UKRI Natural Environment Research Council

IMPACT

Force of nature

Sustainable solutions for net zero, economy and society

NERC science enables government, business and society to protect nature effectively, which strengthens our economic security, propels our journey to net zero, and benefits our health and wellbeing. Building on this strong impact, NERC is leading investments that will drive a shift to a green, low-carbon economy, that embeds environmental considerations into our businesses, financial services, and nature conservation.

Natural value

£1.2 trillion
Minimum value of nature to the UK economy

55%
Global GDP directly supported by nature

37%
Climate change mitigation needs that could be provided by nature-based solutions

Why it matters

Biodiversity is the variety of life on Earth, and the ecosystems it exists within[1]. Biodiversity and ecosystems are critical for human existence, economic prosperity[2], and a good quality of life[3]. Pollination of our crops, regulation of our climate, and countless other ecosystem services, all depend upon nature.

Our economies are embedded in nature[2]. Nature directly supports 55% ($44 trillion USD[4]) of global GDP[5], and is worth £1.2 trillion+ to the UK economy[6]. As noticed by so many during the Covid-19 pandemic, it also boosts mental[7] and physical[8] health and wellbeing. Yet one million species are currently at risk of extinction[9], including 15% of all UK species[10].

The UK Government has committed to restoring nature, enshrining into law ambitious targets to halt British species loss by 2030[11], and pledging to protect 30% of terrestrial land and our oceans by that date[12]. The UK's 25 Year Environment Plan and Net Zero Strategy action biodiversity gain, with goals to treble woodland creation and restore 28,000 hectares of peatland[13]. This commitment extends overseas, with tackling climate change and biodiversity loss the Government's number one international priority[14].

Faced with pressing problems including climate change, land use change and pollution[15], meeting these ambitious targets will require cutting-edge science and multi-disciplinary problem solving.

From NERC support to solutions for nature

Long-term NERC investment in research, innovation, infrastructure, training and partnerships delivers:

- world-leading knowledge, resources and technology
- skilled people
- effective knowledge exchange

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Used by government, industry, organisations and communities

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- International commitment and action
- Resilient, sustainable industries
- Joined up solutions for biodiversity and net zero
- Global conservation gains

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Environmental benefits

- Nature-based solutions for net zero
- Improved biodiversity and ecosystem services
- Weakened drivers of biodiversity loss

Economic and societal benefits

- More resilient and sustainable economies and communities
- Enhanced health and wellbeing
- Job creation
- Reduced/avoided costs of environmental damage

Wider benefits

- UK leadership and influence
- Contribution to legal commitments

How NERC invests for nature

NERC funds world-leading, long-term, large-scale environmental science that cuts across the leading drivers of biodiversity loss: land and sea-use change, direct exploitation of organisms, pollution, invasive and alien species and climate change[16].

Decades of NERC investment in research and innovation, infrastructure, monitoring, training, knowledge exchange and partnership, has delivered:

- Detailed, long-term datasets of species numbers and the features of ecosystems.
- Cutting-edge science, informed through improving our understanding of biodiversity, ecosystem processes and the services they support.
- Skilled people and engaged citizens.
- World-leading research, predictive models and technology to identify nature's boundaries, improve conservation management decisions, and generate alert systems for threats.
- Effective partnerships with governments and industry.

How NERC invests for nature

Long-term research and monitoring

NERC's support for long-term biodiversity monitoring provides baseline population data that underpins policy and decision-making and engages citizen scientists:

- The Biological Records Centre, recording UK soil, animal and plant life since 1964 – underpins UK biodiversity policy and monitoring.[17]
- Isle of Rum deer study since 1972 – now providing ground-breaking insight into genetic responses to climate change.[18]
- Isle of May seabird study since 1973 – supporting expansion of the UK's offshore wind industry.[19]

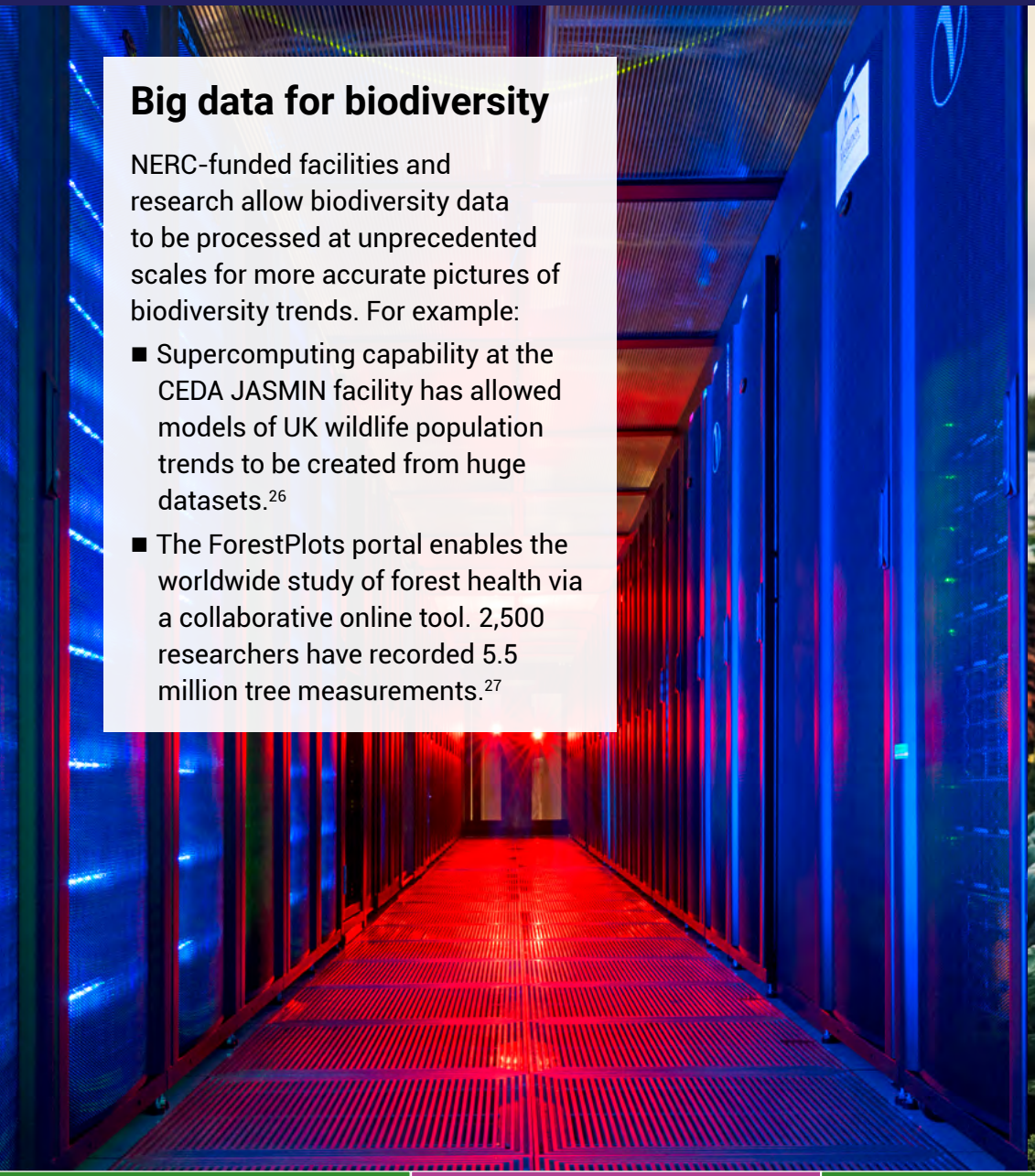
Earth observation

Satellites offer huge potential for biodiversity research and monitoring, enabling much larger areas of the Earth to be analysed at a fraction of the cost and with less disturbance to nature.

NERC-funded research includes:

- BAS has developed techniques to count populations of species in hard to reach areas such as Antarctica from satellite images, which are now widely used to inform conservation.[20]
- New radar technology developed by NCEO will allow satellite mission BIOMASS to accurately weigh the wood in the world's forests, thus mapping deforestation and informing payment for ecosystem services schemes.[21]
- UKCEH's Land Cover Maps use satellite imagery to map grassland, woodland, fresh water and urban areas. The maps underpin land-use decisions and natural capital accounting in the UK.[22]

How NERC invests for nature



Big data for biodiversity

NERC-funded facilities and research allow biodiversity data to be processed at unprecedented scales for more accurate pictures of biodiversity trends. For example:

- Supercomputing capability at the CEDA JASMIN facility has allowed models of UK wildlife population trends to be created from huge datasets.[26]
- The ForestPlots portal enables the worldwide study of forest health via a collaborative online tool. 2,500 researchers have recorded 5.5 million tree measurements.[27]

Targeted research

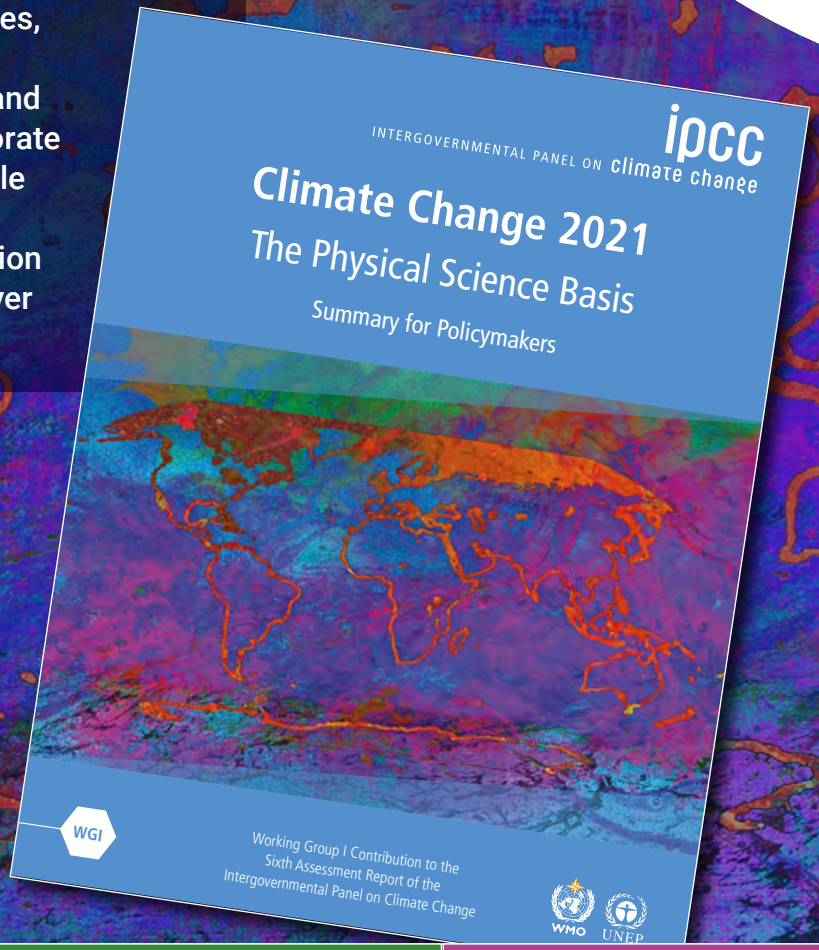
NERC invests in strategically-led research, forging interdisciplinary partnerships that address complex challenges. Recent investments include:

- Valuing Nature programme, £7 million+, NERC-led with Defra and other UKRI councils, 2013-2019.[23]
- Ecosystem Services for Poverty Alleviation programme, £40 million, NERC-led with ESRC and DfID, 2009-2018.[24]
- Biodiversity and Ecosystem Services programme, £13 million, 2011-2017.[25]

Impact: unlocking the benefits

Underpinning international commitment and action

NERC-funded science informs international policies that empower and encourage international governments, businesses, Non-Governmental Organisations (NGOs) and communities to collaborate to conserve nature, while helping the UK meet its international conservation commitments and deliver net zero.



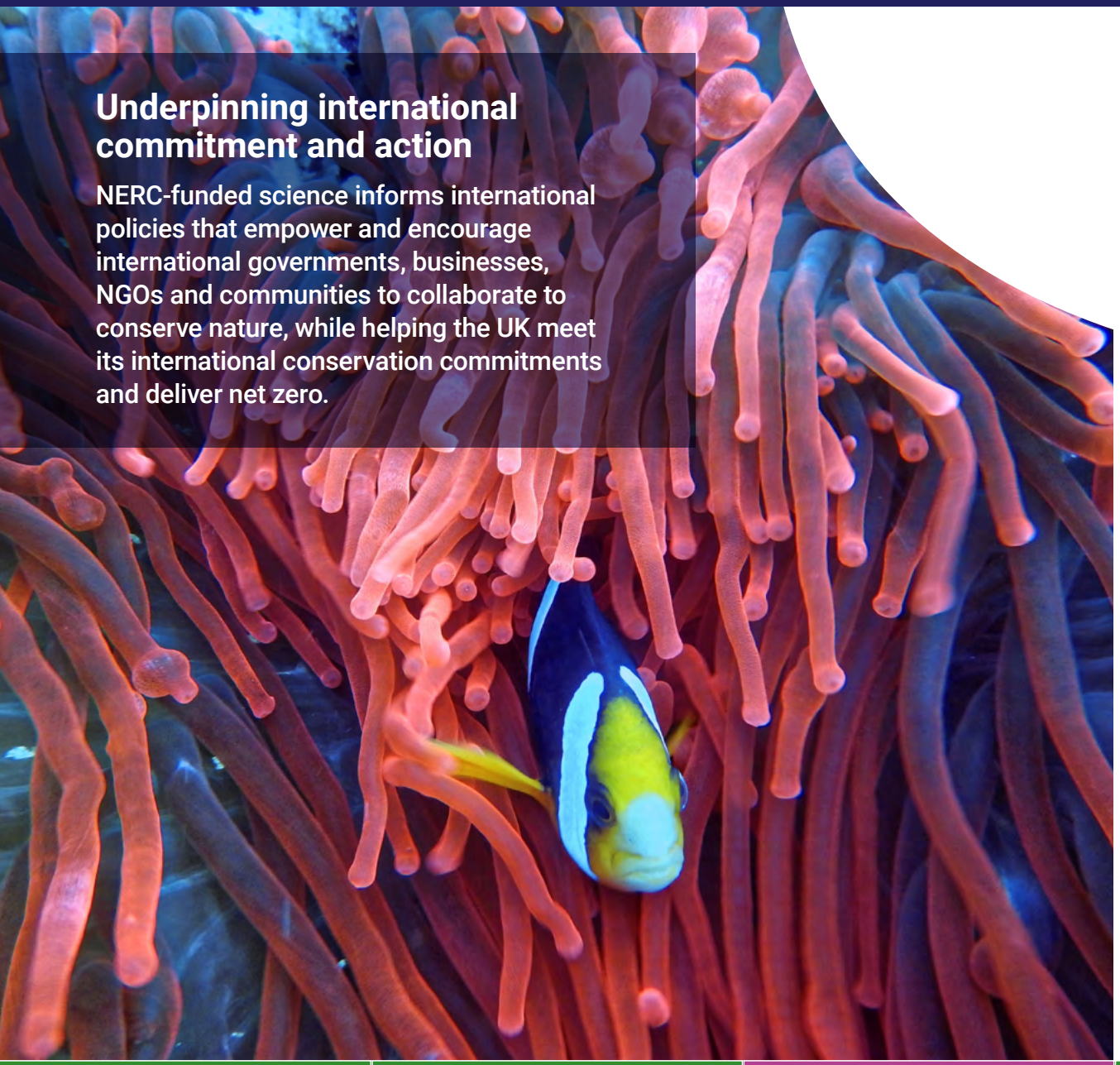
BRINGING BIODIVERSITY LEADERSHIP TO THE IPCC

NERC science and scientists play a key role in the reports of the Intergovernmental Panel on Climate Change (IPCC), which influence and underpin the climate policies of national governments, and landmark agreements such as the Paris Agreement in 2015[32, 33, 34]. 87% of UK-based authors of the latest IPCC Working Group 1 Assessment Report were NERC-funded, covering topics including the impact of climate change on biodiversity, invasive species and ecosystem services[35].

TAKING STOCK OF NATURE FOR UK POLICY

NERC-funded monitoring, research and experts underpin UK environment policy too, including the current 25 Year Environment Plan. Our science played a prominent role in the UK National Ecosystem Assessment (NEA), for example, which was a world first[36]. By quantifying the value of natural assets, the NEA promoted the uptake of natural capital accounting, and empowered the government to create markets enabling the private sector to invest in protecting the environment. Techniques for valuing nature have since been included in the Treasury Green Book, which defines appraisal procedure for government investments[37].

Impact: unlocking the benefits



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CATALYSING GLOBAL CONSERVATION ACTION

NERC-funded researchers led the development of the International Union for Conservation of Nature's Red List of Threatened Species[28]. It is the world's foremost tool for assessing the conservation status of animal, fungi and plant species, and currently includes over 138,000 species[29]. The Red List improves conservation outcomes, informs policy decisions, and allows conservation progress to be measured and celebrated. Listed Critically Endangered bird species, for example, are twice as likely to improve in status as they are to deteriorate and become extinct[30].

BRIDGING SCIENCE AND GLOBAL POLICY-MAKING

NERC-funded scientists contribute to the influential Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) assessments, including the landmark Global Biodiversity Assessment 2019[31, 31.1]. These reports provide consensus on the latest biodiversity conservation science and inform actions by international bodies such as the UN and the Convention on Biological Diversity, national governments, businesses and non-government organisations[31.2].

Impact: unlocking the benefits

Enabling resilient, sustainable industries

NERC-science strengthens industry resilience and sustainability, while supporting livelihoods and protecting threatened wildlife and habitats.

GROWING RENEWABLE ENERGY WHILE PROTECTING MARINE LIFE

Long-term research on marine mammals and seabirds is enabling the rapid expansion of the UK's offshore wind industry. The sector creates green jobs in coastal communities, and is a key part of the UK's journey to net zero carbon emissions. Long-term NERC science underpins government and industry work on wind farm locations, assessments, construction and mitigation. Now the world's largest, UK offshore wind powers 7.5 million UK homes and is planned to increase fourfold by 2030[41].

PLANTING BIODIVERSITY INTO PALM OIL PRODUCTION

Half a million hectares of forest have been conserved across several countries thanks to a toolkit developed by a NERC-funded scientist. The tool calculates the minimum rainforest area needed to conserve biodiversity near palm oil plantations. The methods have been adopted by key players in the palm oil, rubber, paper and cocoa sectors and have been incorporated into the roundtable on sustainable palm oil certification process, allowing a simpler process that enables increased participation by smallholders[42].

Impact: unlocking the benefits

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BUILDING BACK GREENER WITH BEES

NERC-funded research revealing drastic declines in wild insect pollinator species caused by neonicotinoid pesticide use in agriculture underpinned UK and EU bans, safeguarding £430-£603 million worth of ecosystem services delivered to UK farms, as well as the biodiversity they support[39]. Insect population data has spearheaded the government's UK National Pollinator Strategy, and inspired public engagement in pollinator science initiatives, such as the National Pollinator Monitoring Scheme[40].

SUPPORTING MILLION-POUND UK INDUSTRY BY KNOWING NATURE'S LIMITS

The UK rat control market, worth £230 million annually to the UK economy, can operate thanks to NERC-funded monitoring that ensures the use of rodenticides stays safe for wildlife. By measuring the exposure of birds of prey such as owls and red kites to rat poison, scientists inform the industry of the safe limits of their use, allowing continued protection of crops and human-health, while safeguarding wildlife[38].

> ***'The Predatory Bird Monitoring Scheme is the best example of wildlife monitoring and exposure (to chemicals) that measures changes to the environment as a result of policy intervention"***
>
> Natural England

Impact: unlocking the benefits

Providing joined up solutions for biodiversity and net zero

NERC science delivers innovative nature-based solutions that address the joint crises of biodiversity loss and climate change, by integrating biodiversity into the economy, catalysing climate action, and delivering benefits to the economy, society and environment.

CUTTING BUSINESS CARBON BY PROTECTING PEATLANDS

NERC scientists, working with the IUCN, developed the Peatland Code, the UK's first regulated scheme for businesses to support peatland restoration projects using carbon finance[43]. Peatlands are the world's largest carbon sink on land, playing a vital role in storing climate-warming CO_2. Three billion tonnes of carbon is currently locked away in UK peatlands. The scheme aims to restore two million hectares of UK peatland by 2040. Four projects are already underway, equating to reductions of 102 thousand tonnes of CO_2.

"this research has made a considerable contribution and provided us with valuable lessons for the development of Payment for Ecosystem Service schemes in the UK" DEFRA

VALUING NATURE FOR CLIMATE-CLEVER POLICIES

NERC-funded research measured the benefit of healthy marine habitats to fisheries, climate and flood defence in Sussex. This resulted in a byelaw to protect, and ban trawling in, 117 square miles of seabed, allowing key habitats such as kelp forests to recover[44]. Kelp is an example of 'blue carbon', helping to combat climate change by storing CO_2 as it grows.

Impact: unlocking the benefits

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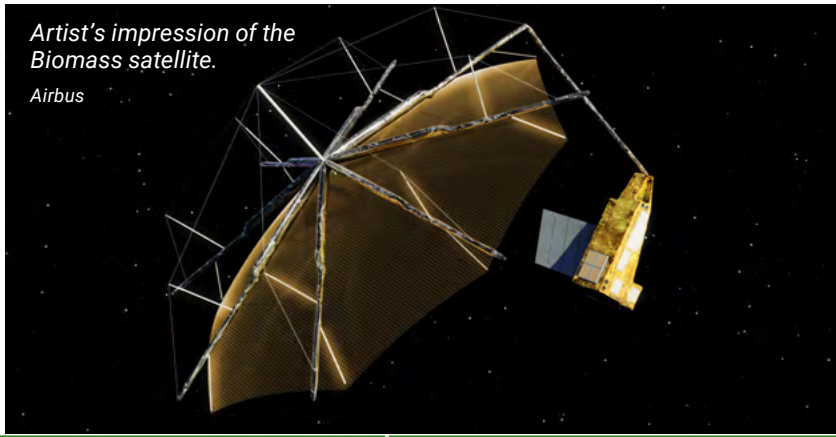
PROTECTING TROPICAL FORESTS AND MITIGATING CLIMATE CHANGE

Innovations in measuring and modelling carbon storage and deforestation funded by NERC are enabling managers of tropical forests to be supported through global payment for ecosystem services schemes like REDD+[45].

For instance NERC-funded scientists identified a technique for measuring tree biomass accurately from space. This played a key role in the European Space Agency's decision to build a new satellite called Biomass, which is being built by Airbus Defence and Space (UK) and is due to launch in 2023. By accurately quantifying changes in tropical forests, the satellite will enable carbon reduction schemes to operate effectively[46, 47].



Artist's impression of the Biomass satellite.

Airbus

Impact: unlocking the benefits

Delivering global biodiversity gains

NERC science informs governments, NGO's and society of best practices in conservation, saving species, protecting ecosystems, and supporting the wellbeing of communities that depend on nature.

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ENVIRONMENTAL SCIENCE FOR GLOBAL MARINE CONSERVATION

Pulverising plastic pollution

Research discovering the harm that marine plastic pollution causes ocean biodiversity underpinned UK legislation to ban microplastic beads. The UK action precipitated similar bans globally, including in Canada, New Zealand, South Africa and Sweden. Now 4,000 fewer tonnes of plastic enter the ocean a year, protecting £380 billion a year of marine ecosystem services, marine animals such as seals, and our food, from harmful microplastics[48].

Protecting antarctic biodiversity and fisheries

Since the introduction of new regulations guided by BAS research, fisheries in the Southern Ocean have seen a 99.5% reduction in seabird mortality and have introduced measures to protect penguins and prevent over-fishing[49].

BAS science has also underpinned international policies to protect polar biodiversity and habitats, including the designation of over three million km^2 of marine protected areas around Antarctica, in the Southern, South Atlantic and South Pacific Oceans[50].

"Scientific research by BAS…is critical for informing UK Government policy objectives, including…the protection of the unique biodiversity and environments of Antarctica and the UK Overseas Territories" FCDO[50]

Impact: unlocking the benefits

Delivering global biodiversity gains

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UNDERPINNING UK NATURE CONSERVATION SUCCESS STORIES

Successful reintroductions

NERC-funded research led to the successful reintroduction to the UK of the Large Blue butterfly, following its extinction in 1979. Scientists identified the precise conditions needed for the insect to survive, leading to tailored – and successful – reintroduction and conservation plans. The butterfly's population numbers have increased by 329% over the last decade, and other species have also benefitted from sites managed for the Large Blue[53].

Protecting biodiversity, health and businesses from invasive species

National alert systems for invasive non-native species, conceived of NERC-research, allow prompt government action and quick eradication of problem species, saving money in avoided damage to business and protecting health and native species. The Asian hornet for example, feeds on honeybees and can cause severe losses to farmers. The alert systems often rely on Citizen Scientists, with engaged members of the public logging sightings of invasive species on a smartphone app[51].

Saving iconic national species

Populations of the Scottish water vole have recovered following a successful programme to eradicate the non-native American mink. NERC-funded research identified the mink as the cause of declines in water vole populations, and guided their eradication. Not only have the water voles recovered, but other species in the study area, such as ground nesting birds, have also benefitted[52].

People-powered solutions for biodiversity

NERC also delivers impact by developing people. Our funding for postgraduate training produces highly-skilled specialists who drive transformative change in relation to biodiversity and climate change.

Dr Liz Morgan

Championing seabirds for renewables expansion

As a senior ornithological consultant at environmental consultancy NIRAS, Liz Morgan provides specialist advice to the UK's offshore wind industry. The expertise developed during her NERC-funded PhD enables her to advise offshore wind developers on reducing their impacts on bird populations, thus protecting the environment, ensuring legal compliance, and enabling the continued expansion of the UK's world-leading renewable energy industry.

Professor Rosie Hails

Leading with science to benefit people and nature

As Director of Nature and Science, Rosie Hails leads on policies to support delivery of the National Trust's nature objectives across its 260,000ha of land. Her NERC-funded PhD and later NERC funding for pioneering science-to-policy work were fundamental to developing the skills needed for the role. As the first holder of this post, she is also developing a research-based approach for the Trust, ensuring that their work is based on the latest science.

Dr Kevin Austin

Guiding policy for a healthier environment

As Deputy Director of Agriculture, Fisheries and the Natural Environment at the Environment Agency, Kevin Austin works with government and business partners to secure a climate resilient, cleaner and healthier environment for wildlife and communities across England. Kevin credits his NERC-funded Masters and PhD with developing his ability to present succinct evidence-based arguments and to think through complex challenges logically, skills that he still uses in his role today.

Investing for the future

NERC continues to support research, training and innovation that will benefit biodiversity and the people and industries dependent upon it. For example:

- **The Future of UK Treescapes:** a £14.5 million programme funded by UKRI Councils, Defra and devolved governments to improve understanding of the UK treescapes to inform national forest restoration and tree-planting, to facilitate our journey to net zero[54].
- **Economics of Biodiversity:** a £6 million NERC and ESRC-funded programme to explore how biodiversity can be economically valued by decision-makers, to inform management of natural assets[55].
- **Climate and Environmental Risk Analytics for resilient Finance (CERAF):** a £10 million NERC and Innovate UK programme to enhance the resilience of the financial services sector to the impact of our changing climate and environmental degradation[56].
- **Latin American Biodiversity Programme:** a £4.5 million partnership between NERC and four Latin American funders, to identify and understand biodiversity and ecosystem services in the region and support sustainable development[57].
- **Biodiverse agriculture:** By 2025, NERC will invest £6 million in partnership with BBSRC to support innovative solutions for biodiverse agriculture, to improve food security while halting nature degradation[58].

Contributing towards the Sustainable Development Goals

Delivering the science to support the United Nations Decade of Ocean Science for Sustainable Development[59]

NERC's commitment to nature

NERC is part of UKRI, which has committed to better understand the biodiversity value of our UK estate and identify opportunities for improvement. The NERC Biodiversity Fund has, for example, supported work to improve and restore habitats such as wildflower meadows and ponds.

More information:
impact@nerc.ukri.org

Notes and references

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21 Biomass satellite: article 1, article 2, ESA Biomass Mission, article 3
22 UK Land Cover Maps: link 1, link 2
23 Valuing Nature Programme
24 ESPA programme
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42 Palm Oil: article 1, article 2
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44 SWEEP
45 REDD+
46 See reference 21
47 Case study
48 PML case study, p18
49 BAS case study, p32
50 BAS case study, p37
51 UKCEH: case study 1, p29, case study 2
52 Case study
53 Case study, UK Butterfly Monitoring Scheme
54 The Future of UK Treescapes, press release
55 Economics of biodiversity programme
56 CERAF programme
57 Latam Programme
58 e.g. Molecules to Landscapes Programme
59 The United Nations SDGs, Ocean Decade, NOC project

Acronyms

BAS: British Antarctic Survey
CEDA: Centre for Environmental Data Analysis, JASMIN is a supercomputer run by CEDA
Defra: Department for Environment Food & Rural Affairs
DfID: Department for International Development
ESRC: Economic & Social Research Council
FCDO: Foreign, Commonwealth & Development Office
IPBES: The Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services
IPCC: Intergovernmental Panel on Climate Change
IUCN: International Union for the Conservation of Nature
NCEO: National Centre for Earth Observation
NERC: Natural Environment Research Council
PML: Plymouth Marine Laboratory
REDD+: Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
UKCEH: UK Centre for Ecology and Hydrology
UKRI: UK Research & Innovation