

Delivery Plan 2019





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1. Foreword



Professor Duncan Wingham
Executive Chair, NERC

NERC has a proud history of identifying the issues that communities in the UK and worldwide face on a changing planet. For over 50 years, our work has increased understanding of environmental challenges and enabled effective responses to them.

Our science is essential to forming and delivering policy that makes it possible for the environment, people and businesses to succeed together. The UK public recognise this work as critically important and in their consciousness it is only matched by future health challenges, to which environmental considerations are increasingly linked. According to our 2017 Public Attitudes survey, 76% of the public want to understand more about the science we fund.

Nationally, our science continues to help the UK achieve the goals set out in the government's Industrial Strategy, Clean Growth Strategy, and in the 25-year Environment Plan and devolved policy, as well as supporting efforts to achieve the 80% cut in CO₂ emissions by 2050 outlined in the 2008 Climate Change Act. Internationally, this science plays a central role in each of the assessment reports published by the Intergovernmental Panel on Climate Change (IPCC), and informs efforts to meet the UN's Sustainable Development Goals and to answer the World Economic Forum's assessment of global risks in 2019, where environmental risks dominate.

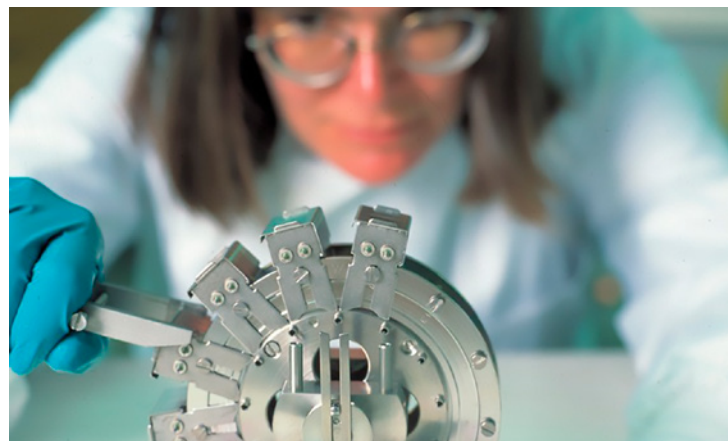
We have produced this plan at a time when NERC is responding to considerable internal and external change. The excellence fostered over more than five decades enables us to respond to these changes and to capitalise on the new opportunities ahead. We welcome the transition to UK Research and Innovation (UKRI), which allows us to develop our leadership of research and innovation for environmental solutions. As part of UKRI, we will continue our strong tradition of commissioning excellent research, supporting the UK's world-leading universities and research institutions, and forming strong partnerships to secure the funding to do so. With significant and rising public support for our science as a core part of societal responses to environmental and economic challenges, the coming years represent an exciting time for environmental science in the UK and beyond.



The formation of UKRI and the collective funds available, in tandem with our existing strengths across our research centres, academic community and broader partners, allow us to think more ambitiously, broadly and generously about the solutions that environmental science, with other disciplines, can bring to business and to public sector services. To maximise this potential, we will convene partnerships that cut across disciplines and put environmental science at the heart of how research responds to challenges. While not new, this role is increasingly important in the light of our ambition, shared across UKRI, to enable and promote interdisciplinary work. As the UK enters a new phase in its global relationships after leaving the EU, we will continue to forge these partnerships across disciplines and borders to tackle the global challenges we face.

It has always been important to us and our community to ensure science reaches beyond scientists. Environmental science provides the ideas and understanding to open entirely new businesses and improve the resilience and productivity of existing industries. We work with our stakeholders in research and business, encouraging partnerships that stimulate ideas and nurture understanding between them. In this way, we powerfully support business innovation and are playing a key role in the government's aim set in the Industrial Strategy to grow research and development spend to 2.4% of GDP by 2027.

I am delighted to present this plan which articulates our ambitions for the future. We are an increasingly agile organisation, whilst maintaining the long view needed to successfully find solutions and ensure the sector has the talent and infrastructure required to outpace the challenges confronting us. This plan demonstrates how we balance and deploy these approaches with our partners and I look forward to what we will achieve together.



2. Vision and objectives

We live in a time of unprecedented change. People are impacting the planet and driving environmental change on a scale unique in the Earth's history. As population and prosperity rise, the way we live and do business leads to overconsumption of resources, affecting air, soils and biodiversity and increasing challenges linked to extreme weather and a changing climate. The issues are complex, with environment and economy coupled in potentially unsustainable ways. Yet we have the capability to adapt, innovate and move to a new, more sustainable state.

Environmental scientists study the entire planet, from the edge of the atmosphere to the centre of the Earth, discovering the past and projecting into the future. Those we fund endeavour to understand planetary processes, excelling at revealing the environmental challenges confronting the world. We have a track record of discoveries that catalyse action, from identifying the hole in the ozone layer and exposing the risks of climate change, to finding microplastics in the oceans. By informing regulation and new economic approaches, our research has enabled society and the economy to avoid the cost of failing to mitigate negative environmental impacts. As the environment deteriorates, it grows ever more important to understand and uncover the extent of the challenges in order to inform action, build resilience and foster a healthy environment and economy.

But NERC must go further. Tackling complex problems demands both a deep understanding of environmental science and a whole-systems

approach, with a broad, diverse research community engaged so that research and innovation are a key factor in delivering the solutions we need. Building on experience in addressing multidisciplinary challenges, we will strengthen our capacity to pinpoint and foster the best interdisciplinary talent and create leaders with the foresight and ability to address interdisciplinary challenges. With the funding and collaborative opportunities that UKRI provides, we will create new partnerships with institutions that have a track record of connecting research and innovation breadth and depth to business acumen and local communities. This will ensure we realise the potential of the UK research base to create the national and global solutions needed to limit climate warming, create a circular economy and ensure clean air and water and biodiverse ecosystems for a productive, healthy, resilient planet.

NERC will pursue this vision by implementing its mission, as the UK's leading public funder of environmental science. We work with our research centres, higher education institutions (HEIs), government, civil society and business to shape the direction of environmental research and innovation; we fund cutting-edge discovery science and strategic research; and we provide the training, skills and infrastructure the UK needs to remain at the forefront of environmental science.

To achieve our long-term ambitions and the next steps to delivery, we have identified eight priority areas that will be the focus of our activities:



- **Environmental solutions:**
 - Champion the importance of environmental solutions in contributing to clean growth across UKRI, and create initiatives that meet this aim.
 - Nurture a generation of researchers who take a systems approach as the norm in order to identify and address complex environmental problems.
- **Pushing the frontiers of understanding:**
 - Maintain the UK's considerable breadth of expertise across environmental science, to prepare for the unknown challenges of the future.
 - Challenge researchers to be adventurous and ambitious in environmental science, exploiting new technologies and approaches.
 - Ensure our funding reaches the most excellent science and scientists.
- **Productive environment:**
 - Build understanding of the interactions between economic and environmental systems.
 - Ensure research and innovation programmes enable a systems-wide approach to valuing environmental risk, embedding environmental sustainability into economic models.
 - Promote research and innovation to enable a shift to a circular, resource-efficient economy, working with partners to translate research into effective business models.
- **Healthy environment:**
 - Promote research and innovation to reduce and reverse environmental degradation, to sustain the resources to support healthy life on Earth.
 - Increase understanding of the benefits of a healthy environment to health and wellbeing, and of feedback mechanisms between environmental systems and a healthy economy, society and culture.
- **Resilient environment:**
 - Increase understanding of environmental hazards, environmental change and their interactions, to plan for and manage vulnerability, risk, response and recovery.
 - Collaborate across disciplines to protect lives and livelihoods and to increase resilience of infrastructure, supply chains, businesses and financial markets to environmental hazards and environmental change.
- **Digital environment:**
 - Use cutting-edge technology to advance environmental outcomes, taking advantage of machine learning, miniaturisation, battery technology and wireless communications.
 - Combine environmental and Earth Observation data with economic, health, social science and administrative data to generate new insights, and harness high-performance computing (HPC) to create detailed virtual environments to simulate alternative futures.
- **Global environment:**
 - Provide leadership in, and bring UK expertise to bear on, global challenges, aiding international development and responses to environmental emergencies.
 - Work in partnership and through internationally coordinated efforts to tackle environmental challenges.
- **Best environment for research and innovation:**
 - Ensure a talent pipeline in environmental science that has the skills and expertise to resolve future unknown challenges and to lead and influence broad, systemic thinking for environmental solutions.
 - Work in collaboration and partnership across and beyond UKRI to secure funding and deploy it in an agile and flexible way.
 - Engage with the public, businesses, NGOs, policymakers and parliamentarians to draw-in expertise and share knowledge.
 - Champion and lead the UKRI approach to environmental sustainability.
 - Benefit the UK environmental science community and our global partners by maintaining and enhancing NERC centres of expertise, infrastructure, services and facilities at the:
 - o British Antarctic Survey (BAS)
 - o British Geological Survey (BGS)
 - o Centre for Ecology and Hydrology (CEH)
 - o National Centre for Atmospheric Science (NCAS)
 - o National Centre for Earth Observation (NCEO)
 - o National Oceanography Centre (NOC).

3. Research and innovation priorities

3.1 Environmental solutions

Environmental science plays a vital role in identifying environmental problems and their cost to the economy and society. This knowledge enables the identification of opportunities for solutions and interventions that reduce environmental damage and avoid the associated costs. NERC science exposes complex, whole-system problems that can only be solved by drawing on a diverse range of expertise. We aim to build on our strength in identifying environmental problems and harness our expertise in collaborating across disciplines and organisations to build a research community that transcends traditional boundaries. This will realise the full potential of our contribution to clean growth, the circular economy and delivery of the government's Industrial Strategy.

Long-term ambitions

- Champion the importance of environmental solutions across UKRI in supporting the delivery of the Clean Growth Grand Challenge and in delivery of the Industrial Strategy Challenge Fund, stimulating and supporting new connections across disciplines to deliver, for example, decarbonisation of energy, creation of a circular plastics economy, socially and environmentally sustainable supply chains, and cleaner air.
- Create new communities to achieve this, nurturing a generation of researchers who take a whole-systems approach as the norm.
- Fund HEIs with strong track records across the range of disciplines that a systems approach demands and their work with business and regional communities, to identify and address complex environmental problems. These institutional partnerships will draw together existing capabilities and regional strengths, building on them to grow new interdisciplinary capacity to deliver environmental solutions.

Near-term actions

- Scope an Institutional Partnerships Programme and announce the opportunity for HEIs to secure block funding for environmental solutions.
- Lead delivery of the £20 million Plastics Research and Innovation Fund (PRIF) with Innovate UK and EPSRC, to move the UK towards more circular economic and sustainable approaches to plastics.
- Lead development of the Smart Sustainable Plastic Packaging challenge, to develop a new generation of advanced plastic packaging in order to reduce single-use plastics, increase recyclability and ultimately cut the amount of plastic waste entering the environment.
- Ensure cutting-edge environmental science informs challenges on (i) Industrial Decarbonisation, to develop and deploy low-carbon technologies and enabling infrastructure, supporting the Clean Growth Grand Challenge Mission to establish the world's first net-zero carbon industrial cluster by 2040, and (ii) Transforming Food Production, to produce resilient, sustainable food more efficiently, cut emissions and pollution, minimise waste and improve soil.
- Lead delivery of the £10.5 million Landscape Decisions programme, supported by the Strategic Priorities Fund, to ensure evidence-based decisions on UK land use, working in partnership with AHRC, BBSRC, EPSRC and ESRC.
- Build our own capacity and capability to achieve high-quality insight into our research community that allows us to provide effective leadership and foster a broader academic community.



Building a coalition to tackle plastics

Plastic pollution is a serious environmental, social and economic challenge. NERC-funded research was instrumental in the ban on the sale of products containing plastic microbeads in the UK from 2018, resulting in 4,000 tonnes/year of microbeads no longer entering the oceans, and the government is taking further measures to reduce or eliminate plastic waste entering the environment. We are now building and leading a coalition of industry, government, NGO and UKRI partners committed to transforming plastics through the PRIF. The first coalition of its kind, it will lead the way in finding new solutions to current use of plastics through recycling methods and developing alternative materials. It will address consumer friendly packaging and new types of plastic that are easier to recycle, and find new ways to recycle plastic packaging currently wasted or which pollutes the environment. It will also stimulate a circular, resource-efficient, low-carbon plastics economy boosting UK productivity and creating jobs.



A systems approach to sustainable fashion

The clothing sector is the fourth-largest source of global carbon emissions. Its production processes also pollute and put pressure on water resources, whilst microfibres shed from textiles through use and washing cause land and water pollution. 'Fast fashion', with its rapid production of new designs, quick turnaround of new trends and low prices, is increasing consumption, and the drive to cut production costs has seen the industry coming under increasing scrutiny with respect to unsafe jobs and low wages. To address these issues, we have been leading a consultation with industry, academia and NGOs. The aim is to identify opportunities to develop a broad, multidisciplinary research and innovation programme that can deliver whole-system solutions to reduce the clothing sector's

negative environmental and social impacts. The consultation is looking at consumer and business behaviour, supply chains, materials, design, and environmental and human health impacts to formulate potential research questions.



3.2 Pushing the frontiers of understanding

The UK leads the world on research quality in environmental science. The question-driven research that NERC funds creates breakthroughs in understanding both the environment and human interactions with it, in the past, present and future. As the planet continues to change, revealing new insights through original inquiry remains central to our purpose.

The advances and lasting benefits that discovery science delivers are demonstrable, driving policy change and catalysing innovation in the UK and worldwide. Our investment in discovery science spans the full breadth of sciences and methodologies required to advance our understanding of the Earth system and to reveal people's impact on environmental processes that have evolved over thousands or millions of years. Driven by researchers' curiosity and imagination, this science enables individual discoveries to be made and unlocks the cumulative benefits of revealing new knowledge over time.

Long-term ambitions

- Continue to invest in excellence, challenging researchers to be adventurous and ambitious, to exploit new technologies and approaches, and to explore new ideas related to any environmental science topic.
- Ensure we maintain the UK's breadth of expertise so we are prepared for the unknown challenges of the future.
- Maintain and enhance the UK's position at the leading edge, ensure the most excellent science and scientists receive our funding by challenging our peer-review processes to take account of all aspects of scientific achievement.

Near-term actions

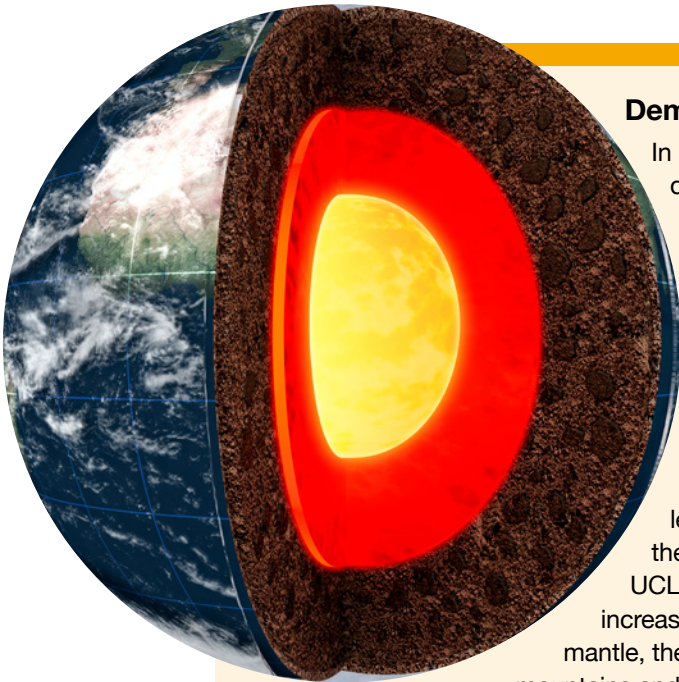
- Review our funding procedures to ensure the best, most innovative, most adventurous research and researchers are supported.
- Invest £2.8 million in understanding the biggest uncertainty in the natural carbon budget, ocean regulation of heat and carbon, through the Ocean

Regulation of Climate by Heat and Carbon Sequestration and Transports (ORCHESTRA) project led by BAS, in partnership with NOC and BGS among others.

- Invest £39 million in standard discovery science grants in 2019/20 to enable individual researchers and small teams to explore questions across the breadth of our remit.
- Invest £8.9 million in complex, large-scale discovery science projects in 2019/20, initiated directly by sizeable teams within the research community, on any topic within our remit.
- Fund £1.5 million of capital purchases within research institutions in 2019/20 to ensure researchers have the state-of-the-art equipment they need to carry out the best research.
- Invest £7 million in 2019/20 in research fellowships to develop scientific leadership among the most promising early-career environmental scientists, enabling them to develop their research programmes and gain international recognition.

SEARRP





Demystifying a new Earth layer

In 1949 a new layer of the Earth was discovered. Named 'D double-prime', it lies 3,000km beneath the planet's surface, between its liquid metal core and rocky mantle. Although D double-prime appeared to play an important role in the transfer of heat through the Earth, it was unclear how this process worked. In 2004, however, the discovery of post-perovskite (a type of magnesium silicate) seemed to unlock the prospect of understanding the layer's properties. Supported by a NERC discovery consortium grant, scientists from the universities of Bristol, Leeds and London ran complex simulations and modelling on national supercomputers, which led to an explanation for the unusual seismic observations of the 'new' layer, while further NERC-funded discovery science at UCL revealed more properties of post-perovskite. The result was increased understanding of heat transfer between the Earth's core and mantle, the Earth's magnetic field and the energy that drives formation of mountains and volcanoes.

Predicting how vertebrate populations will cope with climate change

All multicellular lifeforms undergo ageing, from worms to redwood trees, however there is variation in the way that different species age. These ageing patterns affect the course of their evolution, as well as population, community and ecosystem dynamics. Furthermore, climate change and human activities that modify ecosystems mean some species have to adapt to survive. Such is the complexity of these adaptations and their interplay with ageing patterns that it has been difficult to predict how, or indeed whether, vertebrates will be able to respond to the environmental change our planet is undergoing. With NERC funding, modelling developed and applied by the University of Oxford set out to identify how short-term ecological changes and longer-term evolutionary responses affect animals. This has revealed that the rate of evolutionary change among vertebrates is too slow to allow species to adapt rapidly enough to current rates of anthropogenic climate change in order to avoid extinction. The discovery has now informed management plans to protect the populations of grey wolves in Yellowstone National Park.



3.3 Productive environment

Our economy and our environment are inseparable. Every business and every consumer benefits from natural resources, ranging from energy and materials to transport and waste disposal. At the same time, we all incur the economic cost of environmental deterioration.

NERC-funded science can enable the UK to deliver the ambitions of the Clean Growth Grand Challenge to put the UK at the forefront of the industries of the future, while reducing waste, pollution and climate-warming emissions, and to improve living standards in a world of finite resources. We can create circular, resource-efficient economies across whole supply chains and sectors, drive an expansion in green finance and low-carbon services, and understand the environmental impact of the digital economy.

Long-term ambitions

- Fund research that builds understanding of the coupled economic and environment systems, because judging the balance of economic growth and environmental sustainability will be fundamental to the future of humankind.
- Support research that delivers the systems and solutions which reduce consumption and inefficiency, maximise the productivity of land and oceans while promoting biodiversity and minimising degradation, and embed environmental sustainability in every aspect of economic activity.

Near-term actions

- Establish new centres for world-leading research into the subsurface environment that will stimulate research on underground energy technologies, through investment of £13 million in 2019/20 in the UK Geoenery Observatories (UKGEOS) project led by BGS.

- Invest £16.7 million in the UK Status Change and Projections of the Environment (UK-SCAPE) project, led by CEH, to tackle challenges caused by pressure on air and soil quality, water and food security, and biodiversity.
- Drive regional economic development by investing £12.3 million in the Regional Impact from Science of the Environment (RISE) programme to bring research organisations together with business and policy bodies, such as the South West Partnership for Environment and Economic Prosperity, and the Yorkshire Integrated Catchment Solutions Programme.
- Invest £2.3 million in the Achieving Sustainable Agricultural Systems (ASSIST) project to develop farming systems that contribute to environmental sustainability. Led by CEH in partnership with BGS and Rothamsted Research, this significant collaboration with BBSRC will examine environmental effects of intensive agriculture and develop solutions.
- Invest in Centres for Doctoral Training (CDTs) in renewable energy (with EPSRC) and continued cohorts on soil science (with BBSRC) to foster a new generation of solutions-focused PhD graduates.
- Invest £1.2 million in a NERC highlight topic to develop new exploration tools for mineral resources and understand the genesis of magmatic ore deposits.
- Fund the £3 million highlight topic to ensure objective verification of carbon budgets for assessing climate change mitigation measures.
- Invest £0.2 million in novel approaches combining DNA testing of large collections of historical bumblebee specimens with other technologies to determine how agricultural land-use change has contributed to the decline in the bee population.





Powering clean growth

Since the 1960s, our investment in research, infrastructure and training has aided the UK economy by helping to find and extract new sources of clean, safe energy. From traditional methods such as wind farms to new technologies such as floating wave energy, this work enables the UK to meet its carbon reduction and climate commitments. Through the UKGEOS project led by BGS, we are ensuring responsible development of underground energy technologies. Our science is also enabling growth in the UK's renewable energy sector by helping regulators and operators to pinpoint the best sites for construction. For example, geological experts who mapped and modelled the 2.4GW Dogger Bank offshore wind farm have facilitated development of a site that could produce enough power for up to 4 million homes.

Cutting agriculture's impact on climate

Today's food supply chain creates around a quarter of global CO₂ emissions. A NERC Knowledge Exchange Fellow based at the University of Aberdeen developed the Cool Farm Tool (CFT) software in partnership with potential users, to identify, measure and reduce greenhouse-gas emissions from supply chains. Major international companies across the agri-food sector are now using this software. In 2010, for example, PepsiCo began using CFT to cut carbon emissions from UK potato production for Walkers crisps. Within five years the company had reduced emissions by 50%, while realising financial benefits through lower use of electricity, water and artificial fertilisers. The tool enabled PepsiCo to work with growers to calculate emissions across their entire farming operation, identify hotspots where savings could be made and monitor progress. The company is now looking to apply the principles to other areas of its business and, by 2030, aims to cut greenhouse-gas emissions across its value chain by 20%.



3.4 Healthy environment

To live and prosper, people need clean air in the atmosphere, healthy soils, and clean water in clouds, aquifers, rivers and seas. As humanity increasingly exploits the resources that our living standards demand, environmental science must continue to document and understand the resulting degradation of the environment and the effect of this on the world's population.

Environmental factors impact the health of all of us, from access to stable water supplies to biodiverse ecosystems, insect pollinators and the well-structured, nutrient-rich soils needed for healthy food production. They also promote wellbeing and prosperity across the life course, with the value of spending time in nature recognised as reducing stress for people in cities, while green and blue spaces have a positive impact on public health among local communities in both urban and rural settings.

Long-term ambitions

- Improve an environment that directly contributes to health and wellbeing by bringing our research community's expertise to bear, working collaboratively to tackle issues such as pollution and degradation.
- Sustain the healthy urban and rural environments in the UK and worldwide to benefit people, flora and fauna, by working with partners and experts from other disciplines such as public health and medicine.

Near-term actions

- Lead the £19.6 million Clean Air: Analysis and Solutions programme, supported by the Strategic Priorities Fund, to improve prediction of air pollution exposure and its impact, and promote innovation by working in partnership with the Met Office, EPSRC, ESRC, MRC, Innovate UK, the National Physical Laboratory and the Department for Environment, Food and Rural Affairs (Defra).
- Invest £5.3 million in the Emerging Risks of Chemicals in the Environment programme to predict how the environment responds to chemical exposure.
- Invest £3.4 million in the MRC-led Antimicrobial Resistance (AMR) programme, supported by the Fund for International Collaboration. This initiative will develop global wastewater and environmental regulations to tackle AMR, focusing on pharmaceutical, industrial and wastewater pathways.
- Commission up to £4 million of highlight topic projects to identify the impact of legacy waste in the UK's coastal zone, and up to £4 million to understand the effects of marine noise pollution.
- In two regions of Colombia, invest £4.5 million in the Exploring and Understanding Colombian Bio Resources programme, supported by the Newton Fund, to improve understanding of socio-ecological systems, including the underpinning value of biodiversity.
- Through an India-UK partnership, deliver the £3.6 million Newton Fund programme aimed at better understanding of the sources and fate of different pollutants and develop management strategies and technologies to cut pollution levels.



Nature's benefits for health and wellbeing

Biodiversity and ecosystems play an important part in human health and wellbeing. The Valuing Nature programme, funded by NERC with a range of partners, aims to improve understanding of that role, while the Improving Wellbeing through Urban Nature project at Sheffield, Derby and Heriot-Watt universities studied the connections that urban residents have to their local natural environments. Researchers worked with people diverse in terms of age, gender, ethnicity and utilisation of mental health services, and developed an innovative smartphone app to determine which characteristics of urban natural environments deliver mental and physical health benefits. The researchers found that high-quality environments, trees, woodland and spaces for growing plants were all valued elements of the landscape. The findings have been incorporated into simple steps that health professionals, urban planners and community volunteers can use to improve wellbeing through better connections with nature.



Cleaning our air

By cleaning up the UK's air, our science has saved billions of pounds in the costs of poor health and lost agricultural production. This has involved playing a key role in both domestic and international policy on air pollution. Underpinned by NERC research, reductions in volatile organic compounds (VOCs), nitrogen oxides, particulate matter (specifically PM10) and ammonia have resulted in UK health improvements valued at between £13 billion and £29 billion, while research showing that airborne sulphur from fossil fuels was deposited as acid rain in UK lakes and soils has informed international protocols that have led to an 89% cut in sulphur emissions. As part of our long-term support for atmospheric science, we are currently funding three air quality research supersites in the UK, operated by NCAS, to deliver high-quality data on urban air pollution. We are also partnering with MRC and agencies in China and India to carry out research on urban air pollution and its impact on health in megacities.



3.5 Resilient environment

People have always been at risk from environmental hazards such as floods, droughts, volcanoes, earthquakes, novel diseases and invasive species. These endanger lives and livelihoods, disrupt supply chains and damage critical infrastructure. Environmental change increases the severity of some of these hazards, such as more intense storms and more frequent wildfires; it also brings the additional risks of a warmer climate and rising sea levels. Moreover, the impacts increase as populations grow, exposing more people to growing threats.

Long-term ambitions

- Forge collaborations that bring together the skills and expertise, for example in engineering, finance, economics and environmental science, that will bring about a more resilient environment and ensure capital markets, business and other financial systems are resilient to environmental risk in the short and long term.
- Invest in research and innovation that advances understanding of environmental hazards, and the ability to plan, create policy, and manage vulnerability, risk, response and recovery in a changed and changing world. Through interdisciplinary partnerships and by bringing together outstanding researchers from different disciplines, we can devise solutions that make people, places, markets, systems and infrastructures safer and more resilient.

Near-term actions

- Deliver the £10.6 million UK Climate Resilience programme, supported by the Strategic Priorities Fund, to deliver robust multidisciplinary and interdisciplinary climate risk and adaptation solutions.

- Invest £0.5 million in the Environmental Risks to Infrastructure Innovation programme to provide evidence of environmental risks and their impacts on infrastructure, translating the latest research into industry-relevant outputs.
- Harness £1.3 million of highlight topic funding to deliver new insights into the impact of space weather on UK national grounded infrastructure.
- Invest £1.2 million in 2019/20 in a programme to understand and predict change in the North Atlantic Ocean and the atmosphere above it. Led by NCAS with the Met Office, and in partnership with NCEO, NOC and BAS, the North Atlantic Climate System Integrated Study (ACSIS) will improve understanding of the drivers of environmental hazards in the UK.
- Invest £6.6 million in the programme we fund with the US National Science Foundation to improve decadal and longer-term projections of ice loss and sea-level rise originating from Thwaites Glacier in West Antarctica. BAS is the lead UK logistics provider, ensuring world-class operational support to open up new science.
- Invest £3.5 million in the CEH-led Hydro-JULES¹ programme to build a 3D model of the terrestrial water cycle to underpin hydrological research in the UK. The model will support planning, policy and forecasting by incorporating data across hydrology, land-atmosphere feedbacks, and carbon and nutrient cycles, and will harness data science, novel instrumentation and Earth Observation technologies.
- Invest £1.4 million in a programme to understand how much carbon from soils gets into UK rivers and the impact of this on soil health, drinking water and carbon release into the atmosphere. Led by NOC, the UK-wide Land Ocean Carbon Transfer (LOCATE) initiative is studying sites ranging from the Tamar river catchment on the Devon-Cornwall border to Thurso in the north of Scotland.



Robin Wylie

¹ Joint UK Land Environment Simulator



Minimising the effects of flooding

For over 50 years, NERC-funded scientists have researched UK sea levels, river basins, storm surges, aquifers and surface flows, saving lives, homes and businesses. For example:

- Research led by CEH has resulted in annual savings of between £76 million and £127 million due to a new model that enables accurate flood warnings five days rather than two days in advance;
- Accurate tide and storm-surge information for the Thames Barrier provided by NOC helps protect 1.25 million people on the London floodplain and £200 billion of property. NERC data and understanding also showed that the existing Thames Barrier can continue protecting London until 2070, avoiding billions of pounds in premature replacement costs; and
- Improved forecasting systems and advice provided by BGS mean that over 50,000 fewer UK homes have been flooded. The UK floods in 2013-14 affected 6,000 homes, whereas the 2007 flood affected more than ten times that number, even though the more recent storms were more severe.

Fewer diversions for airlines

Our science helps protect infrastructure from natural hazards, enabling significant cost savings and reducing disruption. For example, airlines have saved millions of pounds thanks to a model that warns airports about severe winds, minimising flight diversions. An air-turbulence forecasting algorithm meanwhile, has revolutionised the ability to predict invisible clear-air turbulence, improving comfort and safety on billions of passenger journeys. Our funded research, spanning support for PhDs through to discovery science, has also enabled theoretical atmospheric research that has delivered real-world benefits. Since 2015, the US National Weather Service has used an algorithm developed by the University of Reading, which has improved comfort and safety for an estimated 2.5 billion passenger journeys and by reducing unnecessary diversions delivered significant savings in emissions. The researchers are now working with Airbus to ensure aircraft design can accommodate increased turbulence forecast due to climate change.



3.6 Digital environment

Environmental science has long understood the data revolution. Forecasting and climate modelling have driven the need for 'big data' and the evolution of HPC, while Earth Observation data has been exploited for decades. The continued growth of communication systems and bandwidth, coupled with advances in miniaturisation and battery technologies, provides new potential to visualise processes in the environment at all scales. This puts digital capacity right at the heart of the drive to deliver leaps in understanding in environmental science and the formulation of solutions.

By harnessing the power of supercomputing, we can create detailed virtual environments to simulate alternative futures, opening up the exploration of options for environmental regulation, management and investment. With autonomous platforms we can extend our reach in hostile environments, from the polar regions to the edge of space, collecting vast data sets more efficiently and sustainably. With advances in battery technology, miniaturisation and wireless communications, we can add 'nowcasting' to our forecasting capability to enable decision-making based on real-time feedback from the environment.

Long-term ambitions

- Invest in research and innovation that uses cutting-edge technology to advance environmental outcomes.
- Grasp the possibility of harnessing the ground-based, high-bandwidth terrestrial mobile phone network.
- Employ the wide range of sensor technologies now available to connect to and visualise the local and national environment, enabling real-time decision-making and the deriving of new insights across disciplines.
- Exploit environmental data as a testbed for machine learning and analytics.
- Combine environmental data with economic, health, social science and administrative data, to unlock insights, create digital services, contribute to smart cities and improve outcomes for people as well as the environment.
- Continue to exploit Earth Observation data for scientific benefit from UK government investment in satellite programmes.

Near-term actions

- Deliver the £10.4 million Constructing Digital Environments programme, supported by the Strategic Priorities Fund, to integrate technological advances in order to monitor and predict the natural environment at high resolution and enable more effective decision-making.
- Invest £5.5 million in 2019/20 in the National Capability Data Service (NCDS) to provide a single, large data service for the environmental science community, and invest in the ARCHER, JASMIN, MONSooN2 and NEXCS supercomputers to provide access to key data storage and processing services.
- Invest £1.7 million in the Multidisciplinary Drifting Observatory for the Study of Arctic Climate (MOSAIC) programme to improve the ability of climate models to predict Arctic environmental change using a distributed regional network of autonomous, remotely operated sensors to improve the data for modelling.
- Invest £3.2 million in 2019/20 for CDTs in: Earth Observation data for Earth systems; modelling



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and quantitative skills in ecology and evolution; use of smart and autonomous observation for the environmental sciences; and risk and mitigation using ‘big data’.

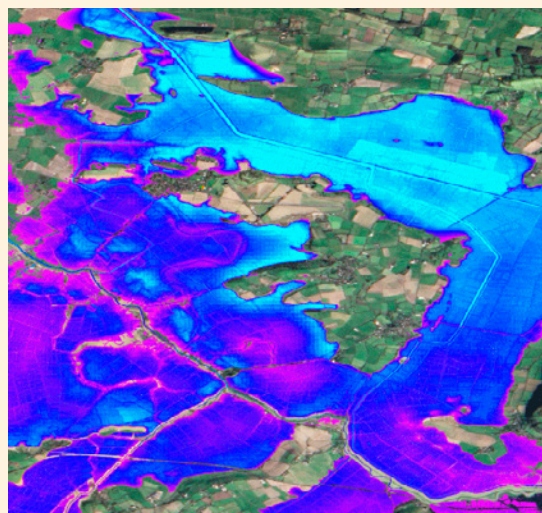
- Deliver £1.3 million in 2019/20 of UKRI investment in CDTs in: application of artificial intelligence (AI) to the study of environmental risks; and environmental intelligence: data science and AI for sustainable futures.
- Invest £1.7 million in the Marine Integrated Autonomous Observing Systems project

to accelerate the use of autonomous measurements.

- Invest £1.9 million in the UK Earth System Model (UK-ESM) to provide robust scientific support to the UK government via the sixth IPCC assessment report. NCAS will lead this work, in partnership with NOC, CEH, NCEO, BAS and BGS, and building on the Hadley Centre Global Environment Model version 3 (HadGEM3) family of climate models developed at the Met Office.

A blueprint for flood-risk management

Developed by NERC-funded researchers at the University of Bristol, a computer model to predict flood risk has served as a blueprint for the flood-risk management industry worldwide. Numerous risk-management consultancies have cloned the technology, which has not only saved commercial developers time but also improved the predictive capability of models used in a multimillion-pound global industry that affects tens of millions of people. The model has also been used to make flood-hazard information available to the general public via Google Earth through a start-up company.



Fathom Ltd

Developing the best autonomous underwater technology

NERC unmanned marine vehicles go further and deeper than any commercial or military capability. Over 15 years of investment has created the largest, most diverse fleet of robotic research vehicles in Europe with a collective value estimated at £20 million. The autonomous underwater vehicles developed by NOC have enabled scientists to capture data in challenging and inaccessible areas such as the Southern Ocean. This data is being analysed to examine complex mixing processes and their effects on climate change, generating a greater understanding of changes in the Antarctic region and shaping global efforts to tackle climate change. Two UK companies, AutoNaut and L3 ASV, now manufacture, sell and export marine robotic vehicles underpinned by NERC technology, attracting inward investment and international clients.



3.7 Global environment

Earth systems and processes and environmental challenges do not exist in isolation from each other, nor do they stop at national boundaries. Challenges such as climate change, ocean health and atmospheric pollution cannot be addressed by one country alone and so the study of the environment must be undertaken in partnership and operate worldwide. Our science has global reach and enables the UK to share its expertise to tackle challenges of global importance and to open doors to new collaborations.

The research we fund makes key contributions to sustaining international development while minimising impacts on the environment, informing business as well as regulation that open up opportunities for sustainable growth. Our scientific community also brings its considerable expertise to the development of environmental responses across the globe.

Long-term ambitions

- Ensure the significant contribution resulting from our research community sharing its knowledge and skills remains a key NERC strength, generating solutions that enable development while protecting the environment.
 - Continue to invest in research and innovation that addresses global issues through internationally coordinated science, brings UK expertise in environmental science to bear to global challenges, takes on challenges in developing nations and responds rapidly to environmental emergencies.
 - Ensure the UK environmental science community is in a position to provide global leadership, growing alliances through shared environmental and scientific ambitions, and to meet the complexity and scale of the environmental challenges that face us through international responses.
- hubs. Led by CEH and operating across South Asia, this partnership will lead major international research to tackle impacts of nitrogen pollution on the environment, food security, human health and the economy.
 - With MRC and partners in China and India, invest £5 million to deliver the Atmospheric Pollution and Human Health Programme, supported by the Newton Fund, to investigate urban air pollution in major Chinese and Indian cities and its impact on health.
 - Establish the £15.3 million GCRF-funded Living Deltas Hub to work in partnership with communities and researchers in Vietnam, Bangladesh and India. This initiative will develop new knowledge and policies to support people and landscapes under threat from human exploitation, environmental degradation and climate change.

Near-term actions

Antarctica and the South Atlantic

- Invest £33.7 million in BAS to deliver and enable world-leading research and sustain an active and influential presence in Antarctica on behalf of the UK. BAS operates three research stations in the Antarctic and two on South Georgia. One of these, King Edward Point (KEP), is managed on behalf of the Foreign and Commonwealth Office (FCO) and the Government of South Georgia and South Sandwich Islands (GSGSSI).
- Building on world-leading BAS expertise in hot-water drilling, invest £3.95 million in a joint UK-Chile Antarctic hot-water drilling programme.

Asia

- Establish the £17.5 million South Asian Nitrogen Hub funded by the Global Challenges Research Fund (GCRF), one of 12 UKRI global research





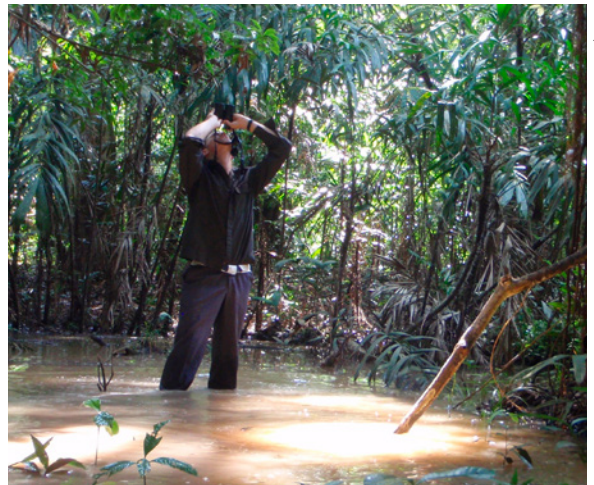
Heidi Burdett

Africa

- Establish the £18.2 million GCRF-funded One Ocean Hub to predict, harness and share environmental, socioeconomic and cultural benefits from ocean conservation and sustainable use, focused on Africa, the Caribbean and the South Pacific.
- Invest £1.2 million in 2019/20 in the joint programme with the Department for International Development (DFID) and ESRC to carry out innovative research in sub-Saharan Africa and south Asia, two of the most hazard-prone parts of the world, to better understand and predict disasters and minimise the risk they pose to vulnerable communities.

South America

- Lead a UK-Peru collaboration to deliver a £3 million Newton Fund programme to improve understanding of the rate of glacial retreat in Peru and its impact on water security and natural hazards.
- Invest £4.1 million in the Latin America Biodiversity Programme supported by the Newton Fund, to provide trans-regional understanding of the role of biodiversity and ecosystem functioning, and the services they provide in managing environments for sustainable development.



Joseph Hawes

Global

- Invest £3.9 million in 2019/20 on our international subscriptions to the International Ocean Discovery Programme (IODP) and, with EPSRC and ESRC, the International Institute for Applied Systems Analysis (IIASA). A further £0.33 million will be invested in NERC-IIASA fellowships to increase interaction between IIASA and UK environmental scientists.
- Invest £0.4 million in worldwide ocean monitoring through the International Argo Project to collect and share temperature and salinity observations from a fleet of 3,000 underwater robots.

- Lead delivery of the Fund for International Collaboration’s £3.5 million Climate, Environment and Health programme to better understand complex climate, ecosystem and health pathways, delivering evidence for action and tools to enhance resilience in food systems and

nutrition, heat and health, and climate-sensitive infectious diseases. This involves partnership with MRC, ESRC and members of the international Belmont Forum, including those from the USA, Sweden, Norway and Chinese Taipei.



Protecting African livelihoods from extreme weather

The lack of weather stations across the African continent meant many African countries could not plan for disruption caused by weather-related events. NERC-funded researchers at the University of Reading, NCEO and NCAS therefore developed the Tropical Applications of Meteorology using SATellite data (TAMSAT) system, an innovative weather and climate forecasting system that provides timely, accurate forecasts to anticipate drought, crop failure and other harmful events across Africa. This contributed to government agencies and charities setting up better aid response, with their work informing planning that ensured 920,000 children received food aid during the 2011-12 Sahal drought. Overall, TAMSAT allows for more effective national weather services and secures family livelihoods by supporting commercial insurance against weather shocks for 8,500 small-scale farmers in Kenya, Uganda and Zambia.

Informing policy on global climate change

Gleaning insights from sediment cores extracted from the ocean, paleoclimate researchers from Cardiff University have shed light on abrupt climatic changes hundreds of thousands years ago. Understanding the causes and far-reaching impacts of past climate change provides context for current observations and improves the models used to predict future climate change. Supported by NERC, the Leverhulme Trust and the Global Climate Change Foundation between 2014 and 2018, this research has provided a critical framework for IPCC assessment reports. Our world-leading climate science and enabling infrastructure continues to provide crucial evidence to inform national and international climate policy, with nearly two-thirds of UK authors of the most recent IPCC assessment report being NERC-funded.



ISD/Mike Mazarakis (enb/isd.org/climate/ipcc/17/14mar.htm)

3.8 Best environment for research and innovation

We are responsible for ensuring the UK has the talent, infrastructure and funding to carry out environmental science now and into the future. Environmental science requires global collaboration, technical know-how and large-scale infrastructure to access remote and challenging environments. Our changing planet needs a suite of talent that has depth, breadth, skills and expertise to resolve future unknown environmental challenges.

The next generation of environmental scientists are central to ongoing success. Our studentships and training will support both depth of knowledge across our remit and interdisciplinary breadth to lead and influence broader structural thinking. This is fundamental to ensuring environmental sustainability is part of future global development.

Our research centres are a core part of UK environmental science. Part of their role is to offer domain expertise and capability commissioned for the benefit of the whole UK environmental science community. Our research centres are home to large facilities and to technical experts who support scientific endeavour and large-scale logistics and planning, and ensure the effectiveness of state-of-the-art laboratories. These centres also provide the ability to collect data across large spatial scales and timescales and to integrate it with expertise to support its use, underpinning further research, policy development and industrial growth.

Long-term ambitions

- Invest in the facilities, resources and services required for UK environmental science to flourish as part of the UKRI Infrastructure Roadmap, making the strongest possible contribution to the national agenda and to meeting global environmental challenges.
- Maintain and advance, for the public good, our nationally important research centres, facilities and resources.
- Work with partners across UKRI and beyond to seek out collaboration and secure and deploy funding and resources with agility, in order to seize the opportunities provided by UKRI collective funds.
- Engage closely with our community to know where the cutting edge lies and work together to develop and create ideas to ensure we fund science that pushes the frontiers of understanding and delivers environmental solutions. Our engagement with business, NGOs and policymakers will draw-in expertise and ensure sharing of knowledge, and our engagement with civil society, parliamentarians, the public and others will inspire and inform with respect to societally relevant issues.
- Lead across UKRI on our approach to environmental sustainability, to minimise the environmental footprint of UKRI organisations and the research they fund, making sure the benefits of research outweigh the environmental costs and impacts of undertaking it.

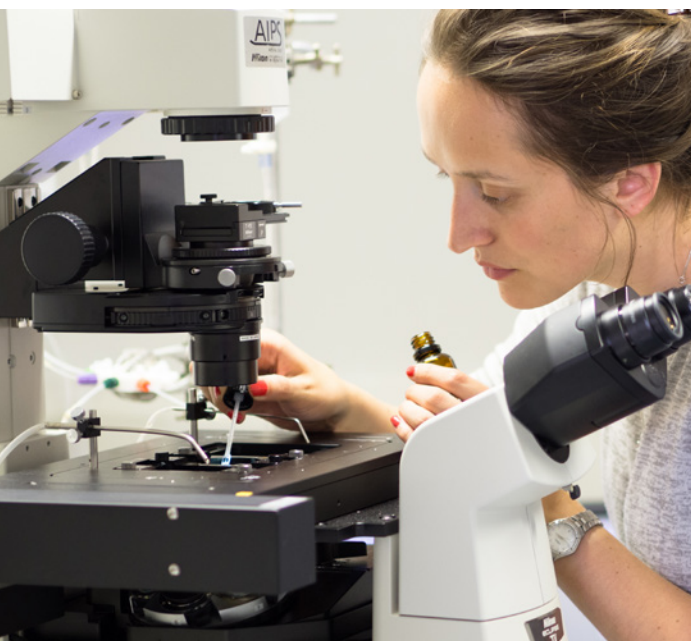


Near-term actions

- Deliver independent status for CEH and NOC, enabling long-term sustainability that ensures high-quality research which delivers real-world impact.
- Invest £3.5 million in 2019/20 in state-of-the-art national laboratory facilities for use by the research community, including radiocarbon dating, field spectroscopy, atmospheric measurement and the geophysical equipment pool.
- Invest £21.5 million in 2019/20 in Doctoral Training Partnerships, providing postgraduate training across all of NERC's remit to maintain the breadth and diversity of our research base.
- Invest in data sets and models for use by researchers, policymakers and businesses, including:
 - £1.4 million in 2019/20 for the undersea array 'RAPID', to extend the long-term data capture which underpins understanding of Atlantic Meridional Overturning Circulation, coordinated by NOC; and
 - £1.9 million in 2019/20 to support the UK contribution to the Coupled Model Intercomparison Project (CMIP) with the Met Office, an international partnership to set common international climate modelling standards and help understand past, present and future climate change.



- Evaluate the requirements to recommission facilities for genomics within environmental research.
- Invest £2.5 million over five years in public engagement programmes to inspire the UK public and foster debate about environmental topics that matter to people's daily lives, and build capability in the research community to do this well.
- Invest £6.2 million in 2019/20 in the specially adapted Facility for Airborne Atmospheric Measurements (FAAM) research aircraft, the unique UK airborne laboratory managed by NCAS.
- Provide two national core stores through a £3 million investment in the largest core store in the UK at BGS and in the British Ocean Sediment Core Research facility operated by NOC.
- Provide £16 million to CEH in 2019/20 to deliver a national network of monitoring stations in diverse habitats, ranging from lowlands, uplands and wetlands to rivers and forests, and deliver in-depth local information to allow sustainable management.
- Invest £16.9 million in 2019/20 in the operation of the Royal Research Ship (RRS) *Discovery* and the RRS *James Cook*, the national marine equipment pool and associated seagoing technicians, managed by NOC.



Charlotte Walker

Modernising Antarctic research

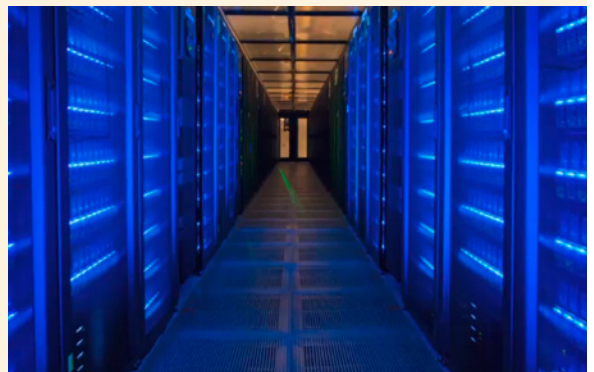
The next decade will see major investment in our world-leading Antarctic research capability. BAS is transforming how it supports frontier science with a £300 million Antarctic Infrastructure Modernisation Programme, launching the UK's new polar research ship, the RRS Sir David Attenborough, and undertaking the full modernisation of Rothera Research Station, the main entry point for UK Antarctic operations by air and sea. The upgraded facilities will improve the efficiency of operations, with lower costs from reduced energy use. The wharf at Rothera is being expanded to accommodate the new research ship, and improve facilities for launching smaller boats and scientific instruments. The RRS Sir David Attenborough will replace two existing polar research vessels, supporting up to 60 scientists with state-of-the-art laboratories, equipment including remote and autonomous underwater vehicles, and will be the first UK polar research vessel with a helipad and moon pool. NERC-supported Antarctic research provides the UK with vital understanding of how the polar regions are responding to natural and human-driven pressures, and their impact on global climate.



JASMIN increases the impact of supercomputing

Joint Analysis System Meeting Infrastructure Needs (JASMIN) is a unique world-class supercomputer that holds and exploits the world's largest co-located archive of environmental observation and simulation data. Delivered with STFC, it is central to strengthening our science across our portfolio and provides an increasingly powerful capability enabling significant improvement of predictive environmental science to benefit the UK and beyond. JASMIN enables comparison of models with observational data from ground-based, air-borne and satellite-based remote sensing, including exploiting the European Space Agency (ESA)-EU satellite data archives, and is integral to major parts of the work of NCAS and NCEO, plus a range of national and international projects. As we continue to exploit

environmental data for scientific and industrial impact, JASMIN will be integrated into the UKRI e-Infrastructure Roadmap, supporting almost 7,000 users from research, government and industry across over 200 projects.



4. Delivering and being accountable as an outstanding organisation

As part of UKRI, we are committed to being an outstanding organisation for research and innovation. We will continue to work actively and collaboratively across UKRI to embed the transition and transformation of functions, ensuring enhanced decision-making, efficient and effective delivery and smoother communications across our shared priorities. We will be an open and generous partner, building on success in collaboration both within and outside UKRI, whilst continually challenging ourselves to be a lean, highly responsive organisation. Working to our Responsibility Framework, we will maintain excellence both in NERC and in our research centres across four pillars: social responsibility, environmental responsibility, responsible business and responsible research.

People are our greatest asset and we will continue to develop an inclusive, professional workforce, building capability to deliver our objectives. We will equip our staff with the skills they need to succeed, and nurture talent from the widest range of backgrounds. We will ensure our working environment supports the wellbeing of staff, maintaining flexibility and promoting a healthy work-life balance.

Working in line with the shared UKRI values of collaboration, excellence, innovation and integrity, we will harness and share our existing strengths and learn from best practice across UKRI to deliver the best services, facilities, talent and research for the UK.

Efficient and effective operations

NERC delivery in Head Office is focused on commissioning training and national capability for the environmental science community, on commissioning discovery science and strategic research to enable environmental solutions, and on identifying and maximising the impact of these commissions within our Responsibility Framework. Delivery in our research centres is focused on carrying out research, on providing services, facilities and infrastructure for the benefit of the research community, and on safe operations in often extreme environments. Both our Head Office and our research centres undertake public and external engagement to bring science to life for adults and children alike, to enter into dialogues that shape research priorities, and to bring our research to the attention of business, parliamentarians and policymakers.

Underpinning these activities at Head Office and our research centres are the services essential for smooth delivery: IT, finance, human resources, project and programme management, data and information management, communications, governance, and secretariat and administrative functions. As part of UKRI, our staff interface with and contribute to central UKRI corporate services, building and maintaining strong relationships with our business partners.

UKRI brings a new structure to pre-existing collaboration across the research councils, Innovate UK and Research England. UKRI collective funds drive increased cross-council working and introduce a greater emphasis on the outcomes of successfully funded research programmes. We are strengthening our staff capability to adapt and thrive in this new context, provide excellent delivery against these requirements and be proactive and transparent in developing robust cases for funding. As the new UKRI-wide grants system comes online



and organisational structures are harmonised, we will align our activity to maximise efficiency while maintaining resilience. We will also work with partners both across UKRI and externally to advance the frontiers of knowledge and understanding, deliver economic impact and create social and cultural impact through our research activities.

Accountability and responsibility

We have implemented a governance structure to efficiently support our Executive Chair in the discharge of their duties across assurance, policy and funding decisions. Our Council advises, supports and challenges the Executive Chair to ensure effective delivery of our mission, decides on research and innovation priorities and provides advice as required to the UKRI Board. The NERC Management Board, comprising executive and non-executive directors, advises, supports and challenges the Executive Chair and is responsible for successful implementation of our strategic priorities. The NERC Assurance Board, comprising non-executive directors and the senior independent member of our Council, reviews assurance across governance, risk, financial statements and the control environment in Head Office, and reviews feedback from Centre Assurance Boards.

The Executive Chair delegates matters relating to our research centres to each Centre Director, including setting their strategic science direction. Each Centre Assurance Board, comprised of executive and non-executive directors, provides assurance to the Executive Chair that NERC and the research centre in question are not exposed to unacceptable or unknown risk, and that legal obligations including financial management are fulfilled. In 2013 an external review advised that significant change was required to our operational model and the research centres we own, in order to maintain world-class research. This resulted in the creation of the BGS Board in 2018 and the decision for CEH and NOC to become independent of NERC in 2019.

Our Science Committee, comprising academics from across our scientific remit, provides advice on national capability and capital investments for decisions by the Executive and collectively decides on the funding of highlight topics. Our well-established Peer Review College decides on the funding of discovery science and fellowships. Our Executive, Council and Science Committee will all be able to draw on the newly established



NERC Advisory Network, a flexible pool of retained expertise, for advice on strategic and policy issues as required.

We actively manage risks that may impact on our ability to deliver. Head Office holds a central risk register reviewed monthly by the Executive and quarterly by our Council. NERC centres hold their own registers, with risks escalated to the Head Office register where there would be impacts beyond centre operation. The research centre registers are internally managed as part of their delegated responsibilities and reviewed every six months through the Centre Assurance Boards.

We will also continue to build our Responsibility Framework to improve our performance and continue to improve across four pillars: social responsibility, environmental responsibility, responsible business and responsible research. A revised framework will identify materially significant impacts across all our investments and will include our implementation of UKRI's equality, diversity and inclusion (EDI) strategy, how we will act to reduce negative environmental impact and how we will continue to embed integrity and good conduct in all organisational and research activities. Central to this framework are the principles of sustainability, accountability, transparency and ethical behaviour.

Measuring progress against the UKRI success framework and our plan

Our approach to evaluation follows the UKRI Monitoring and Evaluation framework. We gather outcomes information on all of our investments through the researchfish® system. Research in HEIs is evaluated via the Research Excellence Framework (REF), led by Research England and the devolved Funding Councils. Building on these, we undertake evaluations where there is a clear case to do so, for example for large, novel or risky investments, to inform future decisions, and to ensure that our policies and processes remain appropriate and effective.

We will undertake the following evaluations over the next two years:

- Evaluation of NERC centres, evaluating the excellence and impact of NERC centres using modified REF methodology;
- Evaluation of Highlight Topic and Partnership processes;
- Strategic review of Discovery Science processes and investment structure;
- Review of Fellowship provision;
- Evaluation of international subscriptions;
- Evaluation of national capability – BAS Antarctic Large Infrastructure; and
- Evaluation of public engagement activities.

The impact of our research is monitored through engagement and analytics, including inviting NERC Impact Award applications from the research community, commissioning economic valuation, and text-mining to identify references to NERC-funded science. We use case studies and quantitative measures to show how the research we fund is translated into knowledge, expertise and skills that deliver benefits to the economy, society, culture, public policy or services, health, the environment and quality of life.

Aspects of our performance are captured through the governance, risk, responsibility, evaluation and impact activities outlined above, and reported to UKRI through the annual Stewardship Return. We produce an annually refreshed Head Office Plan which tracks progress against project delivery that is within or impacts on NERC Head Office, across research, training, national capability and capital investment, corporate services, engagement, impact and strategy. It captures aspects of major projects, although formal programme management structures and procedures are in place for investments over £2 million.

Drawing on all of these sources, as well as monitoring information from researchfish® and bibliometric studies, we will monitor our performance, from input to output to outcome, in alignment with the long-term UKRI success measures:

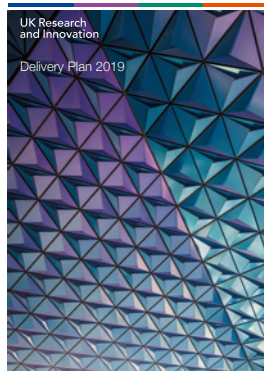
- Pushing the frontiers of human knowledge and understanding: covering new research, tools and methods, high-quality people and improved knowledge sharing.
- Delivering economic impact: covering new products, businesses and services, increased business growth and jobs, and links between the research and innovation, business and investment communities.
- Creating social and cultural impact: covering improved wellbeing, health outcomes, improved policymaking and public services, and improved security, resilience and cost avoidance.

5. Financial allocation

NERC, £m		2019-20
Research and Innovation Budgets		282.1
of which	Antarctic Logistics Infrastructure	34.5
Science Infrastructure Capital		88.2
of which	Antarctic Logistics Infrastructure	9.0
ODA		40.7
of which	GCRF	26.0
	Newton Fund	14.7
NPIF		21.0
of which	ISCF	3.0
	Skills	5.7
	Funds For International Collaboration	2.4
	Strategic Priorities Fund	9.9
NERC Programme		432.1



UK Research and Innovation Delivery Plans



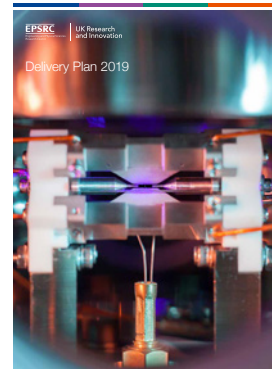
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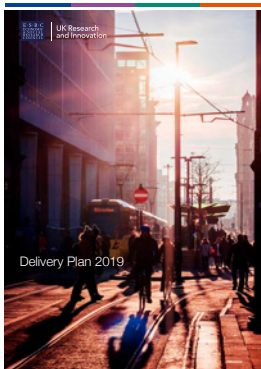
AHRC



BBSRC



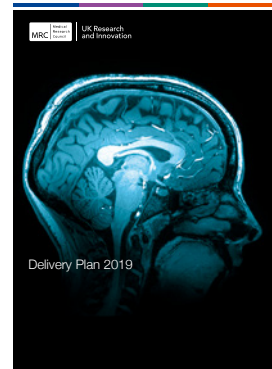
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ESRC



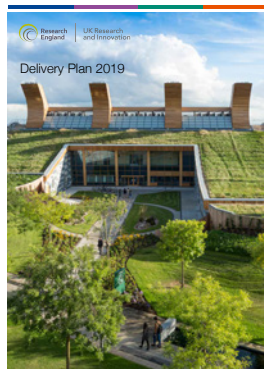
Innovate UK



MRC



NERC



Research England



STFC