<table>
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<th>AO Title/Call Name</th>
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| **Closing date**   | Notification of Intent deadline: 4pm on 20 February 2020  
Full Proposals deadline: 4pm on 19 March 2020 |
| **Funding available** | £16m |
| **Funding mode/stream** | Highlight Topics |
| **NERC Core or UKRI/Collective Fund budget** | NERC Core budget |
| **Project duration** | Maximum of 4 years |
| **Funding partners (if applicable)** | n/a |
| **Start date requirements (if applicable)** | The expected start date for projects funded under this Announcement of Opportunity is no later than 2 November 2020, except for any projects subject to programming of ship-time or aircraft campaigns. |
| **Call aims and objectives** | Highlight topics focus strategic research on defined topic areas, and will be delivered through independent projects. The highlight topics in this call are: |
| | A. Biodegradable plastics as emerging environmental pollutants  
B. Understanding and predicting the cross-ecosystem impacts of insect decline on ecosystem services and natural capital  
C. Marine terminating Glaciers in the Earth System  
D. Achieving net environmental gain and resilient ecosystems in the UK  
E. Consequences of accelerating Arctic warming for European climate and extreme weather  
F. Polyisotopologues for constraining atmospheric budgets  
G. Understanding global lithium resources and cycles to enable a low carbon future |
| **Eligibility criteria** | Investigators may be involved in no more than two proposals submitted to this call and only one of these may be as the lead Principal Investigator. |
| **Call specific requirements** | A notification of intent to submit must be submitted by 20 February 2020 16:00 |
| **Contact** | For eligibility, application process and peer review queries, please contact researchgrants@nerc.ukri.org  
For scientific and remit queries, please contact highlighttopics@nerc.ukri.org |
Highlight Topics 2020

Announcement of Opportunity

Issued on: 4 November 2020
Notification of Intent deadline: 4pm on 20 February 2020
Full Proposals deadline: 4pm on 19 March 2020

1. Summary

NERC invites proposals for the fifth round of highlight topics, a route for funding strategic research. Highlight topics focus strategic research on defined topic areas, and will be delivered through independent projects. The highlight topics in this call are:

A. Biodegradable plastics as emerging environmental pollutants
B. Understanding, predicting and mitigating the cross-ecosystem impacts of insect decline on ecosystem services and natural capital
C. Marine terminating Glaciers in the Earth System
D. Achieving net environmental gain and resilience ecosystems in the UK
E. Consequences of accelerating Arctic warming for European climate and extreme weather
F. Polyisotopologues for constraining atmospheric budgets
G. Understanding global lithium resources and cycles to enable a low carbon future

A notification of intent must be submitted by 20 February 2020 16:00. The closing date for proposals is 16:00 on 19 March 2020. Proposals must be submitted via the research councils’ Joint electronic-Submissions (Je-S) system.

The maximum value for individual proposals under each topic area is £2m at 80% FEC (£2.5m 100% FEC) and up to four years in duration; NERC will fund up to two proposals per topic. For this Highlight Topic call, NERC will consider exceptional cases for exceeding the £2m limit. Refer to section 5.5 for more detail.

2. Background

NERC’s vision is to place environmental science at the heart of responsible management of our planet. NERC’s ambition is to lead a broad and diverse research community to bring about the environmental solutions - clean air and water, limited climate warming, a circular economy, and diverse ecosystems - needed in the UK and worldwide, to foster a productive, healthy and resilient environment.

NERC’s funding streams for strategic research enable the environmental science community to play a role in setting priorities for research funding. Highlight topics are a funding stream that focuses strategic research on defined topic areas.
3. Scope

The following highlight topics have been selected for this call and are considered to be of equal priority. There are more highlight topics announced than available funding will support, so all topics will not, necessarily, result in funded grants. This is to ensure effective competition so that only the very best research is funded.

Proposals must address issues within a single highlight topic; proposals addressing more than one highlight topic will not be accepted. Where multiple proposals are invited within a highlight topic, they must be independent projects and coordination is not required between projects to achieve their aims.

A. Biodegradable plastics as emerging environmental pollutants

Objective

To determine the potential environmental impact of biodegradable bioplastics to better understand the environmental effects of changing plastic production trends.

Strategic context

Industries are rapidly shifting towards ‘compostable’ and ‘degradable’ plastics and the use of biodegradable bioplastics (BBPs) is increasing exponentially across the globe, with 2.11 million tonnes manufactured in 2018 alone. As yet there is little evidence on the potential impact these alternative single use plastics may have on the environment, with most information on the ‘compostable’ and ‘degradable’ nature of these alternative plastics limited to industrial settings. BBPs may not fully degrade in natural ecosystems, or they may persist for a substantial period of time; and it is unclear what they may biodegrade into, and what impact this might have on ecosystems. Most BBPs are composed of organic polymers (e.g. polylactic acid, polyhydroxyalkanoate) and as they degrade, have the potential to release carbon as well as other associated chemicals, e.g. flame retardants and plasticisers that in large quantities could affect organisms, food webs, nutrient and energy transfers, ecosystem function and ultimately ecosystem services. Understanding the fate and ecosystem effects of BBPs under natural conditions is therefore necessary to understand the implications of switching from legacy plastic materials to alternative biodegradable plastics.

Scope

To understand the impact of biodegradable bioplastics on the environment research is required on the fate of BBPs in the environment and their effect on organisms and ecosystem function, and proposals are expected to address both these aspects.

Scientific advances

There are fundamental gaps in understanding of the rate at which BBPs degrade in natural systems, what compounds they degrade into, or what the potential implications are for ecosystems. Research challenges to be addressed include:

Fate of Bioplastics:
- What compounds are produced by BBPs under natural environmental conditions, both experimentally and in situ?

1 https://european-bioplastics.org
• What are the optimal methods for identifying and characterising BBPs in the environment?
• What are the physicochemical and ecological factors that govern how BBPs move, behave and interact with ecological and biogeochemical processes in natural environments?

Effect on Ecosystems:
• What are the direct and indirect effects of BBPs on organisms?
• What is the direct toxicity of BBPs?
• How do biogeochemical effects of BBP degradation affect organisms and how do these effects proliferate through food webs?
• What is the consequent impact of BBPs on organisms, populations, food webs, ecosystem function and ecosystem services?
• Are certain ecosystems more at risk than others, and are there thresholds beyond which given levels of exposure might have irreversible environmental impacts?

By addressing both of the fate and impact of BBPs, the outputs of the research will provide better understanding of the characteristics (e.g. physical, chemical) required of alternative plastics to limit their environmental impacts, and the potential consequences of replacing a significant proportion of single use plastics with biodegradable alternatives.

Delivery

This highlight topic should be addressed by up to two projects, each up to the value of £2m at 80% FEC (£2.5m 100% FEC) and up to four years in duration. Individual proposals should address both the fate and impact of BBPs.

B. Understanding and predicting the cross-ecosystem impacts of insect decline on ecosystem services and natural capital

Objective

This highlight topic aims to better understand the causes, mechanisms, and consequences of insect decline through taking a multiple taxa and drivers approach to understand the cascading consequences for insect-dependent species, ecosystem functions and services.

Strategic context

Insects comprise over two-thirds of the plant and animal species on Earth, and have a diverse range of key ecological roles including pollination, pest control, decomposition, as well as providing resources for higher trophic levels, including mammals, bats and birds. Evidence from European agriculture-dominated landscapes through to primary rainforests shows marked reductions in insect biomass in recent decades. The 2019 IPBES report estimates that 10% of insect species are threatened by extinction, but highlights the limited knowledge to understand this estimate as little is known about the longer-term and ecosystem-wide impacts of such declines, nor about the economic impacts in terms of natural capital. There is a pressing need for knowledge to underpin mitigation frameworks before insect diversity decline reaches a critical threshold from which they may not recover. A cross-ecosystem approach is needed for this functionally important group, as the recently reported insect declines are an under-appreciated risk factor that could have catastrophic effects on many sectors of the economy. Individual projects are required to address all the questions identified below.


**Scope**

This highlight topic will focus on the causes, mechanisms, and consequences of insect decline. This decline has been linked to habitat loss and quality reduction, pesticides, invasive species, and climate change, and this highlight topic seeks to generate cross-ecosystem understanding of the causes and mechanisms of insect decline.

**Scientific advances**

Current data is limited to linking individual drivers to specific taxa, revealing changes in abundance with limited trait associated variance. At present there is no ‘synthesis overview’ across taxa and drivers, which would provide an understanding of the consequences of decline for insect-dependent species and functions. There is a growing awareness of a lack of overview across multiple taxa and drivers, and associated understanding of the cascading consequences for insect-dependent species, ecosystem functions and services. This highlight topic will contribute to improved cross-ecosystem understanding of the causes and mechanisms behind insect decline, and its likely impacts on biodiversity, ecosystem functioning and services, both in the short term, and for longer term resilience; as well as a much needed insight into consequences on our natural capital. The ecosystem functions and services included in this approach will need to be far more diverse than pollination and pest control, and could include for example dung removal and human disease vector control. Subsequently, this knowledge could inform development of mitigation practices to slow or reverse insect decline. Proposals would use empirical and modelling approaches to:

1. Exploit existing data to provide a ‘synthesis overview’ of insect changes across taxa, ecosystems and drivers.
2. Develop a mechanistic, trait-based understanding of changes in insect abundance, function and interactions.
3. Explore cascading effects through ecological networks, and functional consequences of insect declines.
4. Predict future trends for insect taxa and ecosystem services, facing additive, synergistic or antagonistic drivers.
5. Predict the impact of insect decline on natural capital.

This knowledge will eventually enable the development of predictive and empirical mitigation practices to stabilise current ecosystem service delivery, promote increases in services, and increase resilience.

**Delivery**

This highlight topic should be addressed by up to two projects, each up to the value of £2m at 80% FEC (£2.5m 100% FEC) and up to four years in duration. Individual projects are required to address all the questions identified.

**C. Marine terminating Glaciers in the Earth System**

**Objective**

To better understand the coupling of Greenland’s marine terminating outlet glaciers and the ocean in the context of global climate variability, and in so doing, improve projections of its future dynamic response and sea-level contributions.
**Strategic context**

The UK government have declared a climate emergency – in which glaciers and ice sheets play a significant role. They cover 10% of the Earth’s land surface and lock in 75% of the Earth’s fresh water. As the Earth warms, ice melts and glaciers retreat; accelerated melting and dynamic mass loss will dominate future global sea-level rise. Nowhere is ice-sheet behaviour more uncertain than where it meets the ocean. Here glacier dynamics are strongly coupled, in both directions, to ocean and atmosphere, creating a complex web of non-linear interaction, which has resulted in the recent acceleration and mass loss from Greenland’s marine terminating glaciers. Recent increases in global temperature have been most rapid in the Arctic, particularly over Greenland, and Greenland’s ice sheet is losing mass at the fastest rate ever measured.

There is an emerging picture of warming oceans forcing ice sheet retreat in ways that are poorly constrained and understanding the coupled ice-ocean-atmosphere system is more urgent than ever. A major obstacle to understanding marine terminating glaciers has been the paucity of data due to the extremely challenging nature of the environment for in situ data collection, and the high resolution needed from earth observing platforms. The UK is now very well placed to address these issues with the new generation of networked, autonomous measurement systems, and the unprecedented capabilities of new satellite sensors.

**Scope**

This highlight topic is focussed on interdisciplinary research, combining state-of-the-art observational and modelling techniques, that complements international efforts to understand the coupling of Greenland’s marine terminating outlet glaciers and the ocean in the context of global climate variability, and in so doing, improve projections of its future dynamic response and sea-level contributions.

**Scientific advances**

Links between climate, glaciers and sea level rise are an area of increasing scientific interest, but research questions remain which can only be answered by interdisciplinary research combining state-of-the-art observational and modelling techniques. Research questions include:

1. What are the dominant processes, which deliver ocean heat to marine glaciers and drive melting of ice?
2. What is the influence of glacier runoff, meltwater and icebergs on circulation and productivity at the scales of the fjord, continental shelf and ocean?
3. How will changing meltwater and iceberg production affect marine productivity?
4. How will the changing dynamics of Greenland’s outlet glaciers influence iceberg production, and subsequent hazards posed to shipping and marine installations?
5. Are we near a tipping point? Can non-anthropogenic warm episodes during the Holocene shed light on this question?
6. How do we parameterise these nonlinear processes into predictive global systems models?

**Delivery**

This highlight topic should be addressed by up to two projects, each up to the value of £2m at 80% FEC (£2.5m 100% FEC) and up to four years in duration. Individual proposals are not required to address all the identified research questions.
D. Achieving net environmental gain and resilient ecosystems in the UK

**Objective**

This highlight topic aims to understand what mechanisms are at work in ecosystem restoration, how biodiversity, complexity, connectivity, feedbacks and resilience can be secured, with differing approaches to terrestrial system interventions.

**Strategic context**

The 25 Year Environment Plan, sets out a vision to secure a more biodiverse, connected and complex landscape. The Natural Capital Committee has identified the need to secure Net Environmental Gain nationally across all land uses from agriculture, through conservation to urban land uses. However, to achieve net environmental gain there are challenges; what should go where? What does success look like? Currently the approach is random and fragmented, early adopters of such practices as “rewilding” appear to be successful, but with little or no reference as to spatial coherence or where maximum benefit could occur. Moreover, definitions of restoration are not agreed — “going back to the past” is impossible, and “pristine reference sites” are difficult to define, and may not exist in the UK. Restoration ecology has focussed on plant community establishment, relying on species lists and “reference” sites. Whilst the Lawton report “Making space for Nature”, is approaching its tenth anniversary, the “restored, coherent and resilient ecological network” called for in the recommendations has not been realised. The UK government’s 25 Year Environment Plan now provides the opportunity to achieve this with the specific aims to restore 75% of the 1m ha of protected sites, and creating or restoring 0.5m ha of wildlife rich habitat outside the network of protected sites.

**Scope**

This highlight topic seeks to support decisions around land-use in the UK through a better understanding of the complex co-benefits and trade-offs between the health of the environment, well-being, and economic and social factors. To deliver restoration, species lists, and single trophic level interventions are insufficient; understanding sites and processes at a whole system level is required. We need to understand the interplay between ecosystem complexity and connectivity to produce a resilient and biodiverse landscape. Individual projects are required to address all the questions identified below.

**Scientific advances**

The understanding required from this highlight topic is to identify what should go where to maximise environmental net gain, with clear evidence as to those sites which should be restored, and how, to maximise gain. Which restoration interventions succeed most efficiently in re-establishing complex, functional and resilient systems, remain unclear. The research gap in achieving net environmental gain and therefore a productive environment is to develop and apply systems level measurements and feedback that includes above and belowground complexity and transfer of energy, materials and information as well as interdependencies, feedbacks, and dynamics, and how this knowledge would allow us to make more effective and efficient interventions to secure environmental net gain. “What comes first”, “what goes where”, and “at what scale” are overarching questions to be addressed by understanding sequencing of interventions. Limitations to current understanding of the effectiveness of restoration approaches arise through most research being focussed above, or below, ground, and often at one trophic level. By addressing these questions, knowledge and understanding will be gained of the types and spatial location of intervention that would achieve effective and rapid environmental net gain, and
of the underlying mechanisms controlling ecosystem assembly and resilience. In particular, there is a need to explore system level measurements of energy, material, and information flows. The research questions are:

1. What are the effects of restoration on the flows of energy, material and information?
2. What is the relationship between system complexity and these flows during the transition from degraded to restored state?
3. Which biotic and abiotic interventions and investments deliver the establishment of complexity and feedbacks similar to those found in target systems?
4. How dependant is this on the abiotic template of soils, hydrology, topography and scale?
5. How important is buffering capacity and redundancy for making restored systems resilient to perturbation?
6. Can the process of ecological restoration by targeted interventions be accelerated?

The outcome of this highlight topic will be a deeper systems level understanding of the restoration process, what constitutes a “restored” system and will deliver ecosystem benefits from increased natural capital, revitalised stocks and flows within and between sites, and attendant positive cultural outcomes, addressing the ambition of the 25 Year Environment Plan.

Delivery

This highlight topic should be addressed by up to two projects, each up to the value of £2m at 80% FEC (£2.5m 100% FEC) and up to four years in duration. Individual projects are required to address all the questions identified.

E. Consequences of accelerating Arctic warming for European climate and extreme weather

Objective

This highlight topic aims to increase understanding of atmospheric and oceanic circulation changes in response to Arctic warming, and more broadly, the drivers of European climate and extreme weather on decadal to centennial timescales.

Strategic context

Europe has experienced an increase in extreme weather in recent decades. Many of these extreme events were connected to disruptions in the polar jet stream. The jet stream marks the boundary between colder air to the north and warmer air to the south. Displacements in the jet stream lead to unseasonal, and at times, extreme weather. The jet stream owes its existence, at least in part, to the temperature difference between the pole and equator. This temperature gradient has weakened as the Arctic has warmed more than twice as fast as the global average, a phenomenon known as Arctic amplification. It follows, then, that accelerated Arctic warming could affect the jet stream, which is critical for weather conditions at the Earth’s surface and affects the day-to-day lives of billions of people. Other aspects of our weather, such as storms and blocking, may also be affected by Arctic amplification. The loss of Arctic sea ice is one of the most compelling manifestations of man-made climate change. Unless greenhouse gas emissions are severely curtailed, the Arctic is expected to be ice-free in summer by around 2050. In addition, the Arctic Ocean is changing in ways (e.g. “Atlantification” of the Barents Sea; freshening of the Beaufort Gyre) that could have knock-on effects for the global ocean circulation, such as the Gulf Stream; and in turn, on storms which form over
the Gulf Stream before reaching Europe. Increasing scientific evidence suggests the effects of Arctic warming and sea-ice loss will be felt way beyond the Arctic.

**Scope**

Past work has indicated that Arctic amplification can, in principle, affect European weather, but a clear picture of how and why is currently lacking. A timely opportunity exists to move beyond basic reasoning towards providing a predictive understanding of the effects of Arctic amplification on European climate and extreme weather over the coming decades to centuries. Currently numerous, but often conflicting, hypotheses exist for how Arctic amplification may affect European weather and climate. Through this Highlight Topic, the unifying theories of such linkages should be developed, which can guide model evaluation and improvement, be harnessed for decadal prediction, increase confidence in multidecadal to centennial projections, and accelerate physical understanding of inter-regional climate linkages.

**Scientific advances**

Research questions include:

- Do the latest generation of climate models (CMIP6) simulate realistic connections between the Arctic and Europe?
- Is the simulated response to sea-ice loss too weak; the so-called ‘signal-to-noise’ problem?
- Through what physical mechanisms does Arctic amplification influence the atmospheric circulation?
- What are the roles of the ocean, in terms of regional air-sea-ice interaction, heat transport and oceanic teleconnections?
- What are the consequences of the Paris targets for mitigating the effects of Arctic change on European climate and extreme weather?

**Delivery**

This highlight topic should be addressed by up to two projects, each up to the value of £2m at 80% FEC (£2.5m 100% FEC) and up to four years in duration. Individual proposals are not required to address all the identified research questions.

**F. Polyisotopologues for constraining atmospheric budgets**

**Objective**

This highlight topic aims to integrate nascent techniques in isotope geochemistry into atmospheric monitoring science to study the rapidly changing modern atmosphere.

**Strategic context**

Since the 1980s global trends in greenhouse gases have been well quantified and these efforts have been vital for calculating the changing radiative budget and realising the anthropogenic drivers of climate change. These atmospheric measurements, alongside other observables such as bulk stable or radioactive isotope ratios, are also being used to try and quantify fluxes (‘top-down’ estimation). Despite thousands of measurements each year, making conclusions as to the processes driving the changing burdens remains
challenging: The atmospheric rise in methane (CH$_4$) over the last decade, for example, cannot yet be attributed to changes in source or sink strength. Simple spatial extensions of current monitoring networks are unlikely to make a step change because current observables under-constrain such systems containing competing source and sink processes. Traditional isotopic measurements of gases look at total atomic isotopic ratios e.g. 13C/12C for carbon dioxide (CO$_2$) and methane (CH$_4$). This type of analysis, however, removes information about how isotopes are distributed amongst the different isotopic molecular variants, such as how 18O is spread amongst 12C18O16O or 13C18O16O. The information encoded in polylisotopologue signatures provides additional independent information about formation or destruction processes, thus providing unique new constraints. A collaboration between the atmospheric monitoring and isotope geochemistry communities is now needed in order to realise the benefits of these powerful new observables at a time of rapid changes in the Earth system.

**Scope**

This Highlight Topic should bring brand new observables to understanding the atmospheric budgets of carbon dioxide and methane on policy relevant timescales to impact national and international mitigation efforts.

**Scientific advances**

The following research questions should be addressed, focussing on the important major greenhouse gas pollutants that require steep declines in growth rates in order to meet climate targets:

- What are the biological, physical and anthropogenic emissions contributions to the atmospheric CO$_2$ signal? Radiocarbon and conventional bulk isotope ratios are not sufficient to uniquely define CO$_2$’s budget and exchanges between the atmosphere, land and ocean. Additional measurement of rare isotopologues (12C16O17O and 13C16O18O) leads to new independent observables ($\Delta$17O and $\Delta$47) that have potential to add significant constraints.

- How can fossil fuel emissions, wetland emissions and the atmosphere’s oxidative capacity be separated for understanding CH$_4$’s variable growth rate? ‘Clumped’ isotope studies on CH$_4$ have shown unique signatures for sources and sinks, with $\Delta$12CH2D2 and $\Delta$13CH3D measurable by mass spectrometry and laser spectroscopy.

Methodology considerations needed for answering the research questions include:

- What are the best approaches for measuring the rare isotopologues for the purpose of adding new constraints in atmospheric monitoring?

- What are the isotopologue source signatures of the major source and sink drivers for greenhouse gases and are there important processes that can lead to isotopic equilibrium or exchange?

- How can these new measurements be integrated into inverse atmospheric models for understanding how to target sampling and make the biggest impact on constraining fluxes?

**Delivery**

This highlight topic should be addressed by up to two projects, each up to the value of £2m at 80% FEC (£2.5m 100% FEC) and up to four years in duration. Individual proposals
should seek to include parts of the research topic but are not required to address the entire HT scope.

G. Understanding global lithium resources and cycles to enable a low carbon future

Objective

This highlight topic aims to develop a holistic understanding of the global biogeochemical cycle for lithium

Strategic context

Decarbonisation of energy and transport is one of the major challenges facing the global economy today, and a sustainable supply of lithium for the batteries required for electric vehicles and energy storage is a crucial part of that challenge. Recent lithium forecast scenarios suggest that over five times the current global lithium mine production will be required by 2030 solely to support growth in the electric vehicle sector. This extraordinary growth means that recycling cannot meet lithium demand, and extraction from primary resources will be essential.

Around half of the world’s lithium is currently extracted from evaporative brines, largely in South America, with the other half derived from hard-rock deposits in Australia, Zimbabwe and other countries. However, information on many of the world’s potential lithium deposits is limited, and the global endowment of lithium is not well known. This means that we are unable to undertake robust assessments of resource availability and mineral depletion to underpin sustainable resource management. There is now a pressing need to develop a holistic understanding of the whole lithium biogeochemical cycle, to ensure that supply can meet future demand and that production and extraction of lithium is carried out sustainably.

Scope

This highlight topic will use a range of techniques and approaches to address important knowledge gaps in order to develop a holistic understanding of the global biogeochemical cycle for lithium (the ‘lithium cycle’) by characterising global lithium endowments, and understanding the impacts of lithium extraction. This highlight topic crosses many disciplines, and might require contribution from hydrogeologists, geochemists and geologists, mineral resource experts, geodata and earth observation scientists, ecologists, microbiologists, and sustainability experts.

Scientific advances

The lithium cycle begins with weathering and release of lithium from rocks into water. Climatic, tectonic, physiographic and microbial conditions are all likely to play a significant role in the liberation of lithium and its subsequent mobilisation and deposition. Lithium is extremely fluid-mobile, and thus any understanding of the natural lithium cycle must take account of stocks in fluids as well as rocks. Lithium is fluid-mobile enough to circulate in seawater, groundwater, surface water, and geothermal brines, and is eventually deposited in hydrothermal or basinal sediments. Such sediments may subsequently be reworked, through subduction-related magmatism or crustal melting, to form lithium-enriched igneous rocks, which in turn contribute to lithium-rich brines.

Thus far, research on the lithium cycle has been surprisingly limited, and we have little information on the processes and fluxes of lithium throughout the cycle. An improved understanding is vital, particularly because all stages of this cycle (brines, clay sediments,
and igneous rocks) have the potential to host economic resources of this critical metal. Furthermore, the evolution, stocks and concentrations of lithium at each stage of the cycle are not well understood, and nor are the environmental impacts of extracting lithium at the different stages.

Three important and interlinked scientific questions should be addressed:

- What are the quantified lithium resources and fluxes at all stages of the lithium cycle, including both modern systems and those in the geological record? What are the key processes in the lithium cycle, in particular those that concentrate lithium?
- What is the extent of lithium resources in basin-scale brine systems, and associated sediments? What are the time-scales of formation, depletion and replenishment of these systems?
- What are the environmental impacts of extracting lithium from the various resource types, and is there potential for more sustainable extraction methods?

**Delivery**

This highlight topic should be addressed by up to two projects, each up to the value of £2m at 80% FEC (£2.5m 100% FEC) and up to four years in duration. Individual proposals should seek to address the three important and interlinked scientific questions.

4. **Programme requirements**

4.1 **Programme funding**

NERC has allocated £16 million to this call. All highlight topics in this call should be addressed by up to two projects, each up to the value of £2m at 80% FEC (£2.5m 100% FEC) and up to four years in duration. There are more highlight topics than funding is available for, so that all highlight topics will not, necessarily, result in funded grants. This is to ensure that only the very best research is funded.

4.2 **Implementation and delivery**

The expected start date for projects funded under this Announcement of Opportunity is no later than 2 November 2020, except for any projects subject to programming of ship-time or aircraft campaigns.

4.3 **Knowledge Exchange and Impact**

Knowledge exchange (KE) is vital to ensure that environmental research has wide benefits for society, and should be an integral part of any research.

All applicants must consider how they will or might achieve impact outside the scientific community and submit this with their application as a Pathways to Impact statement, with associated delivery costs where relevant. Pathways to Impact activities do not have to be cost-incurring; it is not a requirement to include funded activities. Any funds required to carry out any proposed, outcome-driven activities identified within the Pathways to Impact must be fully justified within the Justification of Resources statement.

The Pathways to Impact will identify those who may benefit from or make use of the research, how they might benefit or make use of the research, and methods for disseminating data, knowledge and skills in the most effective and appropriate manner.
An acceptable Pathways to Impact is a condition of funding. Grants will not be allowed to start unless unacceptable Pathways to Impact are enhanced to an acceptable level within one month of notification of the panel outcome.

4.4 Data Management

The NERC Data Policy must be adhered to, and an outline data management plan produced as part of proposal development. NERC will pay the data centre directly on behalf of the programme for archival and curation services, but applicants should ensure they request sufficient resource to cover preparation of data for archiving by the research team.

4.5 NERC Facilities

Prior to submitting a proposal, applicants wishing to use a NERC service or facility must contact the facility to seek agreement that they could provide the service required. Applicants wishing to use most NERC facilities will need to submit a mandatory ‘technical assessment’ with their proposal. This technical assessment is required for aircraft but not for NERC Marine Facilities (NMF – Ship-time and/or marine equipment) and HPC. For NERC, this means a quote for the work which the facility will provide. A full list of the Facilities requiring this quote can be found on the NERC website. The costs for the service or facility (excluding NMF and HPC costs) must be included within the Directly Incurred Other Costs section of the Je-S form and also within the facilities section of the Je-S form. Further information on NERC services and facilities can be found on the NERC website.

Proposals to some topics may require ship time and other marine facilities. Applicants wishing to use NERC’s marine facilities must complete an online Ship-time and Marine Equipment (SME) or Autonomous Deployment (ADF) application form on the Marine Facilities Planning webpage. The SME/ADF number should be included on the Je-S grant proposal form under Services and Facilities. SME/ADFs must be submitted and approved by NERC Marine Planning by the time the proposal (Je-S form) is submitted, so that a pdf of the SME/ADF can be attached as a facility form. Failure to do so may result in the request not being included in the NERC Marine Facilities Programme. Applicants intending to apply for NERC’s marine facilities should also contact marineplanning@nerc.ukri.org to discuss ship time and equipment needs as soon as possible.

Completed SMEs/ADFs should be submitted by 20 February 2020.

For all proposals, the Ship-time and marine facilities costs do not need to be included within the £2m limit. All other services and facilities should be costed and included within the DI-other budget line on the Je-S form.

4.6 Programme management

Project PIs are responsible for the management and delivery of their projects. Coordination between projects within a highlight topic is not required.

4.7 Reporting requirements

As with all NERC grant holders, there will be a requirement to report through the UKRI reporting system; this is required annually and continues for up to five years post grant end. As set out in Section G of the NERC Grants Handbook, successful projects are required to submit annual reports of Outputs and Performance Measures (OPMs) and a Final Expenditure Statement. For strategic research investments, including successful highlight topic grants, NERC additionally requires biannual progress reports.
5. Application process

5.1 How to apply

Applicants are encouraged to contact the NERC office at an early stage to discuss any questions on call procedures. The Funding Operations Team (researchgrants@nerc.ukri.org) acts as the first point of contact for highlight topic grant proposals. Scientific and remit queries should be emailed to highlighttopics@nerc.ukri.org.

A notification of intent to submit must be submitted by 20 February 2020 16:00. Tell us the topic you plan to apply against, the institutions, investigators and project partners that are expected to be involved and include a title and abstract of your planned work. The abstract will not be assessed, but NERC will use the information to plan the proposal assessment. Full Je-S proposals submitted without a prior notification of intent will be rejected.

5.2 Full Proposals

Closing Date: 4pm on 19 March 2020

Full proposal must be submitted using the Research Councils’ Joint Electronic Submission system (Je-S). Applicants should select Proposal Type - ‘Standard Proposal’ and then select the Scheme – ‘Directed’ and the Call – ‘Highlight Topics 2020’.

The Highlight Topics 2020 call will close on Je-S at 4pm on 19 March 2020 and it will not be possible to submit to the call after this time. Applicants should leave enough time for their proposal to pass through their organisation’s Je-S submission route before this date. Any proposal that is incomplete, or does not meet NERC’s eligibility criteria or follow NERC’s submission rules (see NERC Grants Handbook), will be office rejected and will not be considered.

All attachments, with the exception of letters of support and services/facilities/equipment quotes, submitted through the Je-S system must be completed in single-spaced typescript of minimum font size 11 point (Arial or other sans serif typeface of equivalent size to Arial 11), with margins of at least 2cm. Please note that Arial narrow, Calibri and Times New Roman are not allowable font types and any proposal which has used either of these font types within their submission will be rejected. References and footnotes should also be at least 11 point font and should be in the same font type as the rest of the document. Headers and footers should not be used for references or information relating to the scientific case. Applicants referring to websites should note that referees may choose not to use them.

Applicants should ensure that their proposal conforms to all eligibility and submission rules, otherwise their proposal may be rejected without peer review. More details on NERC’s submission rules can be found in the NERC research grant and fellowships handbook and in the submission rules on the NERC website.

Proposals for this call should be submitted in standard grant format following the requirements outlined in Section F of the NERC research grant and fellowships handbook.

Please note that on submission to council ALL non PDF documents are converted to PDF, the use of non-standard fonts may result in errors or font conversion, which could affect the overall length of the document.

Additionally where non-standard fonts are present, and even if the converted PDF document may look unaffected in the Je-S System, when it is imported into the Research Councils
Grants System some information may be removed. We therefore recommend that where a
document contains any non-standard fonts (scientific notation, diagrams etc), the document
should be converted to PDF prior to attaching it to the proposal.

No associated studentships can be requested under this call.

The expected start date for projects funded under this Announcement of Opportunity is 2
November 2020, except for any projects subject to programming of ship-time or aircraft
campaigns.

5.3 Eligibility

Normal individual eligibility applies and is in Section C of the NERC research grant and
fellowsihps handbook. Research Organisation eligibility rules are in Section C of the
handbook.

NERC research and fellowship grants for all schemes may be held at approved UK Higher
Education Institutions (HEIs), approved Research Council Institutes (RCIs) and approved
Independent Research Organisations (IROs). Full details of approved RCIs and IROs can be
found on the UKRI website.

Investigators may be involved in no more than two proposals submitted to this call and only
one of these may be as the lead Principal Investigator.

5.4 Maximum funding limit for proposals

The maximum value for proposals under each topic area is provided in section 3. Proposals
can request funding up to £2.0m at 80% FEC (£2.5m 100% FEC) and any Ship-time and
marine facilities (SME) costs do not need to be included within the £2.5m limit. All other
services and facilities should be costed and included within the DI-other budget line on the
Je-S form for all topics.

5.5 Exceptional permission to exceed the funding limit

For this Highlight Topic call, we will consider exceptional cases for exceeding the £2.5m
limit. The process for applying for exceeding the £2.5m limit is the same as for Standard
grants (see Section B, paragraphs 14 to 17 of the Research Grants and Fellowships
handbook). The funding limit will only be extended in exceptional cases and any proposal,
which exceeds the limit without permission, will be rejected. For this call, a case for
exceeding the maximum limit must be submitted to researchgrants@nerc.ukri.org by 20
February 2020 at the latest and you should receive a decision within 10 working days.

6 Assessment Process

Full proposals will undergo expert peer review (see the pre-award assessment process and
minimum/optimal review levels of grants). Applicants will have the opportunity to respond to
reviewer comments before consideration by the highlight topic grants moderating panel, that
will allocate final scores and rank proposals based on research excellence and fit to scheme
of the scientific objectives (the appropriateness of the research proposed for the highlight
topic). The moderating panel will also examine the strength of the management
arrangements, resources and whether the pathways to impact proposed are appropriate.

The moderating panel will be comprised of Peer Review College members, augmented if
necessary by relevant experts from outside the College. The aim will be to use at least half
from the core membership of the Peer Review College (expertise and conflicts of interest allowing).

NERC will use the recommendations of the moderating panel along with the overall call requirements and the available budget in making the final funding decisions. The highest ranked proposals will be funded, irrespective of the highlight topic to which they apply. However, the funding limit specified for each highlight topic will be applied, so a maximum of two proposals from each topic could be funded. NERC will not fund two projects with overlapping research. In exceptional circumstances, where the top ranked projects in a topic were overlapping, NERC may fund the third-ranked project instead of the second-ranked project.

Feedback will be provided to both successful and unsuccessful applicants.

7 Timetable

- Announcement published: 4 November 2020
- Notification of intent due: 20 February 2020
- SME/ADF submission: 20 February 2020
- Case to exceed the funding limit: 20 February 2020
- Deadline for submission of full proposals: 19 March 2020
- Moderating panel meets: September 2020
- Latest start date for projects: 2 November 2020

8 Contact

For eligibility, application process and peer review queries, please contact researchgrants@nerc.ukri.org

For scientific and remit queries, please contact highlighttopics@nerc.ukri.org