NATURAL ENVIRONMENT RESEARCH COUNCIL

DELIVERY PLAN 2007

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NERC DELIVERY PLAN 2007

1. INTRODUCTION

Rapid economic and population growth are putting increasing pressures on natural resources, and human activities are causing unprecedented changes in the global climate. These major global environmental challenges require solutions from the scientific community and are explicitly recognised in HM Treasury's fifth public policy challenge for the Comprehensive Spending Review 2007 (CSR).

The UK government's Stern Review is the most comprehensive analysis of the economics of climate change ever undertaken. Stern's key economic finding is that, without mitigating strategies, the overall cost of climate change will be equivalent to losing at least five percent global GDP each year, now and forever. In contrast, starting science-driven mitigation and adaptation solutions now would cost around one percent GDP each year. Natural science is critical to quantifying the risk of change and in delivering detailed regional and local predictions of the impacts of climate change to inform mitigation and adaptation strategies.

The United Nations Millennium Ecosystem Assessment (MA) showed the severe loss of ecosystem services across the planet because of human activities and highlighted the need for increased knowledge of biodiversity and its link to ecosystems. For example, 60% of ecosystems reviewed by the MA were being degraded or used unsustainably, a quarter of commercial fish stocks were being over-harvested and a third of freshwater was being drawn from sources that are not replenished.

This Delivery Plan sets out what NERC intends to achieve during the CSR2007 period 2008-2011. The Delivery Plan ensures that NERC deliver towards the former DIUS strategic objectives whilst also working towards BIS'[1] new strategic objective to 'foster a world-class science knowledge base and promote the commercial exploitation of knowledge, global excellence in research and better use of science in Government'.

NERC works in a strategic partnership with the other six Research Councils[2] as Research Councils UK (RCUK), to facilitate and enable the Research Councils to work together more effectively to enhance the overall economic impact and efficiency of activities. The RCUK Delivery Plan reflects the Research Councils' priorities for joint working, and complements the NERC Delivery Plan. NERC, through membership of the Environment Research Funders' Forum widens that strategic partnership to government departments, devolved administrations and agencies to achieve best value for the UK's investment in and use of environmental science and observations. By involvement in major research design and delivery partnerships, notably, the Living With Environmental Change (LWEC) programme, NERC enables government policy to access the best available evidence and opens routes to commercial exploitation of knowledge products.

NERC's purpose as articulated through its mission is to: fund independent environmental research and survey, train and support world-class environmental scientists, ensure that scientific information is applied and knowledge exchanged, and engage society in science issues, NERC Strategy 'Next generation science for planet Earth' 2007-2012, responds to the mission and challenges set out above. NERC's strategic goal is:

To deliver world-leading environmental research at the frontiers of knowledge:

- **enabling society to respond urgently to global climate change and the increasing pressures on natural resources,**
- **contributing to UK leadership in predicting the regional and local impacts of environmental change from days to decades,**
- **creating and supporting vibrant, integrated research communities.**

Meeting this goal will have a very significant economic impact. The Stern and Millennium Ecosystem Assessment reviews show that management of the environment will be a key area in future decades. The UK's international pre-eminence in many of the relevant science disciplines creates a unique opportunity for the nation to play a leadership role in the emerging field of environmental technologies and management, and for its companies to become major players in the new markets that are rapidly developing.

[1] BIS: Department for Business, Innovation, and Skills.
[2] Research Councils: Arts & Humanities (AHRC), Biotechnologies and Biological Sciences (BBSRC), Economic & Social (ESRC), Engineering & Physical Sciences (EPSRC),Medical (MRC) Natural Environment (NERC) and Science & Technology Facilities Council (STFC)

NERC science will deliver economic impact in many ways: it will enable better policy and investment decisions, both by the public and private sector, through enhancing predictive capability and reducing uncertainty. It will support new or improved goods and services, ranging from catastrophe insurance, remote field sensors, carbon capture and storage and better water management. It will indirectly underpin new business sectors, such as renewable energy and carbon trading, by defining the need for these markets. Finally, it will create the skilled workforce that enables the UK to reap the benefits of this new knowledge, whether in direct financial terms or through improved public goods and services.

Although the economic impact of NERC science is already substantial, in the CSR2007 period NERC aim to achieve a step change. NERC's ambition responds to recommendations of the Warry Report, the UK government's 10-year Science and Innovation Investment Framework 2004-14 and delivers towards the BIS strategic objectives. This ambition also reflects its deep appreciation of the need for solutions to the environmental challenges of our time. Environmental science can – and must – play a leading role in addressing these challenges, and in delivering outcomes that enhance prosperity and quality of life in the UK, and in supporting new initiatives on a global scale.

NERC will continue to direct a significant part of its funding through seven strategic science themes to ensure the most critical issues in environmental science are tackled. In addition, through the Living With Environmental Change programme LWEC will drive the multi-disciplinarity required between natural and social science, economics and engineering, and will pull through policy options and business solutions to the challenges of environmental change. NERC will continue to participate in the complementary Research Councils Energy Programme (RCEP), and other cross-council initiatives as described in section 2.

To promote collaboration and strategic focus NERC has appointed Theme Leaders who are scientific leaders in their fields and who will strengthen the expert advice available to NERC in delivering its Strategy and act as focal points for stakeholder engagement within each science theme.

NERC will continue to strongly support responsive funding (Responsive Mode (RM)) and training. This creates the opportunity for curiosity-driven research, training of the next generation of scientists, and helps NERC identify emerging issues and priorities for future NERC strategies. Responsive funding is critical to ensure a diverse environmental science base thrives in the UK for tomorrow's challenges.

Success in delivering world-class environmental science lies with the skills, knowledge and dedication of all the people in the environmental science community, whether they are scientists, specialists or support staff in research centres or universities. NERC needs to ensure there is a thriving environmental sciences community with the skills now and in the future to address the challenges identified in the Strategy and deliver economic impact in the wider community. Environmental sciences particularly rely on attracting people from underpinning disciplines in science, technology, engineering and mathematics.

Environmental research requires extensive facilities and data to enable the research to be carried out. These include ships, aircraft, satellites, access to remote inhospitable locations, supercomputing and long-term monitoring. In CSR2007, NERC will continue to entirely re-structure its funding streams[3] and programmes to make this "national capability" more effective. National capability (NC) comprises expertise and facilities in the basic components of the Earth system, namely: marine; geology; polar; atmosphere; ecology and freshwater; earth observation. NERC research centres provide the long-term continuity and expertise required to deliver much of the essential national capability.

In addition, national capability includes national good activities that NERC carries out for the nation, e.g., maintaining the UK's Antarctic presence and providing the UK national geological survey.

Environmental research also demands a high degree of coordination and collaboration. To encourage this more fully than previously, and to increase flexibility, NERC has opened up the part of its strategic research funding previously devoted to its centres for competition and collaboration with the academic community.

NERC is committed to significant investment across the CSR2007 period to drive programme and support cost efficiencies (EF). NERC will continue to work towards the completion of the CEH restructuring and implement the shared service centre with other Research Councils. NERC will continue to provide funds to increase organisational flexibility at the other NERC research centres.

This Delivery Plan sets out how NERC, in partnership with others, will respond to the critical issue of the 21st century – the sustainability of life on Earth. It is ambitious, and rightly so, for the challenges that NERC face are substantial. It is also highly inclusive, seeking to develop integrated research

[3] National capability is supported through the following activities: environmental survey and monitoring, shared services and facilities, scientific advice, training, knowledge exchange and indirect costs.

communities, and bring scientists together with wider stakeholders, in new partnerships that will deliver both better science and greater economic impact. It sets out how NERC will start to deliver its vision of "Next Generation Science for Planet Earth."

2. RESEARCH PRIORITIES

2.1 Cross-council multidisciplinary priorities

NERC will continue to:

- take a leading role on Living With Environmental Change working with RCUK and other partners.
- contribute to other cross-council priorities in Energy*;* Global Uncertainties: security for all in a changing world; Ageing: Lifelong Health and Wellbeing (through LWEC); and Nanoscience through Engineering to Application.

Relationship of Living With Environmental Change to NERC Strategy

NERC Strategy has been developed with the cross-council priorities in mind, and many of the NERC strategic themes (see section 2.2) contribute explicitly to these cross-council priorities. The activities described in sections 2.1 and 2.2 are therefore complementary.

Relevant NERC thematic research activities that are capable of exploitation by users in the short-to-medium term will contribute directly to Living With Environmental Change. To illustrate this point, an example from the climate system theme is relevant: 'high-resolution climate predictions' are part of LWEC, whereas 'improving knowledge on cloud physics' is not. Similarly, from the biodiversity theme: 'analysing the impact of environmental change on ecosystem services' is part of LWEC, whereas 'characterising novel biodiversity' is not.

Furthermore, the multidisciplinary approach ensures that LWEC elements are delivered in the context of a whole systems approach: users need research which couples prediction of environmental change with social, economic and engineering consequences and opportunities.

2.1.1 Living With Environmental Change (LWEC)

Living With Environmental Change is an interdisciplinary research and policy partnership to increase resilience to - and reduce costs of - environmental change, addressing the associated pressures on natural resources, ecosystem services, economic growth and social progress. It aims to provide the foresight that business, decision makers and people need to meet the challenges and take up the opportunities presented by environmental change.

NERC, ESRC, EPSRC, BBSRC, MRC & AHRC, working with partners in departments of state, governments, and agencies[4] are designing and implementing the LWEC activities across the relevant research areas and policy and industrial sectors. NERC is providing the overall Research Council lead for LWEC and is also leading on Knowledge Exchange within the programme. Together with the Technology Strategy Board (TSB), NERC has established a Business Advisory Board for LWEC and is working with Knowledge Transfer Networks in engaging industry more widely.

Through a 10-year programme of work, LWEC aims to provide:

- whole-system assessments and risk-based predictions of environmental change and the effects on ecosystem services, economies and communities on local-to-regional, and seasonal-to-decadal time scales;

[4] Department for Energy & Climate Change (DECC), Department for Environment, Food and Rural Affairs (Defra), Department for International Development (DfID), Department for Transport (DfT), Department of Communities and Local Government (DCLG), Department of Health (DH), Environment Agency (EA), Local Government Association (LGA), Met Office, Natural England (NE), Scottish Environment Protection Agency (SEPA), Scottish Government (SG), Technology Strategy Board (TSB) & Welsh Assembly Government (WAG).

- integrated analyses of the potential economic, social and environmental costs, benefits and impacts of different mitigation and adaptation responses;
- guidance for more effective sustainable management of ecosystem services, as a foundation for resilient economic development and social progress;
- new technology and infrastructure solutions in the management of environmental change; and
- a more research-informed dialogue and debate about the environmental challenges and choices that NERC face and their economic and social consequences.

In so doing, LWEC directly addresses HM Treasury Policy Challenge 5[5], and responds to key issues and uncertainties arising from the Stern Review, the Millennium Ecosystem Assessment, and the Intergovernmental Panel on Climate Change (IPCC) 4th Assessment.

More specifically, LWEC will deliver the following strategic objectives:

- to predict the impacts of climate change and to promote sustainable solutions through mitigation and adaptation;
- to manage ecosystem services for human well-being and to protect the natural environment in a changing world;
- to promote human well-being, alleviate poverty and minimise waste by ensuring a sustainable supply of food and water;
- to protect human, plant and animal health from diseases, pests and hazards in a changing environment;
- to make infrastructure, the built environment and transport systems resilient to environmental change, less carbon intensive and more socially acceptable; and
- to understand how people respond to a changing environment and develop thriving, cohesive and informed communities.

Outcomes and Governance

Through new research and alignment of partner activities, LWEC will provide knowledge and foresight towards:

- building effective mitigation, adaptation and resilience to climate change, including preparedness for changes to the intensity and frequency of extreme events such as flooding;
- ensuring the availability of, quality, use and management of freshwater resources;
- accounting fully for the economic value of ecosystem services (the benefits people derive from ecosystems that promote human health and well-being);
- developing strategies to address biodiversity loss and deploying effective conservation practices;
- optimitsing the land use system by examining trade-offs at the landscape scale, including the need for ensuring sustainable crop yields;
- managing human, plant and animal diseases;
- developing of sustainable ecosystem management practices that help reduce poverty;
- evolving consumption and production patterns that decrease or alleviate pressures on ecosystem services and support the development of the 'green economy';
- measuring air quality in cities and rural areas with a view to improving health in the UK and in developing areas of the world;
- advising how the built environment, planning and transport systems might best respond to climate change;

[5] HMT Policy Challenge 5: 'Increasing pressures on our natural resources and global climate from rapid economic and population growth in the developing world and sustained demand for fossil fuels in advanced economies.'

- quantifying and managing the interactions between leisure, tourism and the environment;
- developing appropriate strategies for waste management;
- advancing methods for making integrated assessments of climate adaptation plans and proposals that incorporate the economic, social and environmental value of ecosystem services; and recognise the risks involved; and
- addressing public attitudes, perceptions, changing behaviours and collective action in the face of environmental change and its associated uncertainties.

Key NERC Contributions

As the lead Research Council for the LWEC programme, NERC will continue to play a critical role in delivering major contributions including:

- the assessment of the current state of all the ecosystems in the UK to provide the evidence foundation of the ecosystems approach to policy (in partnership with Defra, SG, WAG, DECC and other partners and stakeholders);
- the ecosystems research required to improve sustainable management of ecosystem services, and thus alleviate poverty, in the developing world (Ecosystem Services for Poverty Alleviation (ESPA) programme, in partnership with DFID and ESRC);
- climate and environmental change prediction on local-regional and seasonal-decadal scales, through creating the next generation of high-resolution climate models supported by more strategic observing systems and identification of key feedback processes (key partner: Met Office);
- the research required to inform the preservation of ecosystems and their key services, through developing and applying new techniques to whole-ecosystem biodiversity quantification, its role in ecosystem functioning, and its resilience to environmental change (key partners: ESRC, BBSRC, Defra, Natural England and EA);
- a national strategic decision-making framework for observation of environmental change (key partners: ERFF, Met Office, Defra);
- research to address the urgent need to understand the changes taking place in the water cycle that will underpin better drought and flood management; and
- research into the complex interactions between the biological, social and environmental factors (e.g. climate change, habitat loss, disease and intensive agriculture) that may be responsible for the rapid decline in insect pollinators, particularly bees.

NERC will continue to deliver the required environmental science through implementation of the NERC Strategy in a LWEC context, including adjustment of existing, and investment in, new national capability and research programme activities.

NERC is providing the LWEC partnership with an environmental science lead. It is working with partners to operate strong governance and management principles, launch co-designed research activities relevant to the LWEC strategic objectives, reorient current activities, and continue investing in new activities, so as to deliver an ambitious programme across the partners. Evaluations will play a role in determining the effectiveness of LWEC and the impact of the programmes and activities that constitute it.

Programme scale: £1b across all partners in the 5 years from the first quarter of 2008. NERC's contribution will be approximately £270m by end of 2010/11, which includes major input from the national capability funding stream. NERC anticipates by end of 2010/11 it will have committed approximately £150m to new research programmes with LWEC partners. By the end of 2009, all partners had committed over £450m to LWEC activities and research programmes, with NERC as a partner in many of these.

NERC is participating in a substantial number of LWEC accredited programmes and activities, including:

- Ecosystem Services for Poverty Alleviation
- Environment and Human Health Programme

- Joint Climate Research Programme
- Centre in Understanding and Managing Natural and Environmental Risks
- National Ecosystem Assessment
- The Changing Water Cycle
- Ocean acidification
- Quantifying Uncertainty
- Knowledge Exchange
- Public Engagement
- Tyndall Centre for Climate Change Research
- Land-based renewables
- Virtual Observatory

2.1.2 Energy

The Research Councils' Energy Programme (RCEP) brings together energy-related research and training across the Research Councils to address the outstanding international issues of climate change and security of energy supply. (Research Council partners: EPSRC, BBSRC, ESRC, NERC, STFC).

The Energy Programme will be developed in close co-operation with its sister programme, Living With Environmental Change. Together, these programmes address the broader energy and environmental/climate change challenges in the Treasury's "Long-term opportunities and challenges for the UK" (November 2006), to provide sustainable management of ecosystem services, including energy, for the developed and developing world, while limiting and adapting to environmental change.

Within the Energy Programme, NERC will continue to use national capability and research programme activities to take a whole-systems approach, and will specifically:

- continue to invest in whole-systems energy research and co-ordination through the UK Energy Research Centre;
- investigate (using a whole-systems approach) land-based, offshore and coastal renewable energies' sustainability and environmental (chemical, physical, ecological) opportunities and risks;
- increase knowledge of basin geology to aid industry in locating, developing and efficiently exploiting marginal North Sea oil and gas reserves;
- identify potential UK underground land-based and offshore sites for storage of carbon dioxide from power generation and assess physical and chemical interactions to inform risk-based predictions of long-term sustainability and environmental impact;
- assess gaps in environmental process understanding, linked to nuclear power generation and the underground disposal of nuclear waste; and
- with RCEP partners, ensure that Energy Technology Institute research includes technologies with appropriate environmental relevance, and addresses relevant environmental issues by pull-through from the research base;

NERC investment: £9m p.a. by 2010/11 (total spend over CSR period, £22m).

2.1.3 Other cross-council priority contributions

Some of NERC's strategic research will be relevant to other cross-council programmes. NERC will continue to seek opportunities to align research outputs from its investments with those of the following cross-council programmes:

Nanoscience through engineering to application

Nanotechnologies can revolutionise society. They offer the potential of disruptive step changes in electronic materials, optics, computing and in the application of physical and chemical understanding (in combination with biology) to generate novel and innovative self-assembled systems. (Research Council partners: EPSRC, AHRC, BBSRC, ESRC, MRC, NERC, STFC).

NERC's particular interest lies in the impact of nanotechnology on the Environment. Contributions in this area will use the capacity built by the existing Environmental Nanoscience Initiative to enable better predictions of the risks of nanotechnologies to environmental and human health.

In response to these drivers, a major joint international programme has been developed on the Environmental Behaviour, Bioavailability and Effects of Manufactured Nanomaterials that will involve NERC, EPSRC, EA, Defra, and the US Environmental Protection Agency (USEPA). ESRC and MRC are working to identify ways to align planned investments with this new initiative.

NERC investment: £2.6m over CSR period, leveraging £725K in co-funding within the UK and a further $4m (approx £2.6m) in the US via the USEPA.

Global uncertainties; security for all in a changing world

The Global uncertainties (GU); security for all in a changing world programme will integrate research in crime, terrorism, environmental stress and global poverty, to address causes of threats to security, their detection and possible interventions to prevent harm. (Research Council partners: ESRC, AHRC, BBSRC, EPSRC, ESRC, MRC, NERC, STFC).

Over the CSR period, NERC will continue to place a considerable emphasis on research on environmental change and stresses on natural resources and ecosystem services. Through LWEC, this research will be set in the broader context of human intervention and poverty. NERC will continue to seek opportunities to enable the interaction of this large body of relevant NERC/LWEC research with global security research. Potentially, the most productive area for LWEC GU linkage will concern resilience (e.g. threats to infrastructure from natural hazards).

Minimum NERC investment: up to £1m over CSR period.

Ageing: Lifelong health and well-being

This initiative will establish new interdisciplinary research centres targeting the major determinants of health and wellbeing over the whole life course and reducing dependency in later life. (Research Council partners: MRC, AHRC, BBSRC, EPSRC, ESRC, NERC, STFC).

Over the CSR period, NERC will continue to make significant investments in research on environment and human health in collaboration with other funders. Much of this investment will be as part of the LWEC programme. Any new contribution to the Lifelong Health & Well-being programme would be specifically on environmental factors relevant to age-related aspects of human health.

NERC investment: up to £1m over CSR period, specifically on the ageing component.

Environment Research Funders' Forum

In 2002 NERC played a leading role in setting up the Environment Research Funders' Forum (ERFF), to coordinate and maximise the effectiveness of UK research investment strategy across Research Councils and Government. Through ERFF, NERC has been able to commission an analysis of future skills needs, a framework to decision-test investments in UK observational capability and an online database to expand its knowledge of how much the UK as a whole is investing in different areas of environmental research. NERC's contribution to ERFF adds value by enabling the same benefits to be available to government, industry and citizens. The UK Environmental Observation Programme hosted by ERFF provides a linking pin between the UK and international observational initiatives.

2.2 NERC research priorities

NERC's priorities for the period 2007-2012 are set out in its Strategy 'Next generation science for planet Earth'. Priorities take account of authoritative reviews, including the Stern Review, the Millennium Ecosystem Assessment and the 2007 Intergovernmental Panel on Climate Change (IPCC) 4th Assessment Report. NERC's investment in research priorities (National Capability and Research Programmes) will be £246M p.a. by 2010/11, of which £101m p.a. is through cross-council priorities (see figure 3, section 8).

NERC's strategic science priorities are set out in six science themes and one technology theme, in which key challenges and ways to meet the challenges are identified. The themes are: climate system, biodiversity, earth system science, sustainable use of natural resources, natural hazards, environment and pollution & human health, and technologies. Each theme has been developed with strong research community and user input.

This spending review period provides the first step in delivering the NERC Strategy. In the longer term, NERC funded science will deliver scientific knowledge that informs policy and decision-making, and helps develop solutions to the problems of mitigation and adaptation, for example through the following scientific outcomes:

- climate predictions on regional-local and seasonal-decadal scales;
- improved confidence levels on safety of carbon capture & storage and nuclear waste disposal;
- optimised locations and whole life costs for renewable energy systems;
- detailed analysis of the impact of environmental change on clean water, air, food;
- better assessment of the risk of thermohaline circulation collapse;
- reliable predictions of intensity and track of wind storms;
- improved response to threats from new and emerging pathogens;
- better assessment of whether the current levels of key ecosystem service flows are sustainable;
- better understanding of climate change impacts on key vulnerable regions such as the Arctic; and
- better quantification of environmental exposures to pollutants and the links to health.

2.2.1 Strategic science themes

Climate system
In the global context, NERC will continue to play a leading role in the development of risk-based predictions of the future state of the climate – on regional and local scales spanning days to decades. The predictions will become the foundations on which society can build future mitigation and adaptation strategies.

Biodiversity
The huge variety of life provides a multitude of services from providing food and fuel, purifying water, regulating climate, and disposing of waste, to less tangible benefits that inspire people. This theme is aimed at understanding the role of biodiversity in key ecosystem processes. Environmental change makes this research more pressing because it can lead to loss of biodiversity and biodiversity plays a key role in the resilience of ecosystems.

Sustainable use of natural resources
The global demand for natural resources continues to grow. Society needs better knowledge of how non-renewable (e.g. minerals, fossil fuels) and renewable resources can contribute to a sustainable economy whilst managing resource use within the Earth's environmental limits.

Earth system science
Planet Earth is a complex, interconnected system. To build an understanding of the whole system requires an increase in our knowledge of its component parts and the ways these interact. This theme looks at how the Earth works today, how components of the system have evolved over time in response to changes in other parts of the system, and predicting what will happen in the future.

Natural hazards
Since 1990 over 1 million people have died in natural disasters and over $1 trillion of economic losses have been reported. NERC has a central role to play in the science of forecasting and mitigating natural hazards in the geophysical environment, such as earthquakes, volcanoes, flooding, storms, tsunamis, coastal erosion and landslides. Scientific advances will lead to tangible economic and humanitarian benefits.

Environment, pollution and human health
As the climate changes, so do the behaviour of pollutants and pathogens, and their movement and reactions within the environment, change in different and complex ways. NERC science will provide new approaches to predicting the future behaviour of pathogens and pollutants and provide solutions to issues, such as, disease spread, drinking water contamination and air pollution.

Technologies
Technology will play an essential role in enabling solutions to this century's most pressing environmental challenges. These are directly relevant to many of the challenges being addressed by the other strategic science themes. Technologies are used to observe and monitor the environment, provide sophisticated models of environmental processes to predict the future state of the environment and develop mitigation solutions such as carbon capture and storage.

2.2.2 Implementation

To improve the implementation of the strategic science priorities, Theme Leader roles have been created to provide scientific leadership, promote partnership and champion the science and technology themes. In dialogue with relevant stakeholders, Theme Leaders also develop regularly refreshed Theme Action Plans (TAPs) that identify the investments needed to meet the Strategy challenges and science priorities.

NERC is implementing its first and second TAPs (2008 and 2009). The 2009 TAPs have identified new research programmes to further progress delivery of the strategic science themes, including building on research currently underway and other activities, to run over a five year period 2009-2014.

For TAP1 (2008) NERC committed £55m, levering £40m in co-funding. Below are the 5 largest funding examples:

- Changing Water Cycle
- Ecosystem Services for Poverty Alleviation
- Ocean Acidification
- Technology Proof of Concept
- Storm Risk Mitigation

For TAP2 (2009), NERC will commit £77m. Below are the 5 largest funding examples:

- Arctic Research programme
- Biodiversity and Ecosystem Service Sustainability (BESS)
- Macronutrient Cycles
- Ice Sheet Stability
- Networks of Sensors – Demonstration High Resolution Networks

2.3 Infrastructure

2.3.1 Investing in critical UK capability

Environmental scientists carry out research into the highly complex and interconnected Earth system. Environmental research is founded on knowledge that has been gathered and collated over many decades, often from hostile and remote parts of the world.

NERC research centres provide the long-term continuity and expertise required to deliver much of the essential national capability to carryout environmental science and national good activities. By restructuring funding streams, NERC has ensured Centres continue to play a full role in delivering its strategic priorities, as an integrated part of the environmental science community.

The key tools of environmental science are observations and simulations of the Earth, which place a heavy demand on facilities and equipment. NERC funded scientists use a range of infrastructure including: cutting edge facilities, such as specialist laboratories, Antarctic bases and the Diamond synchrotron; Earth observation satellites, ships and aircraft to access remote parts of the Earth; and high performance computing to simulate models of how the Earth behaves.

NERC's key aim is to maximise the extent to which infrastructure can enable the delivery of science priorities, by aligning science facilities more closely with NERC's science challenges, developing a joined-up approach to facilities by sharing skills and knowledge of what is available across the UK and internationally, and building more flexible and responsive facilities for future science priorities.

International collaboration provides a greater effort to tackling global environmental issues, by providing leverage of expertise and facilities. The UK government's leading role in international global change policy make international partnerships particularly important for the environmental science community. Following negotiations between NERC and Canadian agencies, the UK and Canadian governments have signed a Memorandum of Understanding, establishing a bilateral agreement on access to polar infrastructure and logistics, providing substantial resources. NERC will continue to provide increased access for Canadian scientists to the BAS facilities in the Antarctic and the use of BAS logistics in the Arctic. In return Canada will provide access to their Arctic bases, vessels and aircraft to NERC-funded scientists.

New national centre for marine science: In response to recent reviews and reports, NERC is strengthening UK national capability to deliver the UK Marine Science Strategy and associated marine action plans. In 2010/11 NERC will progress with the creation of a new, national research organisation that aims to work in partnership with the UK marine research community to deliver integrated marine science and technology from the coast to the deep ocean. The National Oceanography Centre (NOC) will be formed by bringing together the NERC Proudman Oceanographic Laboratory (POL) in Liverpool and NERC-managed activity at the National Oceanography Centre, Southampton (NOCS) into a single institution.

2.3.2 Large facilities

Large facilities are essential to the UK environmental science community to carry out much of its cutting-edge research work and enable scientists to deliver on the science priorities. Notably, scientists need to carry out research on all parts of the planet using ships, aircraft, satellite observations and specialist submersibles, and to have access to facilities to analyse and model samples and data.

In particular, during this spending review period, NERC will continue to make new commitments to:

- Replace the RRS Discovery with a ship that is capable of supporting large multidisciplinary science cruises. This is required to avoid detrimental large-scale changes to UK marine science research, to deliver NERC's strategic priorities, and to ensure that the UK's ocean sciences overall ranking as second to the USA in research excellence is maintained. It will ensure that the UK continues to provide strong international leadership. NERC is strengthening its engagement with European and international partners to deliver its shared infrastructure requirements. NERC has designed the capability of its new research ship (to replace the RRS Discovery) using a process that explicitly takes into account both anticipated future strategic needs and the capabilities offered by other nations to which NERC has access through its ship and marine-facility sharing arrangements with the USA, France, Germany, Spain, Norway, Netherlands and Ireland.
- Provide community access to Chikyu, a scientific ocean drilling vessel that is designed to bore to unprecedented depths and attain a long-held goal to penetrate the earth's rocky crust to the mantle, through UK membership of the Integrated Ocean Drilling programme (IODP). The poorly understood mantle is key in the unseen convection processes linked with tectonic plate motion.
- Invest in a joint supercomputer service with the UK Met Office, in addition to continuing use of the RCUK service High-End Computing Terascale Resource (HECToR) managed by EPSRC. The service, called MONSooN, is based at the Met Office in Exeter; and will enhance collaboration between NERC and Met Office scientists. Initially the research will focus on climate predictions, although it is anticipated this will expand into ocean forecasting and weather research. Anticipated outputs will feed into decisions on future climate change mitigation and adaptation strategies.
- Selective involvement in European Strategy Forum on Research Infrastructures (ESFRI) Roadmap projects.
- Complete construction of the Halley VI science base in the Antarctic - to support polar environmental research.

2.3.3 Science and Innovation Campuses

The development of science and innovation campuses provides NERC with a number of opportunities to derive significant synergy from its existing investments. Examples that will be pursued include, on the

Harwell site creating strong links between NERC's EO investments, including National Centre for Earth Observation (partly based on site), with other co-located space programmes, particularly through the International Space Innovation Centre which is currently being developed. The Earth Observation element at Harwell will focus on the production of high-quality global datasets for climate research, and on creating a data visualisation capability to utilise these datasets; these activities will complement the work of the ESA Climate Office, part of the UK ESA Centre also based on the Harwell Campus.

On the Daresbury site, there are opportunities to partner with the Hartree Centre, a proposed computational sciences institute. As part of the Joint Climate Research Programme, NERC will work with the Science and Technology Research Council (STFC) Hartree Centre and Met Office to develop a new dynamical core for UK weather and climate prediction models, designed to exploit the next generation of massively parallel supercomputers.

2.4 Other cross-council programmes/activities

2.4.1 NERC and cross-council investment in people

Cross-council

The Research Councils are committed to enhancing the quality and output of the UK research base through training the next generation of world-class scientists. NERC will continue to work with the RCUK unit on Research Careers and Diversity to ensure the best potential scientists are attracted into research careers and transferable skills are embedded into research training. In particular NERC will:

- continue to work with sister councils through RCUK to increase the efficiency and flexibility of studentship funding processes; and
- continue to support joint NERC/ESRC interdisciplinary research studentships to foster greater interaction between the social and environmental sciences. The scheme will fund about 20 studentships per year and help develop capacity for the Living With Environmental Change programme.

NERC

In addition to the cross-council activities it supports, NERC is undertaking a number of initiatives through the People theme in its Strategy. These initiatives intend to build and strengthen skills and collaborative working across the environmental sciences community. NERC will continue to:

- develop tools that enable us to more accurately understand the skills that exist within its community and create professional networks around those skills;
- produce, with ERFF, an evidence-based analysis to inform strategic decisions on the skills needs by the UK, within the environmental science community over the next decade;
- introduce a new Postgraduate Training Strategy;
- develop new career models, that reflect the variety of employment models and roles within its community and encourage people to work together and to make the best use of the skills of its people;
- define more clearly its expectations of the people NERC employ, and the opportunities NERC provide to them to address new challenges and acquire new skills; and
- develop greater leadership capability in its community and focus training of NERC staff, at and below leadership level, on key areas such as change management and knowledge exchange.

2.4.2 Public engagement

The Research Councils support and promote the flow of authoritative scientific information and exchange of views between scientists and members of the public. This fosters a climate of trust between these groups, contributes to the development of a society equipped to engage with science, enhances knowledge exchange and ensures the supply of the next generation of scientists.

NERC will continue to participate in cross-council public engagement activities and will actively support and influence the development and delivery of the RCUK Public Engagement with Research (PER) Strategy. NERC will help deliver the RCUK PER Strategy through its own PER Strategy to work on environmental issues on which NERC leads, seeking partners as appropriate. NERC aims to:

- work with the public to foster debate and identify attitudes to environmental issues to be considered in the conduct of research and in deciding research priorities; for example, using the public engagement activity on Geoengineering (with the Sciencewise Expert Resource Group and the Royal Society) as a flag ship and basis for future activities in this area;

- engage young people with environmental research to encourage the uptake of environmental science as a research career and to ensure more informed citizens;

- increase public awareness of NERC-funded research, and the impacts that flow from it by informing the wider public of the outcomes of NERC's investment in science; fulfilling its charter obligation to be accountable to the public. This will be a continuing process of science communication via the media, events, publications and websites;

- contribute to the delivery of the public engagement activities for the cross-council themes in which NERC is involved, in particular LWEC;

- engage in dialogue with the public on issues of environmental concern or interest. Topics from its seven strategic science priorities in which NERC leads, e.g. climate, biodiversity, natural hazards, will be selected. Activities such as debates or interactive exhibits will be developed in partnership between NERC Swindon Office and its research centres and other partners as appropriate. Outcomes will enhance knowledge exchange and inform thinking on future priorities;

- encourage and enable NERC-funded scientists to engage with the public and undertake public engagement activities that link science and society, and support and reward those that do so; and

- Continue to participate actively in ERFF's Science Policy Working Group to align best practice across the research community and government.

This Science for All approach to public engagement will help to break down barriers to NERC scientists engaging and being rewarded for it.

3. SUSTAINABILITY

NERC Strategy and this Delivery Plan have placed an increased focus on the delivery of themed, frontier science to address urgent socio-economic problems. It is crucial however, within this prioritisation, to ensure the long term sustainability of the environmental science base and the ability to supply key national good activities. NERC science is crucially underpinned by the excellence of skills in its community, where NERC plays a key role in developing the skills base through its training programmes; and by the provision of key infrastructure (physical assets and data).

3.1 Health of Disciplines

UK environmental science depends on a healthy and diverse research base. To deliver research that meets national and international priorities, NERC needs to ensure that there is a thriving environmental science community with the skills to address the challenges identified in its Strategy. Environmental science involves a wide range of disciplines, most of which are in a reasonably healthy state but which, like many other parts of the science base, generate a high demand for quantitative skills. NERC plays a key role in building the environmental science community through its training programmes, through support for established scientists in Universities, and through developing the staff it employs directly. NERC places particular importance on creating an adaptable and integrated community, in which individuals work together across boundaries to tackle the most crucial issues facing its planet.

The translation of scientific output into economic impact is also highly dependent on well trained scientists with good communication skills and an entrepreneurial 'can do' approach. NERC is committed to the continuation of the payment of 80% of full economic costs on all research grants and fellowships. As set out below, NERC will continue to encourage more young people to develop these skills, in order

to ensure the continuation of supply necessary to sustain both a healthy science base and a healthy economy.

NERC will continue to fund a stock of about 1000 environmental science PhD students to ensure both the breadth and diversity of skilled people within the research base, and that the specific needs of research programmes (RP) and stakeholders are met. In addition, around 370 masters students are supported each year.

NERC will maintain its support for its fellowships scheme, which provides opportunities for outstanding environmental scientists to devote their time to research, developing their research careers, and producing work of international importance. This helps to identify the leaders of tomorrow, and to retain expertise within the UK.

NERC and ERFF are undertaking a significant review of the Skills needs of the environmental sciences community, including research organizations, government agencies, industry and commerce. A major consultation has produced 145+ responses, highlighting the skills employers feel will be needed over the medium-longer term in order to meet the challenges the environmental science community face. This will form the basis for an initial report in June 2010 which will be used to inform organizations which train those in this community and to guide NERC's own Training Strategy. It will be the first in a series of reviews, to be undertaken every five years; it is hoped that as these continue a more comprehensive picture can be created.

By providing scientists with the opportunity to develop their careers, together with its support for cutting-edge areas of science across the full range of NERC's remit, Responsive Mode funding plays a crucial role in sustaining the UK's position as a world leader in environmental science research.

NERC will continue to implement the Responsive Mode Action Plan (RMAP). The rolling annual cycle of RMAPs will identify actions and progress on meeting the needs of a strong and internationally renowned responsive mode. In 2010, NERC will evaluate the extent to which its RM portfolio delivers excellent research and research outputs.

3.2 Sustaining NERC's national capability

National capability enables the UK to deliver world-leading environmental science, support national strategic needs, and respond to emergencies. National capability is supported through the following activities: environmental survey and monitoring, shared services and facilities, scientific advice, training, knowledge exchange and indirect costs.

The nature of NERC science leads us to require access to multiple geographic locations (buildings, ships, aircraft and satellite), and to exploit a range of equipment (including monitoring instruments and High Performance Computing). During this spending review period NERC will:

- continue to develop its national capability, driven by NERC's Strategy, including ongoing development of the mission and organisation of NERC centres;
- maximise synergy between centres' national capability, research programme and commercial contracts;
- maximise synergy between NERC and other providers of observational capability through participation in the UK Environmental Observation Framework (UK-EOF Programme);
- continue to maintain its estate through the NERC Investment Strategy; and
- achieve a step change in accessibility (and thus potential value) by implementing a NERC wide data portal.

NERC will continue to establish governance and management structures and processes that provide a coherent framework for delivering national capability, and clearly identify activities and value them appropriately. The National Capability Advisory Group (NCAG) has been established to provide advice to NERC's Science and Innovation Strategy Board (SISB) and in 2009 provided the first National Capability Action Plan.

3.2.1 National Good activities

Certain elements of NERC activity have society rather than the research base as the primary customer. These activities are often funded from external sources but some are supported by the science budget, for example:

- Antarctic research and footprint;
- meeting national strategic needs and emergencies, such as providing advice on the burial of livestock during the foot and mouth crisis;
- seal monitoring (NERC's statutory duty);
- geological mapping to underpin a variety of services, including homebuyers' data;
- tidal and storm surge prediction;
- modelling and forecasting coastal water environments; and
- maintaining core stores.

4. ECONOMIC & PUBLIC POLICY IMPACT

The emerging green economy provides a wide range of opportunities for environmental science to impact the business community (construction, water, agri-food, insurance, transport etc.) and wider economy. NERC research will enable these sectors to adapt to environmental change and respond to a low carbon economy. For example, providing the evidence and advice to help the water industry to manage supply, demand and delivery, and for the construction industry to develop buildings adapted to future changes in climate and utilise sustainable use of resources. The low carbon economy has resulted in the emergence of other sectors, such as renewables and carbon trading.

The ability to manage ecosystem services sustainably, and to mitigate and adapt to environmental change, will become major sources of competitive advantage in the decade ahead, and will drive the creation of new high-growth industries. With its strong environmental science base, the UK is well placed to play a leadership role in these emerging global markets.

NERC's science themes address issues of major economic, environmental and societal relevance. Its intention is to fully integrate knowledge exchange (KE) and economic impact in the broadest sense, within all its activities. Professional KE skills already are, or will be, embedded within its research centres, and all major research programmes. Science priorities will be determined by Theme Leaders after consultation with stakeholders, and NERC will continue to emphasise continuing dialogue with all its potential research users.

NERC-funded science generates economic impact in differing ways: by providing the objective science to underpin policy and decision-making, and supplying products and services directly to public and private sector users; through commercialising the results of environmental research; and by ensuring the supply of trained, skilled people needed to drive these activities forward. NERC has made a good start but now aim to achieve a step change. In CSR2007 NERC intend to invest £15m p.a. by 2010/11 in KE activities, which are focussed on achieving impact from NERC science. However, this is the 'tip of the iceberg' in that it builds on a far closer alignment of scientific priorities with stakeholder needs that represents a resource commitment of a different order of magnitude. For example, LWEC brings all of the key stakeholders together to ensure that the strategic research supported is closely aligned with areas of economic and public policy benefit. NERC's role in leading KE within LWEC and establishing a Business Advisory Board, together with the TSB, for the programme will help to derive significant benefit and maximise impact.

Leadership

NERC will continue to work with its partners in the Environmental Research Funders' Forum (ERFF) to identify and address areas of research and observational needs, and barriers to the efficient exchange of knowledge, particularly in the context of public policy formulation.

NERC has led in developing strategic partnerships for the LWEC programme. There are now 20 partners: 6 Research Councils, 14 government departments and agencies, the TSB and Met Office (a trading fund). From the beginning of 2009, NERC's lead on KE in LWEC initiated a business engagement scheme whereby NERC seconded up to five individuals from key business networks (including Knowledge Transfer Networks (KTN) run by the TSB, such as the Environmental Sustainability KTN, Sensors and Instrumentation KTN and the TSB itself) to map out the needs of

specific business sectors and implement KE activities in these areas, working across the LWEC partnership. As part of the LWEC KE effort, attention will also be paid to increasing the impact of NERC research on policy and practice in those areas where, to date, the impact of NERC science has been somewhat restricted, for example in areas of responsibility covered by Department of Communities and Local Government (DCLG), Department for Transport (DfT), and local government.

A key element of the UK government's forward strategy with businesses is to develop the green economy. This economy will understand and exploit environmental opportunities whilst recognising constraints and the processes of environmental change. The application of technologies and solutions within this context will deliver competitiveness and environmental sustainability.

NERC plays a key role in the green economy through contributing to the creation of environmental markets, exploiting environmental science, enabling effective policymaking and building resilience into the global economy.

NERC's economic impact action plan, and progress in achieving its objectives, will be reviewed annually by NERC's Council.

Through ERFF, NERC will be leading the development of a UK flooding research strategy to identify priorities over the medium to long term in order to inform future funding decisions.

Influencing

NERC will continue to encourage its community at all levels to increase the economic impact of the research that NERC fund, and seek to develop a positive culture of knowledge exchange. NERC will continue to seek to embed KE in all NERC processes and activities including themes, TAPs, programmes and reporting structures. In particular, NERC will continue to:

- require all its research investments to include an impact plan. In 2008 NERC established the requirement for KE plans to accompany all RM applications. From June 2008 RCUK introduced a requirement for 'impact plans' to be included in RM applications for all Councils (in place of separate KE plans), and NERC will now be implementing the 'pathways to impact' approach;

- refine its guidelines for developing KE plans in programmes and develop systems to monitor them. NERC will require impact plans of the highest quality, and that link in with broader NERC activities so that it develops a critical mass of activity across the UK;

- ensure that KE in national capability and research programmes is appropriately resourced, and financially reward good plans for impact in RM;

- make its existing KE grant schemes simpler and more flexible, introducing bi-annual calls for proposals;

- stimulate entrepreneurial activity by increasing its support for follow-on funding, linking this with proof-of-concept funding from TSB and raising awareness and understanding of commercialisation opportunities in the environmental sciences;

- continue the programme of entrepreneurial training for NERC staff funded by Public Sector Exploitation Fund (PSRE) 4 award;

- promote good KE practice across the academic community through the development of training materials, support for local and regional workshops, in association with RDAs where appropriate, and of networks for professional KE staff in environmental sciences;

- continue to develop the NERC KE network launched in 2007, to spread good practice throughout NERC's major investments, with representatives from most RCCs and major programmes, including creating working groups as necessary; and

- build on the success of the Environment Young Entrepreneurs Scheme (YES), by expanding the scheme to include 20 teams in 2010, to provide training at a very early career stage in the basics of the commercialisation process; and continue to support the RCUK Business Plan Competition.

Engagement

To maximise economic impact, NERC's stakeholders will be engaged at all stages, from the setting of research priorities to the dissemination of results. NERC will continue to give users room for their strategic and technical input on their needs, the style in which they would like us to engage and the mechanisms for taking things forward. NERC will continue to:

- consult with its stakeholders when setting research priorities, creating new strategic partnerships with the public and private sector in areas of common interest;

- increase its support for 'science to policy' and 'science to industry' facilitators to build and manage relationships with its key stakeholders;

- increase the number of students and host organisations NERC supports through secondments in parliament and government. In 2010/11 NERC will have around 11 secondments (increased from 9 in 2009/10, 6 in 2008/09 and 4 in 2007/08); and

- establish a Linking Innovation in NERC project to build a cadre of KE fellows in academic departments. This pilot programme has placed 8 fellows in HEIs in its first phase.

NERC's data and information holdings are national assets that must be made easily accessible by public and private sector organisations and citizens alike. NERC will continue to:

- demonstrate the potential of modern digital technologies to create innovative data and information portals, using science communicators to help 'write the interface' where appropriate; and

- identify and, where possible, support the creation of new data and information products, moving to Information Fair Trader accreditation for all NERC's research centres.

Translating environmental science into effective public policy will be of critical importance in a post-Stern world. NERC will continue to:

- support the policy placements for scientist secondments into government agencies and for policy-maker secondments into academia, to help translate NERC-funded science into practical policy development;

- support the development of training materials and workshops to promote better understanding of science to policy issues across the community;

- maintain and further develop its relationships with environmental policymakers at all levels, from international and national to regional and local. As part of this NERC will continue to commission a project on NERC science needs for local authorities, and take forward the recommendations from this with the Local Authorities Research Council Initiative (LARCI). NERC will also continue to build on its strong relationships with Department for Environment, Food and Rural Affairs (Defra) and Department for Energy & Climate Change (DECC);

- implement with the Met Office, the Joint Climate Research Programme, to ensure co-ordinated research agendas and efficient use of Government funding. NERC will also work with the Met Office Climate Services initiative to accelerate the impact of environmental science on user communities through this partnership; and

Finally, working closely with the TSB (see further below), the Regional Development Agencies (RDAs) and others, to promote rapid take-up and commercialisation by the private sector, including both traditional and 'non-traditional' sectors, of research undertaken by NERC research centres, NERC will:

- drive the commercialisation of research in its research centres, placing particular emphasis on environmental technology and value added data products; and

- use its Public Sector Research Establishment 4th round (PSRE4) award, of c. £1m over 3 years, to hire an Environmental Economist and Market Analyst to form an Emerging Markets Unit[6] to carry out research/industry collaboration workshops, major research sector studies, and an Intellectual Property landscaping exercise.

[6] In this context, 'Emerging Markets' refers to emerging markets in the UK for innovations from NERC science.

Through devolved administrations, NERC will continue to:

- pilot an internship scheme for NERC funded PhD students in Scottish Government;
- place policy secondments for NERC PhD students at the Scottish Parliament Information Centre (SPICe) and at the Members Research Service (MRS) at the National Assembly for Wales.

Demonstrating economic impact

NERC will continue to demonstrate and celebrate the economic impact of the work that it supports in a variety of ways, and will:

- provide early warnings of environmental change to protect society and industry;
- refine its performance evaluation methods, seeking to assess the economic impacts of all its major investments on a rolling basis and improving the way NERC report on economic impact and gather data;
- continue to populate and promote its Science Impacts Database with case studies demonstrating the economic impact of NERC-funded research;
- produce an annual Economic Impact Report, summarising the achievements both of NERC and of the community that it supports; and
- generate sector-focussed publicity materials to illustrate what NERC science has to offer to different business sectors.

Building collaborations with the Technology Strategy Board (TSB)

NERC will continue to develop a close working relationship with the TSB, and envisage potential collaboration in the following areas in particular:

- developing the Technology theme of its Strategy, exploring the potential for co-funded projects in areas such as sensors, instrumentation and data integration;
- translating the output of other strategic themes, in particular Climate System and Natural Hazards, to develop information products for the service sector (in particular, the insurance community and water industry);
- using Knowledge Transfer Networks (KTNs), Knowledge Transfer Partnerships (KTPs) and innovation platforms to increase business interaction with the environmental science community. NERC will continue to establish a flagship KTP programme for the insurance industry with TSB and ESRC. The Maths KTN will work with NERC, TSB and other Research Councils to generate a roadmap linking science with business needs. Within LWEC, NERC will continue to work with the TSB (the Environmental KTN), EPSRC, ESRC and others to map the process of adaptation to climate change for the water sector and to generate roadmaps and collaborative research and development as needed; and
- continuing to work with the TSB to identify opportunities for future collaboration with the construction industry, building on the joint NERC/TSB workshop with this sector held in December 2008.

NERC will continue to aim to develop a continuum of funding for research and development, using TSB co-funding at the early stages of research programmes (to introduce an element of ‘demand-pull’), moving to larger co-funded initiatives where commercial opportunities are identified. NERC will commit at least £5.5m during the spending review period, in collaboration with the TSB.

5. INTERNATIONAL

Global sustainability problems and an understanding of the processes that cause them require knowledge that only the best cooperative scientific effort can deliver. NERC funded scientists collaborate internationally to generate new knowledge and understanding, stimulate technological development and innovation, and provide training. These activities will contribute to enhanced economic growth and alleviation of poverty. International aspects of infrastructure (section 2.3.1) and training (section 2.4.1) are covered in other sections.

The extent of existing collaborations is well demonstrated by the fact that 51% of NERC-funded ISI publications in 2008 were written with international co-authors (an increase of 13% over 3 years). Through interactions of scientists across national boundaries, and scientific pursuits focused on specific areas of the globe (e.g. polar and equatorial regions), NERC will continue to also provide routes for establishing good relationships among countries, enhancing mutual understanding, and improving collaboration and security across international borders.

During the spending review period NERC will continue to:

- address the problems of those most at risk from environmental change, through international collaboration (including with China and India) in the Living With Environmental Change programme;
- increase understanding to help the world's poorest people through the Ecosystem Services for Poverty Alleviation initiative with the Department for International Development and sister Research Councils. This will promote sustainable management of ecosystems in South America, Africa, India and China;
- increase the impact of NERC funding through targeted collaboration with the USA. Specifically, NERC will continue to develop and implement the RAPID-WATCH programme with US (and European) funders, leverage NERC investments to improve its understanding of carbon drawdown in the Southern Oceans, develop partnerships in the atmospheric sciences, and deliver a joint international programme on the Environmental Behaviour, Bioavailability and Effects of Manufactured Nanomaterials with the US Environmental Protection Agency and UK partners (see 2.1.3);
- increase its capability for prediction and impact assessment of tropical monsoons, in partnership with Indian scientists;
- capitalise on the UK Global Science and Innovation Forum's Strategy, and the increased visibility of RCUK overseas, by stimulating collaboration with the science communities in China, India and the USA, and raising awareness of UK research and innovation expertise;
- influence the European Union research agenda, in particular the environment theme of Framework Programme 7;
- support and, where applicable, provide leadership within the global environmental research programmes. This includes hosting the International Polar Year Project Office, and other project offices within the World Climate Research Programme and International Geosphere Biosphere Programme; and
- lead, in partnership with the US National Science Foundation, a new initiative to strengthen strategic engagement between the worlds leading funders of global change research, and funders from emerging economies, in order to increase collaborations on major research programmes.

6. ANNOUNCED COMMITMENTS

NERC has a number of financial commitments that relate to its functions of: giving out research grants, funding international subscriptions, being a major employer, and as an organisation that holds significant estates. A few of these commitments are highlighted below:

Carbon Reduction Commitment

NERC will set up a scheme to comply with our Carbon Reduction Commitment (CRC). Through this, NERC will facilitate the British Government commitment to reducing carbon emissions within the UK by 60% by 2050, in comparison to 1990 levels.

British Geological Survey, Keyworth, Construction Phase II

NERC will complete phase II of the construction project to provide an enlarged, purpose-built data centre for the British Geological Survey (BGS) in Keyworth, designed and constructed to high sustainable and environmental standards. The extension to the existing warehouse will allow consolidation of BGS stores on a single site, with 10 years growth capacity. Project budget £17.7m.

European Space Agency

Earth Observation satellites are becoming ever-more important to environmental science. They provide global, consistent, timely observations which often cannot be collected in any other way. To ensure ESA's Earth observation missions provide the essential data for the NERC scientific community, NERC's funds have been used to contribute to ESA membership, and subscribe to the Earth Observation Envelope Programme (EOEP) and a contribution to the subscription to Global monitoring for Environment and Security (GMES) programme. Current commitment c. £47.1m per annum. Following the announcement of the creation of the UK Space Agency on 23rd March 2010, NERC will arrange the transfer of responsibility for its ESA subscriptions to the new Agency over the coming months. NERC will also work closely with the Agency during the transition period, and beyond, to ensure that the strong linkages between ESA and the environmental science community are maintained in the new structure.

Centre for Ecology and Hydrology (CEH) Transition and Integration Programme

NERC will continue with the CEH Transition and Integration programme to enable CEH to sustain and improve on its position as leading centre in environmental research and monitoring. This will create important synergies across different programmes and disciplines, and improve resources available to carry out first class science. By focusing CEH activities at four sites, significant savings will be made overall in running and maintenance costs so that more funding will be available for science. £17m over the CSR period.

Shared Services Centre

£28m (including £5.5m of interim management charges) over the CSR period. See section 7.2 for further details.

RRS Discovery

NERC will design and deliver the ship to replace the RRS Discovery essential for improving our understanding and prediction of the Earth's environment and continuing to underpin the UK's approach to Earth system science. £12.4m over the CSR period.

7. EFFICIENCY AND EFFECTIVENESS

The RCUK Delivery Plan sets out the requirement for Research Councils collectively to make efficiency savings. NERC is committed to meeting its share of the total efficiency savings. NERC successfully achieved the required efficiency savings for 2009/10.

NERC will be implementing the first phase of its Science Information Strategy during 2010/11. The strategy has been developed to improve effectiveness and efficiency of the acquisition, management, discoverability, reusing and repurposing of NERC's data and information assets across NERC's communities.

7.1 Programme

Cashable savings on programme expenditure are anticipated during this period. These will be realised through increasing the efficiency of Research Council institutes, for instance through CEH restructuring savings. Growing the level of co-funding of research between the science budget and other sources of funding, for instance through commercial contracts or leveraging funding through the LWEC programme.

7.2 Administration

Cashable savings on administration are anticipated during this period as well. These savings will mainly be achieved through reducing the proportion of Research Council expenditure attributable to administration costs. For NERC, it will participate fully in the cross-Council Shared Services Centre, from which the vast majority of savings in this area are envisaged.

The Shared Services Centre (SSC) Project was established in March 2006. The SSC will serve all the Research Councils (headquarters and institutes) for the following business areas:

- Finance;
- Grants processing, including fellowships and studentships;
- Human resources;
- IT and telecommunications (HQs and SSC);
- Payroll; and
- Procurement.

The SSC is already providing IT and telecommunications services to NERC and it is expected that all other services in all the other business areas will be delivered to NERC during 2010.

7.3 Performance Management and Metrics

Efficiency will be increased in CSR2007 through a strategic performance management system and improving the funding allocation and budgeting process to balance priorities and provide flexibility in redirecting resources to new priorities. This approach includes implementing robust business performance management, using a strategic management tool integrated with how to implement strategy to underpin NERC's strategic decision-making.

The first annual review of strategy delivery was carried out February 2010. The purpose of these reviews is to establish progresses in delivery of the Strategy, i.e. what elements of the Strategy have been delivered over the financial period (April-March) and if this meets expectations. The results will help inform whether priorities need to be amended to reflect the evolution of drivers and to respond to emerging issues. These reviews will also help identify the key achievements, outcomes and impacts that will inform NERC's evidence base, including for spending reviews and BIS performance management requirements.

7.4 Asset Disposals

Research Councils collectively have a target for asset disposals of £29m for the CSR2007 period. The annual targets for the financial years 2008/09 to 2010/11 are £9.5m, £2.2m and £17.3m respectively. The NERC share of £2.4m for the CSR2007 period consists of the sale of three sites (Bidston, Monkswood and Penrhos Road). Monkswood was sold for £1.6m in 2009/10. In 2010/11 NERC should receive a one-off payment of £2.7m for lease surrender in CEH Oxford.

8. COMMITMENT INFORMATION

NERC Summary of Investment during the Spending Review Period

Spending Plan[1]

	2007/08	2008/09	2009/10	2010/11
	£m	£m	£m	£m
Administration costs	22	22	21	21
Institutes programme costs	106	118	110	116
International subscriptions[2]	38	41	51	56
Postgraduate training	23	24	24	24
Fellowships	6	8	9	10
Grants	95	104	107	115
Knowledge Transfer and Science in Society	11	13	13	16
Restructuring / exceptional items	17	13	18	7
Near Cash	**318**	**343**	**353**	**365**
Capital (incl Large Facilities Capital Fund (LFCF)[3]	35	32	53	31
Capital Grants	12	13	16	25
Non-Cash	24	29	28	36
Total Spending Plan[4]	**389**	**417**	**450**	**457**
Funding Plan				
Near Cash	322	342	353	350
Capital	36	33	38	26
Capital Grants	11	14	20	24
Non-Cash	20	27	31	36
Science Budget Allocation	**389**	**416**	**442**	**436**
Pending changes				
Near Cash:				
- BIS Foreign Exchange compensation				16
- Solar Terrestrial Physics				2
- STFC				-2
Capital:				
- Discovery Replacement[3]			10	10
- Accelerated Capital				-5
Pending changes			**10**	**21**
Total Funding Plan[4]	**389**	**416**	**452**	**457**
Estimated End of Year Flexibility	**0**	**-1**	**2**	**0**

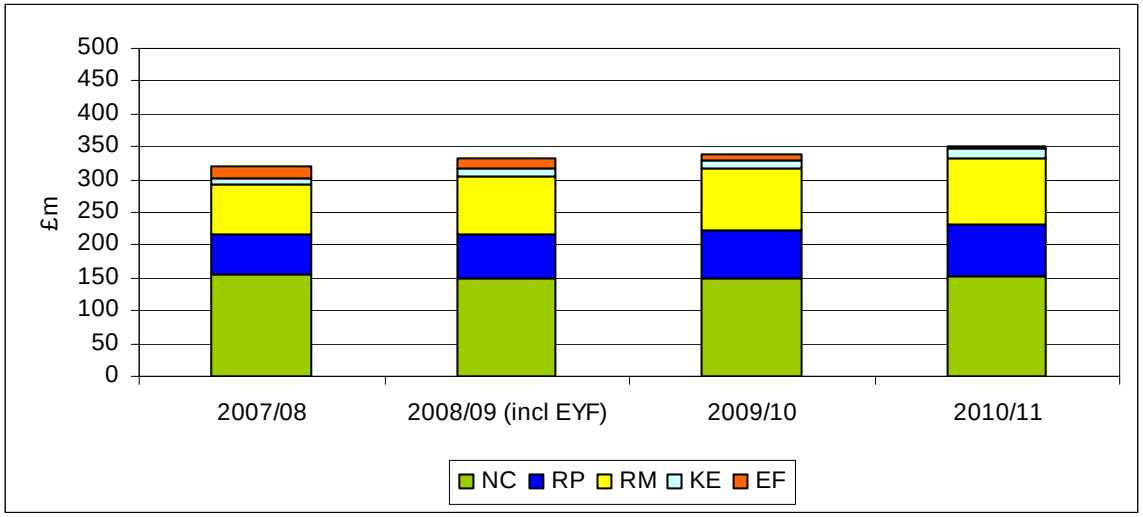
Notes:

1. Figures included are net of external income.
2. Subject to confirmation due to the launch of the UK Space Agency on 23 March 2010.
3. Discovery replacement ship scheduled to start March 2010. LFCF of £48m agreed.
4. Clear Line of Sight and non cash changes not yet included

NB Columns may not add up exactly due to rounding.

- Funding streams have been redefined into national capability (NC), research programmes (RP), responsive mode (RM), knowledge exchange (KE) and efficiency (EF).
- Research themes (including cross-council programmes) will be supported directly by both national capability and research programme funding streams

Figure 1: The breakdown of annual investment (near cash) by the five NERC funding streams over the CSR period



Notes

- National capability comprises expertise and facilities in the basic components of the Earth system, namely: marine; geology; polar; atmosphere; ecology and freshwater; earth observation. NERC research centres, collaborative centres and other service and facilities providers, play a leading role for the UK in managing and delivering this capability. National capability also includes public good activities that NERC carries out for the nation.
- Research programmes use national capability to address short-to-medium term strategic science goals.
- Responsive mode includes training and funding of responsive grants.
- Knowledge exchange includes specific KE funding schemes (e.g. follow-on funding, CASE studentships and KTPs), dedicated support for KE in RM, networks (including KTNs), KE facilitators, science and enterprise fellowships, data and information portals, KE training and workshops, and commercialisation.
- Efficiency includes completion of the CEH restructuring, implementation of the shared service centre, and funds to increase organisational flexibility at the other research centres.

Figure 2: CSR investment (near cash) in 2010/11 in national capability and research programmes

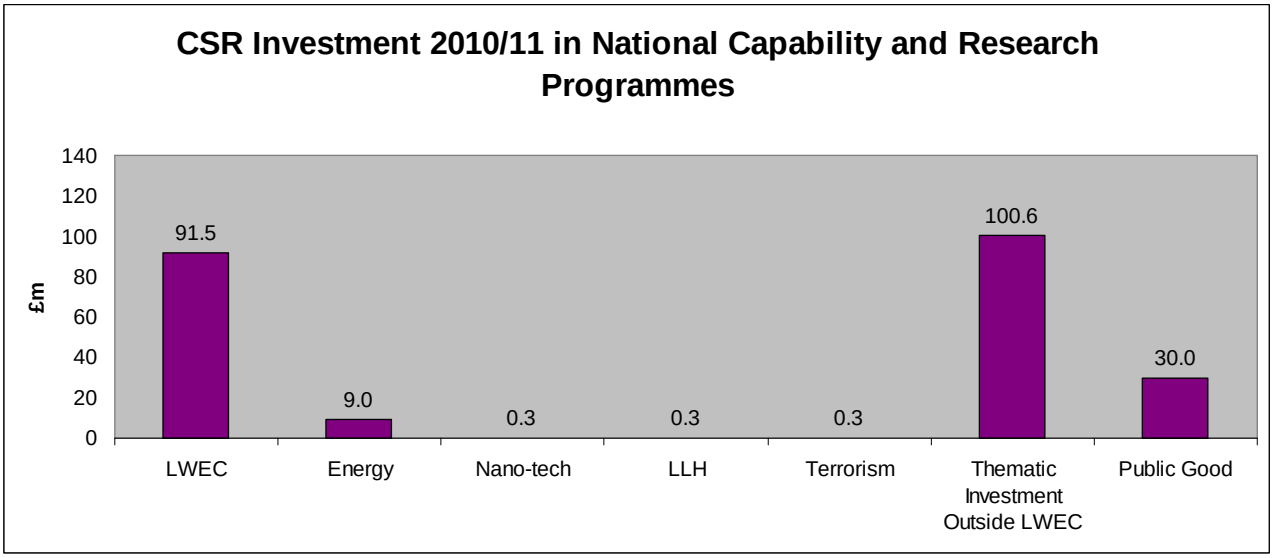
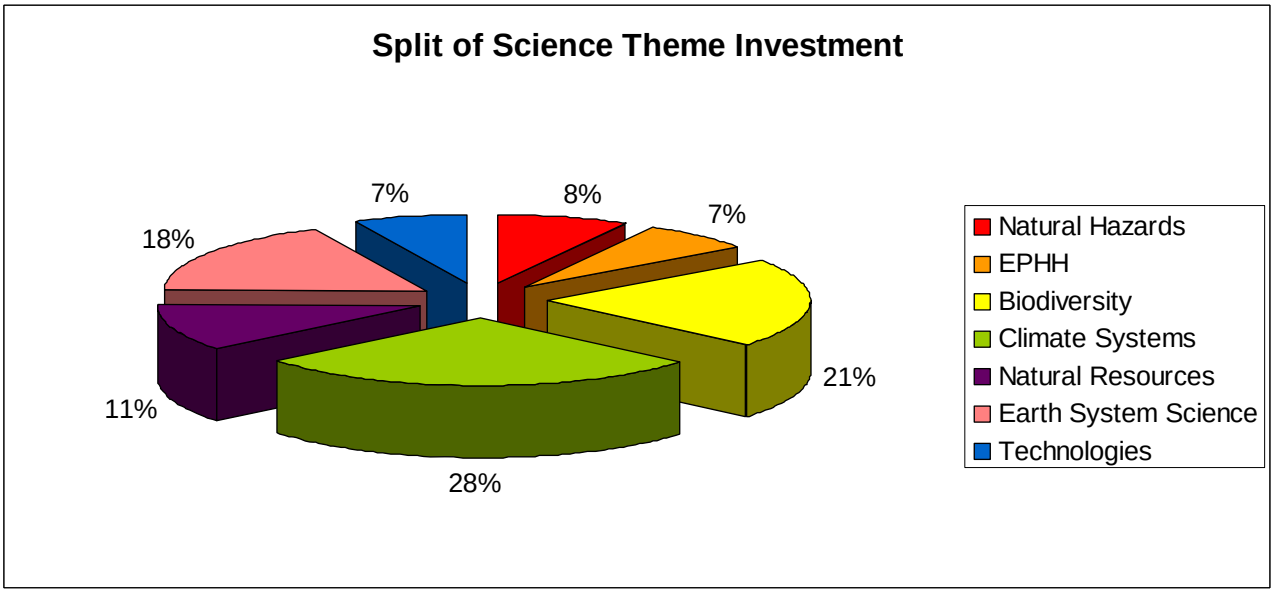


Figure 3: Approximate split of science theme investment (including cross-council programmes)



Note: Science theme investments are approximate. Decisions on the annual breakdown of science themes during the CSR period will be subject to Council decision on the theme action plans in 2008.