



**University of
Reading**

Research Students Conference 2018



**School of Archaeology
& Geography &
Environmental Science**

Thursday 10th & 11th May 2018
Room G05, Miller Building
& Sorby Room, Wager Building

Conference Abstracts

If I told you your home would flood next winter, would you believe me?

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Funded by: IMPREX Horizon 2020 Project

Predicting how rivers will change in the next months is vital to decision-makers for many applications of the water sector, such as flood preparedness, agriculture, hydropower and navigation; and ultimately to us! Yet, river flow forecasts a season ahead are poor in Europe due mainly to uncertainties in forecasts of the upcoming weather. Using the European Flood Awareness System (EFAS) seasonal river flow forecasts, produced for all European rivers from 1990 to now, I am looking at how well we can predict river flows up to seven months ahead in Europe. Results are contrasted across Europe, but overall suggest that using forecasts of the future weather leads to better forecasts of the European river flows up to one month ahead only. Nevertheless, the EFAS seasonal river flow forecasts are potentially useful for decision-making, especially in winter for most of Europe, where they can predict the likelihood of anomalously high or low river flows up to seven months ahead. So, how can we extract the relevant information to support decision-making across Europe? And how can we improve the river flow forecasts where they are still too limited to be used by decision-makers?

Who should pay for climate change?

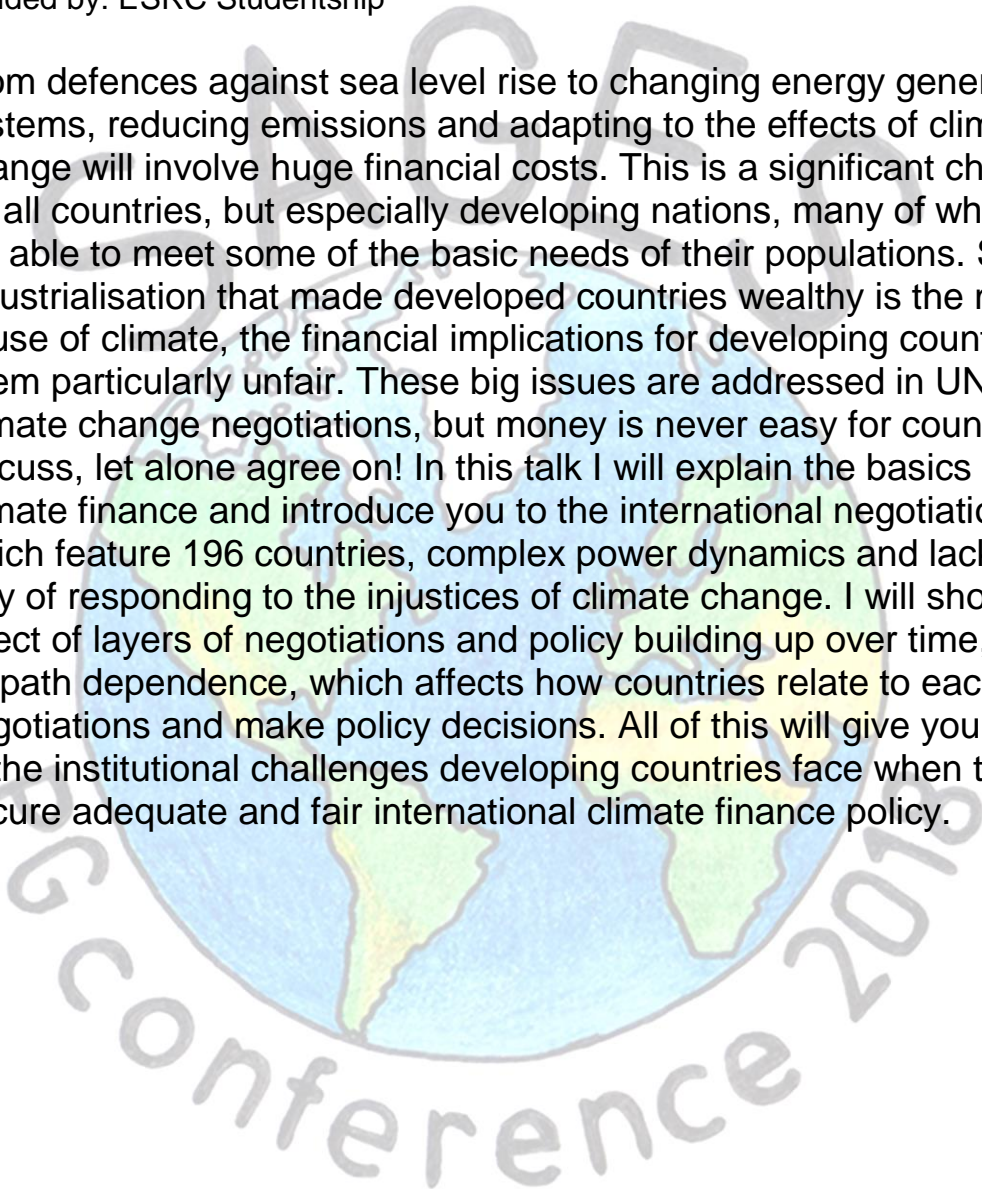
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Funded by: ESRC Studentship

From defences against sea level rise to changing energy generation systems, reducing emissions and adapting to the effects of climate change will involve huge financial costs. This is a significant challenge for all countries, but especially developing nations, many of which aren't yet able to meet some of the basic needs of their populations. Since the industrialisation that made developed countries wealthy is the main cause of climate, the financial implications for developing countries seem particularly unfair. These big issues are addressed in UN-level climate change negotiations, but money is never easy for countries to discuss, let alone agree on! In this talk I will explain the basics of climate finance and introduce you to the international negotiations, which feature 196 countries, complex power dynamics and lack a clear way of responding to the injustices of climate change. I will show the effect of layers of negotiations and policy building up over time, known as path dependence, which affects how countries relate to each other in negotiations and make policy decisions. All of this will give you an idea of the institutional challenges developing countries face when trying to secure adequate and fair international climate finance policy.



Don't mention the touch-feely stuff! Developing inner resilience for action on climate change: opportunities, defences and paradoxes

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Funded by: ESRC Studentship

The issue of climate change evokes many emotions. Without opportunities to feel, embody or express some of the more painful emotions, it can be difficult to acknowledge them, particularly when some societies, environments and species are not recognised as 'grievable', or our interdependence is negated (Butler 2009). There are a range of emotionally reflexive methodologies (ERMs) which can enable participants to better deal with information and situations which can seem complex and overwhelming, such as climate change. Whilst differing in approach, these ERMs can encourage the acknowledgement, expression and potential transformation of emotions. In turn, this can help develop 'inner resilience' to enable fuller engagement with, and action on, issues such as climate change.

Many of these ERMs take place in grassroots and community settings. Given the urgency to enact bold action and leadership on climate change in the UK, it could be argued that these approaches would be more effective if they were scaled up at an organisational level to enhance policy-making. However, in professional workplace settings, there are defences against so-called 'touchy feely stuff'. This presentation will explore the opportunities and potential benefits for developing inner resilience within organisations, the defences that have been encountered by facilitators, and the paradoxes that have emerged.

Individual-based models as a tool for ecosystem-based approaches to fisheries management

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Fish products comprise around 17% of the human population's animal protein intake. It is therefore crucial that fisheries are managed effectively. Regulatory bodies worldwide are increasingly adopting "ecosystem-based" approaches to fisheries management. This stems from the realisation that fish population change is driven by spatial and temporal variation in many ecosystem drivers, including food-web interactions and the wider environment. Traditionally-used mathematical models cannot easily accommodate these drivers. However, increasing computer power now permits the development of more demanding approaches that can, such as Individual-Based Modelling (IBM). Here, I will present a generic marine fish IBM that incorporates spatial and temporal variation in temperature, food availability and exploitation. Key features of the model include: (1) realistic fish energy budgets; (2) representation of the full fish life cycle; (3) a spatially-explicit environment and (4) the incorporation of satellite remote-sensing data to represent the environmental drivers. To demonstrate the use of the model, we calibrate it for mackerel (*Scomber scombrus*) in the North East Atlantic, and show it can fit available population data well. We then demonstrate how it can be applied in a management context by simulating the population consequences of closing one sector of the North Sea to mackerel fishing. The outcomes will be discussed in terms of IBMs as strategic tools for fisheries management.

Puberty and adolescence in post-medieval England

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Through the use of osteological, historical, and archaeological sources a primary sample of 462 individuals from the ages of 10 to 25 years were examined for age, sex, pubertal stage, stress, and pathology. The post-medieval period was defined as the years AD1550 to AD1850 and all individuals were divided into a classification system of Urban, Semi-Urban, and Infirmary in order to address the rapid changes in urbanization and industrialization, and the effects that they would have on a child growing into adulthood. Additionally, a database of 424 previously recorded individuals were compiled into a secondary source group to compare, age, sex, and pathology in order to establish a better framework of post-medieval adolescent health.

An examination of the 6 pubertal stages indicated that no 10 year olds had yet begun puberty. In addition, there appears to be variability to the timing of pubertal development independent of sex that is associated with stress and pathology. By the age of 16.2 the average girl had already passed menarche. Despite the age range of 25 being utilized 6 (15.4%) of males and 7 (20.6%) of females were found to still be at the last stage of pubertal development.

ABSTRACTS

PGD conference 2018

Health impacts of intermittent water supply in rural Kenya

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One of the development questions in Sub-Saharan Africa has been that of sustaining safe and reliable water supplies in rural areas to reduce the disease burden caused by drinking contaminated water.

There is a research gap in the understanding of the dynamics of disease when household switch water sources. This study looks at this gap. Firstly, water usage patterns have been investigated by using remote monitoring data from handpumps, and compared to short-term and seasonal changes in precipitation to better understand actual water use choices. Secondly, using information on handpump usage, breakdown and repairs, in conjunction with self-reported diarrhoea data, the connection between pump reliability and disease has been examined. Finally, to further examine these linkages, a health survey has been linked to a handpump repair service.

The study has two main findings. The first is that water use patterns and behaviour are more complex than commonly assumed with apparently safe sources of water often rejected in favour of more convenient ones. The second is that even very short pump breakdowns can cause adverse health impacts. The policy implication of these is that the way in which rural water is managed may not be providing the intended benefits.

Therapeutic landscapes of prehistory: exploring the role of prehistoric archaeology in the facilitation of existential wellbeing

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Funded by: Arts and Humanities Research Council

In recent years heritage professionals and researchers in the UK have been called on increasingly to evidence the therapeutic value of the historic environment. Previous research in this area has successfully demonstrated the wellbeing effects of heritage participation in relation to the development of social and human capital. However, the degree to which heritage assets in themselves directly influence individual wellbeing is less well-understood. Consequently, this uncertainty begs the question of whether, in fact, the intrinsic nature of the historic environment has anything unique to contribute in terms of personal wellbeing.

This paper examines these issues through a review of qualitative research recently undertaken in the Stonehenge and Avebury World Heritage Site (WHS) and the Vale of Pewsey, Wiltshire, to investigate how individuals experience, interpret and value these prehistoric landscapes. Drawing on preliminary results from semi-structured interviews with local residents, and reflective workshops with student and community groups, this paper considers some of fundamental ways in which prehistoric archaeology and its associated narratives can help to facilitate a sense of existential wellbeing.

Mangrove ecosystem carbon stock changes in abandoned shrimp ponds in Thailand

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Mangrove forests are known to capture and store exceptional amounts of carbon and are increasingly recognised as highly significant in terms of carbon sequestration within global ecosystems. Yet land-use change in the tropics continues to threaten this ecosystem and its critical 'blue carbon' (carbon stored in marine and coastal habitats) stores. Given that shrimp aquaculture expansion is among the major causes of global mangrove loss, and mangrove forests are highly significant carbon-rich ecosystems, it is important to understand how land-use change from shrimp farming affects the carbon stored by these forests. Here, the impact of mangrove to shrimp pond conversion on ecosystem carbon stocks is assessed in Thailand, along with how the carbon in shrimp ponds built on former mangrove habitat changes over time after ponds are abandoned. We show that although potentially up to 60% of ecosystem carbon is lost when mangroves are converted, some abandoned shrimp ponds still retain deep mangrove soils (>2.5 m) and large carbon reservoirs exceeding 1,750 Mg carbon per hectare. In addition, along the studied chronosequence of abandoned pond sites, we found a positive natural recovery trajectory for carbon stocks in the upper soil horizon (0-15 cm), associated with natural mangrove regeneration and recovery of the carbon sink function of the forest.

Examining the relationships between climate and environmental variability, and societal change, during the past 1000 years in south east England

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Funded by: University of Reading Regional Bursary

This research project's main aim examines the relationship between environmental variability and societal change over the last millennium in South East England, using artificial lowland wetlands (ponds, mires and moats) which provide the potential for compiling high temporal resolution records of environmental change. A second aim was to evaluate whether known periods of past climate change (MCA, LIA and the Anthropocene) could also have been a factor causing changes in the environment resulting in changes in human activities. South East England forms the geographical focus as there is a paucity of high resolution palaeoenvironmental records spanning the Late Holocene, although the region boasts a high density of artificial ponds associated with the former iron industry as well as a high proportion of moats and episcopal fishponds. Despite the South East's population density and importance with respect to its cultural, economic and political history, we know little about the interrelationships between climate, environmental and societal change in the South East.

This research focusses on generating multi-proxy, environmental records from core samples extracted from six artificial wetland sites located in Surrey, Hampshire and Sussex. Preliminary analysis of the results has demonstrated that artificial wetlands hold a rich archive of important palaeoenvironmental information, revealing a local to sub-regional landscape story, evidence for erosional +/-or disturbance; as well as identification of clear anthropogenic atmospheric pollution signals.

Nutrient status of cocoa soils in Ghana as affected by soil management practices

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Funded by: Ghanaian Cocoa Board

This study aimed to assess the effects of two management practices (farmers normal practice against recommended practices) on chemical and physical properties of soils across five cocoa growing regions and to determine the effectiveness of recommended fertiliser regimes in improving soil fertility.

Soils were sampled from 20 farms from 5 regions. Each farm was split into four plots and on two randomly assigned plots recommended fertiliser regime was strictly adhered to. Soil samples were analysed for texture, pH, organic matter content, total carbon, total nitrogen and available nutrients. CEC and Base Saturation were also determined.

The soils were generally acidic with low organic matter content, deficient in nitrogen and phosphorus, and potassium was barely above the minimum required, even after recommended fertiliser application was followed. There were no significant variations in nutrient status between farmer managed plots and scientist managed plots. The study therefore recommends that nutrient management strategy that increases organic matter content and nutrient levels, and reduces pH should be considered for sustainable cocoa production.

Burning by numbers: quantitative petrography and its application in the analysis of late iron age and roman cremation practices in Britain

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Funded by: Arts and Humanities Research Council

The Late Iron Age and Roman period in Britain witnessed numerous cultural, social and technological transitions, including increased interactions with the continent. While these processes have received significant attention with regards to discussion of material culture, it is only recently that bioarchaeological research has considered the role of funerary practices and what they can contribute to our understanding of these transitions.

The primary mortuary rite during this period was cremation. Although previously thought to contain limited information compared to inhumation burials, current research now recognises that they hold the potential to reconstruct entire funerary sequences, from the building of the pyre, to the final deposition within the grave. Recent methodological advances in the field allow us to infer a wealth of information concerning burning intensity, providing insight into ancient cultural, technological and social practices that could not be achieved before.

This paper introduces a new quantitative method that measures the extent of ultra-structural thermal alteration within burned bone thin sections, and how it can contribute to the archaeological understanding of the Late Iron Age to Roman transition in Britain. Attention is given to both the methodological advantages and drawbacks in employing qualitative and quantitative technologies in the assessment of burned human remains, and discusses the potential for future research in the field of cremation studies.

Lighting up Lusitania

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Funded by: Arts and Humanities Research Council

While many features of the Roman Empire are superficially similar across its entirety, there are often subtle regional differences that provide revealing insights into local practices. Lighting equipment represents an important form of material culture but the lack of standardised methods of recording across Europe has made it increasingly difficult to compare archaeological data across the Mediterranean and beyond.

This project examines the role of lighting equipment in the social, economic and ritual practices of the people of Roman Lusitania (modern Portugal and western Spain). It deliberately combines material from two modern countries to study an ancient province, and also explicitly compares the data from Lusitania to other provinces to better understand lamp chronology and use. It has adopted a theoretical framework shaped by Anglophone scholars while engaging in detail with the archaeological record of a region that does not necessarily have a long tradition of material culture research.

This project highlights the benefits as well as the challenges of working with these approaches in the Mediterranean and argues that constructive dialogue between traditions has never been more relevant than under the current political climate.

Shouldered axes from Taiwan - its function, usage and chronology

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Funded by: Ministry of Education, Taiwan

The andesite shouldered axes in Northern Taiwan are unique artefacts of the Yuanshan culture during the Late Neolithic Age. They are commonly regarded as agricultural tools related to rice cultivation. However, this claim has not yet been supported by archaeological evidence or experimental archaeology test.

Understanding of the distinctive surface marks on the shoulders and the blades of the shouldered axes, and how those relate to their hafting methods and uses, is central to understanding their function. This dissertation develops this understanding by replicating, hafting and using experimental shouldered axes. Use wear analysis is employed to document and interpret the traces on the experimental artefacts generated by this research. This enables the testing of competing hypotheses for the function and the usage of shouldered axes.

In addition, the phytolith analysis is performed to two shouldered axes and one soil sample from the same site. Results of the phytolith analysis provide recommendations for the usage of the shouldered axes and an understanding of the palaeoenvironment of the site. In general, this research shows that the usage and function of shouldered axes possibly is an agricultural tool for hoeing.

Planting the modern city, the role of plants in the modernisation of Bogotá, Colombia

Diego Molina

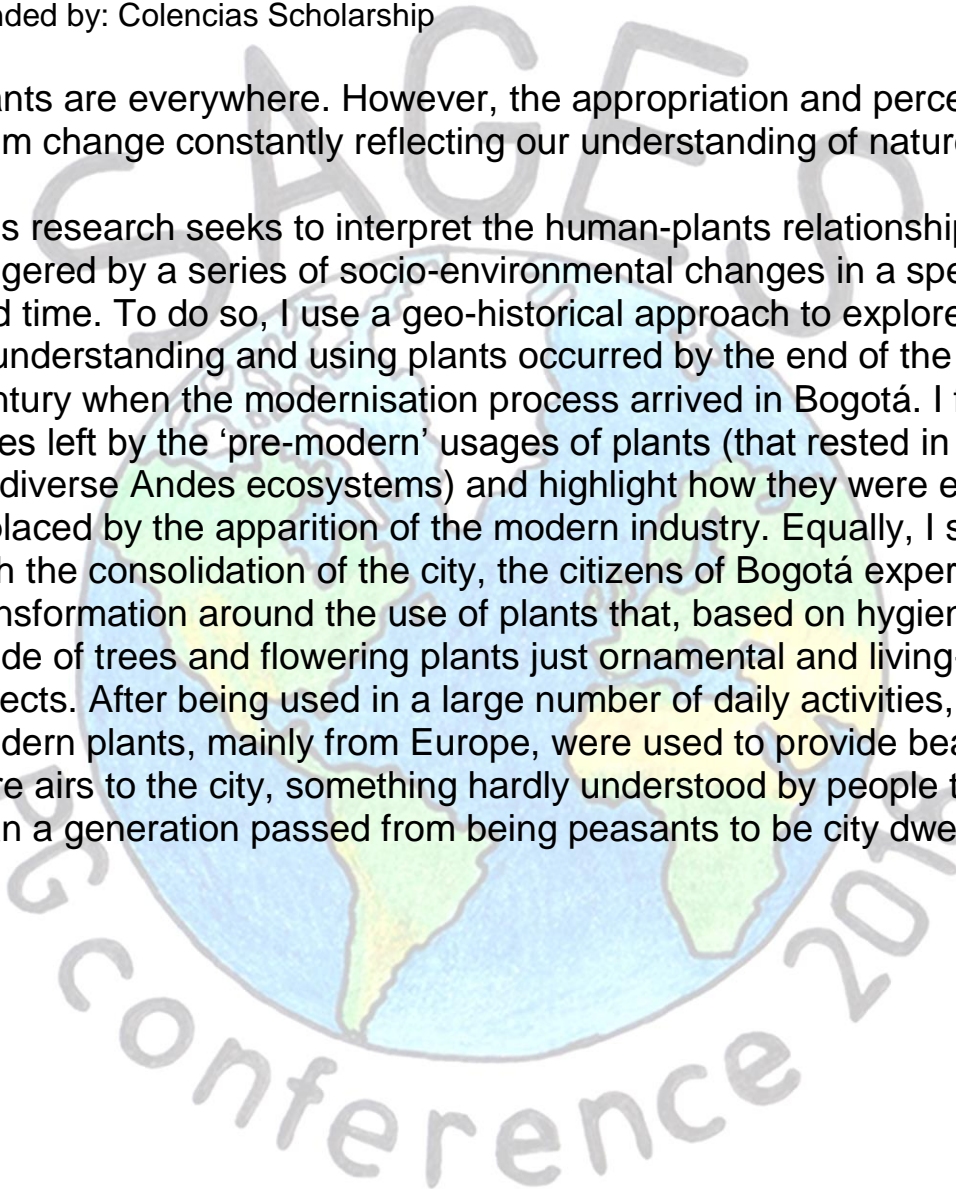
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Funded by: Colencias Scholarship

Plants are everywhere. However, the appropriation and perception of them change constantly reflecting our understanding of nature.

This research seeks to interpret the human-plants relationships triggered by a series of socio-environmental changes in a specific place and time. To do so, I use a geo-historical approach to explore the shift in understanding and using plants occurred by the end of the nineteenth century when the modernisation process arrived in Bogotá. I follow the clues left by the 'pre-modern' usages of plants (that rested in the highly biodiverse Andes ecosystems) and highlight how they were eventually replaced by the apparition of the modern industry. Equally, I stress how, with the consolidation of the city, the citizens of Bogotá experimented a transformation around the use of plants that, based on hygienic ideas, made of trees and flowering plants just ornamental and living-machine objects. After being used in a large number of daily activities, the modern plants, mainly from Europe, were used to provide beauty and pure airs to the city, something hardly understood by people that in less than a generation passed from being peasants to be city dwellers.



A perturbed biogeochemistry model ensemble evaluated against in situ and satellite observations

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Funded by: Bakrie Centre foundation

The dynamics of biogeochemical models are determined by the mathematical structure used for the main biological processes. Earlier studies have shown that small changes in the model formulation may lead to major changes in system dynamics, a property known as structural sensitivity. We assessed the impact of structural sensitivity in an intermediately complex biogeochemical model (MEDUSA) by modelling the chlorophyll and nitrogen concentrations at five different oceanographic stations spanning three different regimes: oligotrophic, coastal, and the abyssal plain over a 10-year timescale. A 1-D MEDUSA ensemble was used with each ensemble member having a combination of tuned function parameterizations that describe the key biogeochemical processes, namely nutrient uptake, zooplankton grazing, and plankton mortalities. The impact is quantified using phytoplankton phenology (initiation, bloom time, peak height, duration, and termination of phytoplankton blooms) and other statistical measures. The spread of the ensemble as a measure of uncertainty is assessed against observations using the Normalised RMSE Ratio (NRR). We found that even small perturbations in model structure can produce large ensemble spreads. The range of 10-year mean surface chlorophyll concentrations are between 0.14-3.69 mg m⁻³ at coastal stations, 0.43-1.11 mg m⁻³ on the abyssal plain, and 0.004-0.16 mg m⁻³ at the oligotrophic stations. Changing mortality and grazing functions have the largest impact on chlorophyll concentrations. The in situ measurements of bloom timings, duration, and terminations lie mostly within the ensemble range and using the ensemble properties such as the mean and median, the errors are mostly reduced compared to the default model output. The NRRs for monthly variability suggest the ensemble spread is generally narrow (NRR 1.21-1.39 for nitrogen and 1.19-1.39 for chlorophyll profiles, 1.07-1.40 for surface chlorophyll, and 1.01-1.40 for depth-integrated chlorophyll). Among the five stations, the most reliable ensembles are obtained for the oligotrophic station ALOHA (for the surface and integrated chlorophyll 10-year time series and bloom peak height), coastal station L4 (for inter-annual mean), and abyssal plain station PAP (for bloom peak height).

Overall our studies provided a novel way to generate ensemble spread by perturbing the model structure/parameterizations, and reliable ensemble means and spreads may be generated.

Let's play...the weakest index!

Using remote sensing to monitor peat bog health

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Funded by: NERC Scenario Studentship & The James Hutton Institute

Peatlands are vitally important environments for carbon storage, but many have been degraded through human mismanagement. Some damaged peatlands are now being restored, and this has been recognised as a way to gain carbon credits under the Kyoto protocol. Restoration can be monitored by water table rise, vegetation type and cover, and carbon uptake. Remote sensing has the potential to provide estimates of all these measures cheaply and easily, but there is still uncertainty about the best methods to use, and the accuracy of the results. Indices calculated from spectral data can give lots of information about the land surface, for example vegetation health and water content. In this project we test these indices against real experimental data from the field and the laboratory, to find out which indices give useful information in this environment, and which we can dismiss.

Quantifying and understanding the uptake of plant protection products from soil into plants

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Funded by: BBSRC Industrial Case Award with Syngenta

Regulation of plant protection products requires agro-chemical products to be assessed for their environmental fate prior to use. Environmental fate models predict this behaviour based on the physical and chemical properties of each compound. The plant uptake of these compounds remains a relatively underdeveloped area of research but has been proposed to have a significant effect on the environmental fate of pesticides and their transport down the soil profile.

Plant uptake models are frequently used for the prediction of plant uptake of agrochemicals where experimental data do not exist, however, a lack of scientific consensus has led to a loss of confidence in their accuracy. This study has collated all available laboratory plant uptake data from peer-reviewed literature and contrasted it against existing model relationships. Although the performance of the models was low, the reasons for this are discussed and a method for further research proposed.

There also is variation among the environmental fate models in their method for calculating the plant uptake. The plant uptake values were altered across their expected range for a specific set of compounds and a model scenario setup for growing winter wheat in locations across Europe. Results are discussed as an inter-model comparison.