

Themes, Indicative Priority Topics and Exemplar Projects

Themes

Theme 1. Ecology and Biodiversity (E&B)

Theme 2. Marine, Atmospheric and Climate Science (MACS)

Theme 3. Geosciences, Resources and Environmental Risk (GRER)

Theme 4. Environmental Genomics and Microbiology (EGM)

Theme 5. Agri-Environments and Water (AEW)

Themes serve to focus, organise and highlight ARIES research and training strengths, and they traverse 11 of NERC's 15 priority Research Areas. ARIES Themes will promote PhD training to support the UN's Sustainable Development Goals, DEFRA's '25 Year *Environment Plan*' and the UK's 2017 Industrial Strategy, especially for Clean Growth. Importantly, the Themes will address NERC's three grand challenges for society to: 1) benefit from natural resources, 2) build resilience to natural hazards; and 3) manage environmental change. They include broad subject/ecosystem-focussed research areas (Themes 1-3, E&B, MACS, GRER), the evolutionary and microbial driving forces behind life and earth processes together with core 'omics technologies (Theme 4, EGM), and the environmental science that underpins the supply of clean, safe and plentiful food, water and biomass (Theme 5, AEW). Each Theme has a healthy critical mass of ~100 to ~200 project leaders, and similar numbers of additional research support staff.

A team of Theme Leaders will assist in identifying Priority Topics for Research and Training, feeding directly into the project selection process and fostering end-user input for defining a subset of strategically important topics to be given preference for funding. Priority Topics are dynamic, as opportunities and demands change, so they will be reviewed each year at our Theme-Leader / End-user conferences, where academics and end users will identify future priorities and needs for ARIES projects and training. Indicative Priority Topics, identified from recent end-user/academic sandpit events and ongoing discussions among Theme Leaders, are given below; importantly, they cut across the Themes. Moreover, the Exemplar Projects, similarly emanating from ARIES sandpits, naturally sit under multiple Themes. Thus, the Themes have proven already to be structurally valuable while allowing multidisciplinary thinking and unconstrained flow of ideas.

The Exemplar Projects further demonstrate the end-user input as well as the range of existing collaborations between ARIES partners, together with those forged from recent ARIES events. Although we encourage projects that address Priority Topics, they may fall within or outside of these, and range from blue-skies to end-user-driven research. Importantly, all potential ARIES supervisory teams will have to demonstrate that their projects are novel, challenging yet feasible, and offer outstanding discipline-specific and multidisciplinary training for the student to perform high-level, impactful research. If successful, supervisory teams will work within the ARIES framework to ensure that their student develops a tailored and balanced portfolio of skills to become a leading 21st-century scientist.

Indicative Priority Topics

1. Biodiversity and Life Support

Why this topic? Earth's life support system depends on the security of food provision and the maintenance of biodiversity and ecosystem function, but these are severely threatened by immense pressures from human population growth and resource demand. 21st century scientists need the advanced skills to quantify and understand biodiversity, as well as effective communication capabilities to inform political decisions.

Why ARIES? ARIES has depth and breadth of expertise across partners in measuring, analysing and understanding biodiversity from microbes to mammals, in a wide range of ecosystems on land and sea, and from the gene to the ecosystem. Projects will combine expertise in taxonomic and functional assignment, 'omics, analysis of big datasets, and social sciences to inform policy on food security, ecosystem functions and services. ARIES is uniquely placed to couple these strengths in ecology and evolutionary genetic theory with: i) agri-tech expertise (e.g. at JIC and via Agri-Tech East); ii) aquaculture and fisheries expertise (e.g. at Cefas); iii) an array of end users from the environment, energy, water and engineering sectors (see below); iv) the UK's key policy makers for environmental protection and food security on land and sea.

Student training and employability: This topic will provide unparalleled opportunities for students to develop expertise in an area of the utmost societal importance. In addition to acquiring advanced field and experimental skills pertaining to their projects, students will develop state-of-the-art skills from across the ARIES stakeholders and academics. For example, they will be exposed to field methods that range from ROVs and purpose-built sleds for seabed surveys and sampling for eDNA analysis, to the application of detection dogs to map the distribution of endangered mammals in unexplored and inaccessible field sites. Skills developed within the projects, via cohort training and advanced training courses, will result in highly employable environmental scientists, who have excellent coverage of the NERC most-wanted skills, namely: modelling, multi-disciplinarity, data management, analytical skills, translating research into practice, fieldwork, risk and uncertainty. Therefore, students will be highly employable in the diverse sectors, conservation, fisheries, agriculture and beyond.

Wider engagement: In addition to links to international governmental and non-governmental organisations ARIES has a large number of diverse partners heavily invested in this topic in addition to HEIs, including: expert non-HEI hosting partners (e.g. IoZ, BTO, CEH, JIC, EI), major policy makers in the UK (the Defra group: EA, Cefas, JNCC, FR, MMO, NE), water, infrastructure and engineering organisations (e.g. Anglian Water, Balfour Beatty, Mott MacDonald, Royal Haskonings DHV), consultancies (e.g. MarineSpace Ltd., PML Applications, RPA), and conservation bodies of varying breadth in terms of habitats, taxa and global reach (e.g. Amphibian & Reptile Conservation Trust, Broads Authority, Bumblebee Conservation Trust, Chester Zoo, RSPB, Woodland Trust, West Country Rivers Trust, Wildwood Trust, WWF-UK).

Main [and secondary] themes under which the topic sits: E&B, AEW, [EGM, GRER, MACS]

2. Integrating Environmental DNA (eDNA) Applications into Policy and Practice

Why this topic? eDNA approaches are rapidly being adopted in fields as diverse as forensics, invasive species mitigation, energy flow and biodiversity assessment, generating wide interest from governmental and non-governmental organisations. However, this topic requires careful integration and communication between scientific capabilities and end-user expectations. Adoption of eDNA technology as a 'silver bullet' approach in environmental issues is problematic, requiring more rigorous research into how sampling and environmental conditions affect the reliability of eDNA as a surrogate for species presence or abundance.

Why ARIES? Projects in this area will be co-designed with end users (see below) and will exploit ARIES expertise in eDNA-based and conventional population and community ecology over a range of ecosystems. ARIES has a wealth of expertise in conservation across several partners, with a particular focus at UoK's Durrell Institute of Conservation and Ecology (DICE), IoZ and UEA, as well as in eDNA analysis, (e.g. at UoE, PML, MBA, CEH, UEA and EI).

Student training and employability: This topic will equip students with advanced molecular biological, bioinformatic, taxonomic and ecological skills. These skills, combined with those developed via cohort training, advanced training courses and opportunities to work with end users, will result in rounded, versatile environmental scientists, whose skills will be in demand in a wide range of sectors within and beyond conservation.

Wider engagement: The Natural History Museum will provide excellent research and outreach opportunities. Nature Metrics is a partnering company whose business is the application of eDNA technologies, providing important contributions to research and training in this topic. In addition, ARIES has a large number of partners who can contribute to, and benefit from, this topic, as well as providing expert training and placement opportunities, e.g. major policy makers (the Defra group: EA, Cefas, JNCC, FR, MMO, NE), water, infrastructure and engineering organisations (e.g. Anglian Water, Balfour Beatty, Mott MacDonald, Royal Haskonings DHV), consultancies (e.g. MarineSpace Ltd., PML Applications, RPA), conservation bodies (e.g. Amphibian & Reptile Conservation Trust, Broads Authority, Bumblebee Conservation Trust, Chester Zoo, RSPB, WWF-UK).

Main [and secondary] themes under which the topic sits: E&B, EGM, [GRER, AEW, MACS]

3. Adapting to Climate Change

Why this topic? Links between climate change and abundance, range and phenology of populations are commonly reported, but detailed understanding of the biota's potential to adapt, and our capacity to predict and manage such changes, remain limited. Combining expertise in the genetics and ecology of key animal, plant and microbial taxa with climate and paleoclimate science and modelling will enable informed predictions of how climate change will impact on biodiversity and ecosystem functioning, translating this knowledge into policy and planning.

Why ARIES? ARIES has considerable capability across the whole partnership for integrating strengths in evolution, ecology, work with key model organisms and 'omics technologies (UEA, UoE, UoP, UoK, IoZ, CEH, BTO, PML, MBA, JIC, EI) with climate-change and paleoclimate science, social science, and modelling (RHL, UEA, BGS, BAS). This integration of phylogenetic, experimental and modelling-based methods allows us to understand the capacity of populations (including interacting populations) to adapt to different climate-change scenarios, including the study of additional drivers (such as pathogens), and the actions required to facilitate such adaptation. The involvement of key policy makers in ARIES projects will facilitate the application of new understanding and knowledge.

Student training and employability: This topic will equip students with a selection of advanced molecular biological, taxonomic, ecological and modelling skills. The training program will be tailored to provide understanding of the fields required to contextualise their research, such as climate science. End users will provide valuable input into the research and contribute to the development of the students' ability to interact with stakeholders and the public. These skills, combined with those developed via cohort training, advanced training courses and other opportunities, will result in rounded, versatile and highly employable environmental scientists.

Wider engagement: A diverse array of ARIES partners will contribute to research and training in this topic, including: major policy makers in the UK (e.g. the Defra group: EA, Cefas, JNCC, FR, MMO, NE), water, infrastructure and engineering organisations (e.g. Anglian Watr, Balfour Beatty, Mott MacDonald, Royal Haskonings DHV), consultancies (e.g. MarineSpace Ltd., NatureMetrics, PML Applications), conservation bodies of varying breadth in terms of habitats, taxa and global reach (e.g. Amphibian & Reptile Conservation Trust, Bumblebee Conservation Trust, Chester Zoo, RSPB, Woodland Trust, West Country Rivers Trust, Wildwood Trust, WWF-UK), in addition to links to international governmental and non-governmental organisations. The understanding of pathogen adaptations to changing climate will benefit greatly from input from the Pirbright Institute and Public Health England (PHE). This topic also links to our Priority Topic 1. "Biodiversity and Life Support".

Main [and secondary] themes under which the topic sits: E&B, EGM, MACS, [AEW, GRER]

4. Air Quality and Climatically Important Pollutants

Why this topic: The World Health Organisation attributes 8 million premature deaths per year to air pollution, making it the leading cause of environmental mortality: the number is 40,000 in the UK according to the Royal College of Surgeons, with the UK in breach of EU legal limits for nitrogen dioxide in most major cities. Ozone, particulate matter, NO_x, SO₂, and volatile organic compounds (VOCs), including biogenic VOCs such as isoprene, contribute to poor air quality and, along with organo-sulfur compounds and methane, are also short-lived climate-altering substances.

Why ARIES: UEA, RHL UoE, PML, in conjunction with NCAS, UKMO, NPL, CEH, Defra, EA and others, are internationally recognised for observing, modelling and improving our understanding of the origins of these pollutants across the globe, their complex physico-chemical transformations, the involvement of the carbon cycle and biosphere, and their societal and ecosystem impacts. ARIES is uniquely placed to address this global problem with its expertise, observatories, including the only Integrated Carbon Observation System atmospheric observatory in the UK, aircraft, instrumentation (e.g. for isotopologue measurements of multiple atmospheric gases), which have been deployed in major UK cities, as well as in Malaysia, Africa, China, and Vietnam. We also have unique facilities to simulate air pollution and chemistry over solid and aqueous surfaces, from tropical to polar temperatures.

Student training and employability: Students will be trained in project-related advanced techniques, and will also be exposed to a wide range of approaches and background information that will complement their research, ranging from atmospheric chemistry and modelling to the mechanisms of biogenic VOC production. They will also have excellent opportunities to work with end-user partners to learn aspects of policy relating to air pollution's impacts on the environment and society, and will have the chance to further develop skills such as communicating science to a wider audience. Whilst (bio)technological developments and political decisions will hopefully improve air quality, this may take decades, and new threats to air quality may arise as new products, processes and agricultural practices are developed. Therefore, ARIES students trained under this priority topic will be in demand for many years to address this global problem. Also, due to their analytical and computational skills coupled with their breadth and versatility, they will be high-value employees in a wide range of sectors.

Wider engagement: We currently work with Defra, NCAS, NPL, FR, Cefas and the UKMO (ARIES partners) as well as city and county councils in the UK; with Met Malaysia and the University of Malaya in Malaysia, the Chinese Academy of Sciences and the Tyndall Centre Fudan in China, amongst others. Collaboration with the Rutherford-Appleton Lab provides access to world-class facilities for investigating the physics and chemistry of atmospheric particles and pollutants. There is also a lot of scope for further collaborations with ARIES partners, e.g. with SAC, MSL, NCC, NOC.

Main [and secondary] themes under which the topic sits: MACS, EGM [E&B, AEW, GRER]

5. Cascading and Coupled Environmental Hazards

Why this topic? Hazardous events and processes are of broad concern to societies across the globe, but they rarely generate human adversity in isolation. Frequently, impacts are amplified by human choices around land use and regulation, or the occurrence of one hazard (or anthropogenic influences) can pre-condition the environment for response to a second event. These interactions and their cascades need better understanding, as do communication tools for reducing human responses to cascading environmental hazards.

Why ARIES? ARIES has depth and breadth of expertise in Earth processes (past and present) and how they can dictate and contribute to the existence of environmental hazards. ARIES is particularly well-placed to address this priority topic with expertise and facilities across partners that enable cutting-edge research and high-level training that includes: volcanology, tectonics, paleoenvironmental change, meteorology, fluid flow, hydrodynamics, soil erosion, generation of energy, catchment science, geochemistry, social science, and science communication (UoP, RHL, UEA, BAS, BGS).

Student training and employability: Students will develop advanced skills in the analysis of physical processes and their effects, specifically considering how they may be coupled with multiple other processes and human activities, and in turn how this interaction may be modelled. Thus, they will receive advanced training in advanced geosciences techniques, statistics and modelling. Due to the frequently sparse nature of data emanating from hazards, students will be trained in game theory and game technology. Importantly, students will be trained so that they are conversant with psychological and socio-economic issues related to hazards, and they will learn how to communicate risk / hazard scenarios across scientific disciplines as well as to policy makers and the wider public. Coupled hazardous events are likely to increase in number and affect more lives due to population growth, urban development, deforestation, coastal squeeze, and extreme weather, and so skills developed by ARIES scientists trained under this priority topic will be highly sought after.

Wider engagement: This topic is of broad relevance to a range of ARIES partners, including the Defra group, especially the EA, as well as those involved in major engineering projects, notably Royal Haskoning and Balfour Beatty. In addition to HEI hosting partners, the expertise within BAS and BGS will be particularly pertinent to this topic. International engagement will be facilitated through ARIES scientists' connections with overseas universities, volcano observatories, national geological survey's and other institutions.

Main [and secondary] themes under which the topic sits: GRER, [MACS E&B, AEW, EGM]

6. 21st Century Soils

Why this topic? There are exciting possibilities to geo-engineer and bio-engineer soils to increase yields and carbon storage, regulate greenhouse gas emissions and water flows, and mitigate pollution. However, these manipulations generate trade-offs where improved provision of one service might be to the detriment of others. ARIES will nurture research and training concerned with the holistic understanding of soil and the ecosystem services it supports. The food-energy-water nexus that is underpinned by soil requires the next generation of environmental scientists to undertake discovery science to influence environmental regulation and policy, and to engage with agri-water industries to deliver societal impact.

Why ARIES? Collectively, ARIES partners have the joined-up expertise required to engineer better soils across the sediment-soil-microbe-plant-ecosystem continuum alongside expertise of socio-economic drivers and feedbacks to balance issues of equity, local values and feasibility. Specific expertise can be found in crop science (JIC), biogeochemical cycling, carbon storage and pollution mitigation (UEA, UoE, UoP, RHL, CEH, BGS), social sciences (UEA) and water flow / erosion (UoP, RHL, UEA, AW, BGS).

Student training and employability: In addition to developing advanced skills through the research project and specialised training, the students' training program will be tailored to provide complementary skills, so that they perceive soil as a chemical-physical-biological unit of societal and economic importance. The multidisciplinary nature of supervisory teams and the opportunities available through the ARIES training program (e.g. internships) will facilitate the goal of producing 21st century soil scientists. The current involvement of ARIES partners in multidisciplinary programs overseas, e.g. funded by GCRF, will provide opportunities for students to obtain a more international perspective.

Wider engagement: ARIES has a wealth of collaborating partners who add great value to this topic, e.g. The Sainsbury Laboratory, with world-renowned expertise in plant-microbe interactions, form a pivotal link between soil science and food security. ARIES partners have valuable collaborations with current Case partners, such as AB Vista (developing products for animal feed and nutrition) and ADC BioScientific Ltd. (developing soil / plant monitoring equipment). The involvement of the Defra Group ensures that ARIES research is informed by policy. Community support for interventions and long-term socio-economic gains is essential, and so projects in this priority topic will benefit from input from the social sciences (e.g. via the ESRC DTPs SeNNS and SWDTP).

Main [and secondary] themes under which the topic sits: GRER, AEW, E&B, EGM, [MACS]

7. Solutions for Pollution from Microplastics

Why this topic? The global problem of microplastics was brought to prominence by ARIES partner UoP. Important gaps that ARIES research aims to fill include: improved detection, better understanding of processes that alter the transport and fate of microplastics, microplastics as vectors of persistent organic pollutants, challenges associated with removal of microplastics from waste streams, and non-plastic alternative micro-materials.

Why ARIES? Considering the entry points of microplastics into the marine environment, ARIES has excellence in waste-water treatment, riverine transport modelling, shelf-sea processes, ocean circulation and modelling, and the application of autonomous platforms. Once in the sea, biofilms and resulting production of extracellular polymeric substances alter the characteristics of microplastic surfaces affecting their uptake and transfer through marine food webs. ARIES has renowned expertise in environmental chemistry, microplastic diagnostics and impact assessment, and microbiology. Equally, ARIES is well equipped to address these issues with coastal and ocean-going research vessels, marine stations with easy access to southern and eastern research sites, and associated wet laboratories and aquaria, together with the state-of-the-art Coastal Ocean and Sediment Transport (COaST) wave tank (UoP, PML, MBA, UEA, UoE). Minimising microplastics from waste streams is a major challenge to the water industry, and so Anglian Water's expertise and facilities will be complemented by those of other partners to investigate integrated optical and electrostatic removal technologies.

Student training and employability: Students will receive training in the advanced skills required for their project from multidisciplinary supervisory and support teams. Skills will include combinations of chemistry, microbiology and community ecology. The projects are end-user focussed (e.g. informing the legal framework for discharge consent limits and development/scale-up of methods for microplastic removal), and students will benefit from ARIES end-user partners in their projects. Students will be expected to take on leadership roles in the grand-challenge training that focuses on the issue of microplastic pollution. Core numeracy skills will be enhanced by the diverse ARIES offerings, so that students can analyse large, long-term data sets and model microplastic fate and transport, resulting in rounded graduates with a wealth of skills in demand by diverse sectors.

Wider engagement: As outlined above, the involvement of ARIES end-user partners will be important for success in this Priority Topic, including water and engineering companies (notably Anglian Water), the EA, and Cefas, MMO and PMLA in the context of coastal processes.

Main [and secondary] themes under which the topic sits: AEW, MACS, EGM, E&B, [GRER]

8. The Changing Polar Cryosphere and its Impacts

Why this topic? Dramatic, continuing declines in sea ice in the Arctic Ocean after each summer have major environmental, societal and economic impacts. However, current climate models vary widely in their projections for Arctic sea-ice extent through the 21st century. In Antarctica, the accelerated melting of glaciers could have major repercussions for sea level and climate. NERC is heading a high-profile campaign to investigate the rapidly melting Pine Island and Thwaites Glaciers. Addressing these challenges requires scientists able to understand the dynamic processes of ocean, atmosphere, sea ice and ice shelves, both through observations and through numerical modelling.

Why ARIES? ARIES brings together meteorologists, cryospheric scientists and oceanographers, with extensive research experience in the Arctic and Antarctic. Major projects in the Amundsen Sea are both ongoing and newly implemented (UEA, BAS) and will provide exciting opportunities for student projects. Expertise in polar meteorology and polar marine science (PML, UoP, UEA, UoE, BAS), climate modelling and dynamics (UEA), cryospheric experimental chambers (RHL, UEA), and fleets of ocean gliders, surface vehicles and aircraft (UEA, BAS, Cefas), collectively make a unique partnership for spearheading these advances.

Student training and employability: Students will receive training in advanced techniques, appropriate to their project, delivered through their host institution and ARIES partners. This topic trains students in observing the climate system (atmosphere, ocean or ice) and in running and interpreting sea-ice and climate models. They will also be provided with hands-on training in the equipment used to obtain data. Experience of the ARIES partners (UEA, BAS, Cefas) with the NEXUSS CDT as well as EnvEast gives a springboard for training in this research area, including the Glider ATSC which brings students together with industrial partners who both use and manufacture autonomous vehicles. Their training program will be tailored such that they obtain the complementary skills, which could range from biogeochemistry to social sciences, which will be needed to contextualise their projects and provide wider socio-economic impact. To these ends, the students could take advantage of the ARIES scheme to award an additional three months stipend to students from numerate disciplines to undergo training in the environmental sciences, and/or ARIES Multidisciplinary Workshop scheme. They will also have excellent opportunities to work with end-user partners to learn aspects of policy relating to the impacts of sea-level rise, new transport and migration routes, changes in nutrient inputs, etc., on the environment and society, and will have the chance to further develop skills such as communicating science to a wider audience. Employers such as the UK Met Office, Cefas, marine consultancies and companies require people with skills in making and analysing hands-on measurements of the earth system. The analytical and modelling skills developed by the student, coupled with their breadth and versatility, will result in high-value employees in a wide range of sectors.

Wider engagement: BAS led the EU-funded ICE-ARC (www.ice-arc.eu) project, which brought together physical scientists, social scientists and economists to study Arctic change and its impacts. The project has left a legacy of interdisciplinary collaborations that can be built on within ARIES. Many partners within ARIES are invested in issues associated with the opening of the Arctic Ocean and sea-level rise, e.g. in relation to: increased potential for oil pollution (OSRL), changing faunal migration patterns and impacts on UK fisheries (Cefas), changing marine-atmosphere gas exchange (see Priority Topic 4), flooding and coastal erosion (EA, MMO), and the impact on weather patterns (UKMO).

Main [and secondary] themes under which the topic sits: MACS, GRER, E&B, [EGM, AEW]

Exemplar Potential Future Projects

Title and Partners	P	C	Theme					
			1	2	3	4	5	
Futureproofing aquaculture through biological containment and improving closed systems UEA, UoP, PML, MBA, EI, Cefas	1							
Optimising pest insect release for biological control using repressible lethal genetic constructs UEA, CEH, Pirbright	1	B						
Evaluating rapid biodiversity assessment at multiple scales using eDNA UoK, UEA, UoE, UoP, IoZ, CEH, CZ, WWFUK	2							
Is it safe to go into the sea? Influence of climate change on the abundance and distribution of pathogenic <i>Vibrio</i> bacteria UoE, UEA, Cefas	3	E						
Air quality in the UK: the impact of boundary layer meteorology UEA, Defra	4							
Understanding the impacts of nitrogen deposition and land management on seasonal fluxes of N ₂ O and CH ₄ in forest soils RHL, UoE, FR	4							
The effect of earthquake preconditioning on landslide distribution UoP, BGS, AECOM	5							
Soil erosion, siltation and the food-water-energy-environment nexus UoP, UEA, NGOs in East Africa	6							
New technologies for the removal of microplastics in waste streams UoP, UoE, UEA, AW	7							
Optimising AutoNaut to understand polar sea-ice regions UEA, BAS, NOC, AutoNaut	8							
How will seasonal-to-decadal changes in sea-ice cover affect Arctic shipping routes? BAS, UEA, UKMO	8							
Optimal scales for management and conservation of UK biodiversity and ecosystem functions UoK, UEA, IoZ, BTO, NE, CEH, Chester Zoo	1							
Optimising crop yield through pollen and pollinator diversity JIC, UEA, CEH, UoP	1							
Roles of biodiversity and genetic variation in protecting food crops from enemies: an ecosystem approach JIC, EI, CEH, Pirbright	1	B						
Cumulative environmental impacts of energy production development at multiple scales UoK, Royal Haskoning	1							
Optimising eDNA methods for quantifying presence, abundance and activity of aquatic alien invasive species CEH, UEA, UoK, NatureMetrics	2							
Animal pathogen evolution and ecology under future climate change scenarios IoZ, UEA, UoP, CEH, Defra	3							
Genome editing for the exploration of biotechnological applications and evolutionary potential of microalgae UEA EI	3	B						
Identifying environmental drivers of population dynamics in migratory birds using citizen science data BTO, UEA, UoK	3							
Proximate drivers of local extinctions under extreme weather conditions in butterflies UEA, UoP, CEH	3							
Adaptation to changing environments at the gametic level UEA, EI	3	B						
Isotopic fingerprints of carbonyl sulfide, an analogue of CO ₂ in the atmosphere and biosphere UEA, JIC, NPL, U Utrecht	4							
Biogenic trace gas production by seaweeds: impacts of worldwide aquaculture expansion UEA, MBA, UoE, U Malaya	4							
Identifying origins and chemical transformation of air pollutants in London and Ho Chi Minh city UEA, RHL, NCAS, UKMO	4							
The isotopic signature of urban methane emissions RHL, U Utrecht	4							
Microbial roles in DMSP and DMS production, and atmospheric consequences PML, UEA, MBA, Cefas	4							
Seawater control of an atmospheric pollutant: Ocean-atmosphere interactions between iodine and ozone UEA, PML	4							
Contribution of microbes to local and global production of climate-active terpenes UoE, UEA, UoP, PML	4							
A source of atmospheric nitrous acid in snow – understanding air quality	4							

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above snow covered regions BAS, UEA									
How will nitrous oxide emissions respond to global change? UEA, PML	4								
Understanding the role of communication strategies in reducing the risk associated with volcanoes UEA, UoP, OS Geological Surveys	5	E							
Volcanoes and retreating ice: feedbacks and interactions during eruptive activity UEA, Satellite Appl. Catapult	5								
Sustainable soil and land management practices for safeguarding food security, livelihoods & biodiversity in east Africa UoP, UEA, African NGOs	6								
Novel techniques to detect and predict microplastic pollution UoP, UoE, Defra, AW	7								
Mechanisms of aggregation and mass transport of microplastics in intertidal sediments UoP, UoE, UEA, Cefas	7								
Implications of declining Arctic sea ice on the production of climate-active gases PML, UoE, UEA, BAS, Cefas	8								
Is increased insect pest attack in forests a sign of compromised ecosystem function? UoP, NE	4								
Determining the contribution of oil-spill dispersants to marine-snow formation and thus on oil/carbon sinking UoE, MBA, OSRL, Cefas									
How effective are catchment approaches to reducing metaldehyde loss to water supplies? UEA, RHL, AW									
Dynamics of nanoparticle impacts on irrigated and sludge-treated crops UoE, JIC, ADC Bioscientific Ltd.		B							
Impacts of trace metals from ship plumes on marine biogeochemistry UoP, UEA, PML, Brittany Ferries, Bermuda Inst. Ocean Science									
Predicting reintroduction success of endangered species UoK, IoZ, Chester Zoo									
Determining the role of gulls in the global spread of antimicrobial resistance UoE, BTO, UoP, PHE									
Directional reflectance of desert sands and salt pans for vicarious calibration of satellite remote sensing RHL, NPL, Satellite Appl. Catapult									
Future changes in storminess in southern ocean BAS, UEA, Defra, Gardline									
Rock 'n' Roll: passive and automated sensing of fluvial sediment and wood transport UEA, UoP, SW Water									
Weather-climate feedbacks during Eocene hyperthermal global warming events RHL, UoP									
Deep-sea octocoral seascape genomics: implications of deep-sea mining UoE, UoP, Cefas									
Understanding controls on oxygen deficits in UK waters using a community ecosystem model and isotopic tools PML, UEA, Cefas									
Sensor development for understanding life-cycle & behaviour responses of shellfish in changing environments UoE, Colchester Oyster Fisheries									
Numerical modelling of pollutant transport by porous flow RHL, UEA, AW									
Searching for baselines in benthic habitats: the land-use change in the sea we cannot see UoP, UoE, NE, MMO									
Geophysical detection of fluid movement at active volcanoes UEA, BGS									
Legacy and current drivers of algal community dynamics and water quality in drinking waters UoE, AW									
Rapid adaptive evolution of microalgae is realized by two-tier genomes and transcriptomes UEA, EI		B							
The future governance of 'blue' common pool resources: what do fisheries and 'blue' carbon have in common? UEA, UoE, Cefas									
Magmatic flow along the fast-spreading ridge system of the Oman ophiolite UoP									
What drives urban community assembly in northern Amazonia? UoK, UEA, Protected Areas Commission									
Biodegradation of mixtures of organic pesticides & effects on freshwater ecosystem function UoE, UEA, AW									
Measuring the reach and significance of sexual selection at the phenome		B							

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and genome using experimental evolution UEA, UoP, UoE, EI									
Extremes of water availability and water quality under climate change: sensitivity to rainfall resolution UEA, AW									

The host partner is named first. Partners with a primary role as an end user are shown in italics. Other end users are in grey italics. **P** - Priority Topic (1 to 8; see Priority Topics). **C** - Cross-DTP with potential for co-funding (**B** = BBSRC NRP; **E** = ESRC DTP SeNSS).

Themes - Fit to ARIES themes (shown by shading, best in black) 1. Ecology & Biodiversity; 2. Marine, Atmospheric & Climate Science; 3. Geosciences, Resources & Environmental Risk; 4. Environmental Genomics & Microbiology; 5. Agri-Environments & Water