Call for evidence: Shaping NERC's Priorities

Submission template

Responses should be completed on the evidence template and submitted via email to
NERCevidence@nerc.ac.uk

The closing date for responses is **Monday 23rd March 2015**

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Q1 **What emerging research and innovation opportunities promise to make the biggest impact on societal challenges?** (Please identify a maximum of three themes; max 300 words each; see here for example themes.)

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(1) Supporting nature's services

The environment supports extensive natural capital, the range of living and non-living components that provide value to people, both directly and directly. Natural capital and the flow of benefits to society (ecosystem services) underpin our economy and society, with the economic value estimated at billions of pounds in the UK alone.

However in 2015, the UK environment is facing continuing threats to natural capital stocks. The Valuing Nature Programme (2013-2018) will address a number of specific challenges, but significant gaps remain, requiring substantive investment. The Natural Capital Committee's advice paper to Government on natural capital research needs (March 2014) identified two priority themes: the development of metrics for natural capital accounting that reflect the status of natural assets (alternatives to GDP); developing a resource of widely available values for ecosystem services, underpinned by natural science, and incorporating these into decision-making.

NERC leadership, coordination and funding will help us to further advance our knowledge of natural capital and enhance the integration of natural capital in decision making. This will enable the UK to support biodiversity and nature's services and make better decisions for the future.

In addition to the themes identified by the Natural Capital Committee, potential priorities for NERC research and innovation investment, working with partnership with others, might include:

- **Valuation and Monitoring-** develop a consistent and robust approach to valuation and monitoring, measuring changes in the status and estimated value of natural capital.
- **Natural Capital in Decision making-** to mainstream the consideration of natural capital and ecosystem services, integrating evidence and knowledge into decision-making frameworks.
- Improve our understanding of the relationships between changes in natural capital and economic growth, employment and related measures.

(2) Building resilience to environmental hazards

Climate change models suggest an increased frequency of torrential rainstorms and severe heatwaves. If extreme events become commonplace, there will be significant changes to the behaviour, appearance and habitat availability along rivers and around small lakes and ponds. Even without an increase in the frequency of extreme events the continuing physical modification of rivers and their floodplains will mean increased flooding and drought incidents, putting unprecedented pressure on freshwater ecology.

The BES brought together current science on this topic in 2013, in 'The Impact of Extreme Events on Freshwater Ecosystems'. It concluded that knowledge about the cumulative effects of extreme events on freshwaters is inadequate. Instead of relying on opportunistic post hoc studies, a strategic programme of replicated experimental studies is required that provides statistically robust links between cause and effect.

Freshwaters need to be managed to provide invaluable ecosystem services in such a way as to also limit the likely impacts of increased extreme events. Already, the capacity of freshwater habitats to provide ecosystem services such as flood regulation (slowing water down), water storage (above and below ground) and water cleansing (breaking down pollutants naturally) has been severely compromised. Channelisation, land drainage, water abstraction, pollution and tree removal are responsible. There are also tensions regarding delivery of different ecosystem services (e.g. pristine drinking water versus moderate nutrient enrichment to sustain fisheries). The evidence base for long-term recovery of ecosystem services provided by freshwaters, and how these would be delivered in rivers and lakes subject to more extreme events, needs to be improved. Researchers currently speculate based on limited and imperfect information: a multi-disciplinary approach incorporating existing data, improved models and experimental studies is required.

Research Priorities:

- Meta-analysis of the incredible range and volume of hydrological, morphological and ecological data available;
- Catchment experimental studies;
- Species-habitat requirements for key vulnerable taxa.

3) Biodiversity monitoring and data

The UK is experiencing reductions in all aspects of biodiversity: 60% of species have declined over the last 50 years and 31% have declined strongly. Monitoring the state of biodiversity and the impacts of global environmental change on natural capital is fundamental to effective adaptation and mitigation strategies. Although some aspects of UK biodiversity are well-recorded, many functionally important species are missing. Data on abundance and on trends in abundance are lacking. NERC should provide leadership to fill these gaps, in partnership with others (e.g. the Biological Records Centre, National Biodiversity Network).

NERC must recognise the value of citizen science for both scientific inquiry and public engagement. The UK is providing international leadership in citizen science: this can be an 'export' to enhance our international standing. The usefulness of data collected via mass participation citizen science (e.g. to answer scientific questions and be re-used) must be maximised.

Local biodiversity monitoring should be enhanced, particularly beyond the 'popular' taxa, in order to address specific questions regarding adaptation to climate change, resilience to environmental change and the benefits of positive management (e.g. restoration, agri-environment schemes).

Potential priorities for NERC research and innovation investment, working with partnership with others, might include:

- **Development of Sensors-** to promote the development of Remote Sensing Biodiversity Variables. Improving fine-scale assessments (e.g. trees and tree identity, acting as correlates of quality to remote-sensed data). Also the development of personal sensors (e.g. for air quality, sound recording and eDNA surveys).

- **Biodiversity data management-** to develop a single, cross-domain (marine/freshwater/terrestrial) solution for biodiversity data management (incorporating data storage, discovery analysis, visualisation and publication).

- **Training and Education**- to promote increased opportunities for training and education to realise an increase in the volume of open data from NERC science and facilitate broad-scale collaboration and big data solutions to environmental challenges.

Q2 How should NERC ensure that our research and innovation investments deliver the most impact?
(See meaning and broad scope of impact above; max 200 words)

NERC should invest in high quality training for the researchers it funds, particularly prioritising training for PhD students and post-doctoral researchers in their first post. Researchers should receive support and training in communicating to non-specialists, including policy-makers, business and in public engagement. NERC should foster a research culture where engagement with non-academic audiences is valued.

Interdisciplinary collaborations should be encouraged, as should cross-Research Council partnerships on programmes to tackle major research challenges.

Partnerships should be developed with the users of research beyond academia, including business, industry and policy-makers.

Q3   **Given the priorities identified in your answer to questions 1 and 2, who are key partners NERC should be working with?** (max 200 words)

NERC should partner with learned societies and other Research Councils. It's important to engage with business, economists and the accountancy profession with respect to the valuation of natural capital and integration into supply chains.

Learned Societies can play a significant role in advising and contributing to environmental research and innovation agendas. Independent learned societies, like the BES, are leading voices for specialists in their fields, ensuring that the expertise of their members informs policy and decision-making. The BES has over 5,000 members, drawn from a full spectrum of ecological research reflected in the Society's specialist groups on topics including forest, freshwater, tropical, agricultural, aquatic and conservation ecology.

NERC should increasingly partner with other Research Councils including BBSRC, ESRC and EPSRC. As highlighted in our response to the 'Consultation on the Triennial Review of the Research Councils' in 2013, artificial disciplinary divisions compromise the delivery of individual Research Council objectives. The current disciplinary divisions fail in a number of areas such as agriculture, health, food, energy and conservation. The divisions fail to support multi, inter and trans-disciplinary science adequately. In particular, the divisions are unhelpful in areas where a systems approach is needed, such as water, resource use and flooding.

Q4   **How could NERC's research and innovation investments best support innovation and growth at a regional/local scale?** (max 200 words)

Please see the answer above regarding local biodiversity monitoring. This should be enhanced to address specific questions regarding adaptation to climate change, resilience to environmental change and the benefits of positive management (restoration, agri-environment schemes etc).

**Q5	Do you have any other comments about NERC's strategic investment priorities?** (max 200 words)

NERC's priorities for strategic investment must be underpinned by investment in high-quality training for postgraduates. PhD students and Postdoctoral researchers in their first post must be given the opportunity to develop transferrable skills that can equip them for interdisciplinary working – a fundamental approach to tackling the challenges that face society. Training must equip students for careers outside academia, recognising the contribution highly qualified ecological and environmental science graduates can make to careers in practice, policy and business. The BES can assist NERC in providing this training. In 2015, we will begin a partnership with the ACCE DTP to deliver two one-day training courses in 'Employability and Careers', 'Knowledge Exchange and Science Communication'.

NERC has a significant role to play in encouraging a culture shift in academia, helping researchers and their peers to understand the value of public engagement. The BES appreciates the support that NERC has provided for the Society's public engagement work this year, under the 2015 'Summer of Science' scheme. NERC, its research institutes and researchers it funds must continue to support those involved in communicating their research to the public, who are contributing to a wider societal culture whereby ecology, the environment and scientific enquiry is appreciated.