programme until the final phase of the programme.

6.2.3 Zero growth (NOK 68 million) – worst case scenario

Within this budgetary framework, the Environment 2015 programme will only be able to carry out core tasks relating to research within the four specific thematic areas. The programme will not be able to achieve all the stipulated objectives. A budget of this size will result in the same problems that the current research programmes have experienced with regard to generating new research, increasing the proportion of social science-related environmental research and building new, essential expertise. The primary motivation underlying the structural design of the programme, to promote cross-sectoral research and link together environmental topics, would remain unfulfilled. Nor would it be possible to issue annual calls for proposals under the programme, or facilitate new competence-building in a satisfactory fashion.

6.3 Potential sources of funding

Potential sources of funding include the ministries, industry organisations and individual companies, as well as NGOs. The Environment 2015 programme will seek to obtain the necessary increase in funding through larger allocations from the Research Council, as well as by employing knowledge-building projects with user involvement (KMB) – a key funding instrument – to involve players in trade and industry. The Environment 2015 programme has the flexibility to address new research needs arising from the involvement of new sources of funding.

An increase in the budget of the Environment 2015 programme is primarily dependent on additional support from ministries and sources other than those currently providing funding. The Research Council's annual budget proposals will recommend further growth in allocations to the programme. Use of KMBs, and in the longer term BIPs (user-initiated innovation projects), as funding instruments will also help to bring new funding for the programme.

6.4 Priority objectives for various budgetary frameworks

Research activities will be carried out within all four thematic areas – SOCIETY, LAND, WATER and POLLUTION – even with a zero-growth budget. Under a budgetary framework of roughly NOK 70 million, priority will be given to research on processes and systems. This will provide an important foundation on which to build in the event of budget growth. In order to generate relevant, applicable results, the programme will have to set priorities regarding the areas or sectors on which research activities will be focused. At present there is insufficient funding to initiate research on certain topics and questions encompassed by this work programme. The possibility of initiating such research is also dependent on the sources that are providing funding to the programme and their established priorities and requirements. The Environment 2015 programme is designed to be an action-oriented programme, and will therefore initiate research activity on measures and instruments in special-priority areas, even at low budget levels. This will be assessed in connection with the individual calls for proposals. With a lower-level budget, the programme will be largely unable to engage in research targeting other stakeholders, industries and partners than those with whom the programme cooperates today. With a higher-level budget the programme will place greater emphasis on researcher recruitment.

7 International cooperation

The Environment 2015 programme is an internationally-oriented research programme. This implies that the programme will address global research questions relating to the environment and will promote expanded cooperation between Norwegian and international research communities.

7.1 International arenas of cooperation, level of ambition

The Environment 2015 programme will keep close tabs on relevant activities under the following global programmes: the International Geosphere-Biosphere Programme (IGBP), the International Human Dimensions Programme on Global Environmental Change (IHDP) and DIVERSITAS, as well as within the information network Global Biodiversity Information Facility (GBIF). It is essential that Norway participates in these types of networks to facilitate access to information and network-building for environmental research.

The Environment 2015 programme will also be the main channel for the Research Council's participation in the environment-oriented ERA-NETs. The ERA-NET scheme,

which is an instrument under the EU Sixth Framework Programme, seeks to improve coordination and exploitation of research at the European level. The Environment 2015 programme will participate in the SKEP (Scientific Knowledge for Environmental Protection) ERA-NET, as well as BiodivERsA, which covers research on biodiversity. Participation in the ERA-NET scheme will help the programme to achieve its scientific and strategic objectives. Cooperation on international joint calls for proposals will be funded over the programme budget.

8 Communication

An overview of the programme's communication plan can be found in the Environment 2015 action plan for 2007. Communication activities are described in brief below. NOK 200,000 per year will be earmarked for dissemination and communication activities under the programme.

8.1 General information and profiling

Information for grant applicants and programme users will be publicised on the Environment 2015 programme's website on an ongoing basis. The programme will also be profiled at conferences and through participation in relevant discussions on environmental research. A designated staff member in the Research Council administration will have the primary responsibility for information, profiling and dissemination activities for the programme.

8.2 Dissemination to relevant users and the public at large

Popular science publications, conferences and small-scale seminars at which researchers and users of research findings can meet will be the main channels for dissemination to users. Dissemination activities will consist of both broad-based and more narrowly focused activities relating to the specific thematic areas. Another important objective is ensuring that many projects maintain good ongoing user contact and involvement in the research process.

9 Performance targets, success criteria, milestones and performance indicators

Performance target no. 1: High scientific merit

- Promote environmental research of high international quality.
- Develop research groups that are active in the international arena and leaders in their field.

Performance indicators for performance target no. 1:

- Number of publications in scientific peer-review journals.
- Number of publications in other scientific and/or professional journals.

- Number of professional books or monographs.
- Number of lectures and/or posters at international conferences.

Performance target no. 2: Enhance researcher recruitment

- Assist researchers in developing extensive expertise within the programme's scientific thematic areas.

Performance indicators for performance target no. 2:

These indicators will be reviewed and quantified.

- Number of completed doctoral degrees funded under the programme.
- Number of doctoral fellowships funded under the programme.
- Number of post-doctoral fellowships funded under the programme.
- Number of researcher man-years.
- Gender distribution of researcher man-years. Goal: minimum 40 % of each gender.

Performance target no. 3: Good user involvement

Performance indicators for performance target no. 3:

- Number of projects with user involvement. Goal: 20 % distributed among various types of users.
- Number of user seminars in connection with strategic processes (planning of calls for proposals, dissemination, etc.). Goal: Two per year.

Performance target no. 4: Enhance relevance and cross-disciplinarity in environmental research

Performance indicator for performance target no. 4:

- Percentage of funding allocated to cross-disciplinary projects involving the natural sciences, the social sciences and/or the humanities.
- Percentage of funding allocated to projects dealing with public instruments and policy.
- Number of projects that have resulted in Official Norwegian Reports, Reports to the Storting, etc.

Performance target no. 5: Strengthen international cooperation

- Lead the effort to expand cooperation with leading international research communities in the field.
- Place priority on participating in international research cooperation and international network-building.

Performance indicators for performance target no. 5:

- Number of projects incorporating collaboration with international research groups.

- Number of fellowship-holders/researchers on a longer research stay at an international research institution (minimum three months).
- Number of international guest researchers involved in projects.

Performance target no. 6: Satisfactory dissemination of research findings

Active dissemination efforts that include a synthesis of the programme's research findings and recommendations for how these can be followed up.

Performance indicators for performance target no. 6:

- Number of open scientific seminars and workshops.
- Lectures at scientific meetings.
- Dissemination measures targeting government administration.
- Media coverage in the written press, radio and TV.
- Number of popular science publications.

Performance target no. 7: Budget increase

Performance indicator for performance target no. 7:

- A programme budget of NOK 90 million in 2009.

10 Milestones and progress

10.1 Milestone plan

The following is a short summary of milestones for activities under the Environment 2015 programme.

Milestone and activity	Time-frame	Financial framework
Call for proposals I	Application deadline 2007, project start 2008	NOK 60 million per year for 3-4 years
Preparation of state-of-the-art review	End of 2007	
Scientific meeting	Mid-2008	
Potential international cooperation and joint call for proposals under the SKEP ERA-NET or BiodivERsA	First half of 2008	Decision to be taken later, dependent on the topic
User seminars	First half of 2008	
Call for proposals II	Application deadline 2008, project start 2009	NOK 40 million per year for 3-4 years
Programme conference	First half of 2009	
Call for proposals III	Application deadline 2009, project start 2010	At zero growth, NOK 35 million per year for 3 years

11 Organisation

The Environment 2015 programme board is composed of members with backgrounds in environmental research or government administration or who represent other users of environmental research. Support is provided by a programme coordinator at the Research Council and a secretariat comprising former scientific and executive officers from the previous environmental research programmes.

Delegation of responsibility and authority

The programme board is responsible for setting research-related priorities, issuing calls for proposals and approval of grant awards under the programme. The Research Council administration supports the programme board by preparing matters for discussion by the programme board, helping to ensure compliance with Research Council guidelines and clarifying important issues from the Research Council's governing bodies (Division Boards and the Executive Board).

Advisory groups

Four advisory groups will be appointed for a period of three years to support the scientific activities within the four thematic areas under the Environment 2015 programme. The advisory groups each have a specific mandate for their activities. They are responsible for supporting the programme board by providing scientific input for steering documents as well as by participating in grant application assessment. The programme board will determine the input needed from the advisory groups in relation to the relevant research questions and calls for proposals.