UNIVERSITY OF LIVERPOOL

School of Environmental Sciences

Newsletter • No2 • 2019/20

Landscape Winner - SoES student photographic competition 2019-20
Photograph by **Isabel Ashman**
Reflections on Neves-Stausee

Pirates of the Caribbean offer a wing in aid of regional-scale conservation science

Inside an environmental time machine of Abercromby Square

The Herdman Symposium "Climate Variation Through Earth's History"

Earth, Ocean and Ecological Sciences • Geography and Planning

Contents

Any news you would like to share with the School, of work being done, grants awarded, fieldwork, new staff, retirements, facilities, social events or anything else, please submit an article along with any images for the next edition to **SoES Marketing and Communications team** soesweb@liverpool.ac.uk

Introduction from the Dean

Dear all,

Once again I invite you to take some minutes to read through this tremendous Newsletter filled with a selection of some of the truly fascinating activities going on within the School of Environmental Sciences. Though much of this continues in the virtual, online world, the scope and breadth and dynamism of these activities is in sobering contrast to the insular conditions in which we now find ourselves.

For all of us the COVID-19 pandemic is deeply unsettling. Mental health and well-being resources are widely available to help us through and some of these are included on the final page of this Newsletter. Please read to the end and look through these if you are interested.

Collectively, we will pass through this phase, and when we do we will have changed somewhat as a result. Many of us are familiar, at least in theory, with the concept of short-term disturbance within the context of longer-term more gradual change. But it is a curious feeling to reflect that we are experiencing such a paradigm shifting moment. Book recommendations have been swapped lots recently. One book I'd recommend is "Fugitive Pieces" by Anne Michaels. It's very poetic account of generations affected by war but finding solace and parallels in the natural world. Here's a taste of it, which might chime with many of us:

"The present, like a landscape, is only a small part of a mysterious narrative. A narrative of catastrophe and slow accumulation. Each life saved: genetic features to rise again in another generation."

This crisis has also illuminated the fact that we do not live in entirely separate worlds from each other; that we have agency in creating social and environmental change; and that outwardly distinct aspects of life are inextricably linked: all themes that we as a School have sought to embrace.

I wish you all good health and look forward to us sharing continuing dynamic experiences from our work, research and learning in the next Newsletter.

Best wishes
Doug

Congratulations and celebrations on funding successes

PI CO-I	Investigator	Funder	Project Title	Dept	Total Cost	Funder Contribution	Investigator Contribution
CO-I	Darlington Pollock FM (Dr), Green M (Dr)	Liverpool Clinical Commissioning Group Uk	Health inequalities in the care pathways for people living with young- and late-onset dementia in Liverpool	G&P	£12,394.07	£6,633.67	£1,658.42
PI	Darlington Pollock FM (Dr),	The Nuffield Foundation Uk	Understanding the geography of opportunities, challenges and need in an aged population	G&P	£168,234.20	£168,234.20	£67,293.68
CO-I	Dolega L (Dr),						£67,293.68
	Lord AD (Prof),						£16,823.42
	Dunning RJ (Dr)						£16,823.42
PI	Kavanagh JL (Dr)	UK Research and Innovation (UK)	Modelling Magma movement: linking indirect observations with dynamic processes	EOES	£1,553,785.00	£1,193,004.20	£1,193,004.20
PI	Jeffreys RM (Dr)	NERC	Seabed mining and resilience to experimental impact	EOES	£203,869.00	£163,095.20	£163,095.20
PI	Arribas-Bel (Dr)	ESRC	Learning an urban grammar through AI	G&P	£433,165.83	£346,532.66	£346,532.66
PI	Hacket Pain AJ (Dr)	Royal Society (OST)	MonkeyPuzzle: Reconstructing mast events and climate in Patagonia using Araucaria araucana tree rings	G&P	£10,150.00	£10,150.00	£10,150.00
PI	Patrick SC (Dr)	International Human Frontier Science Program Organization (France)	Do seabirds use infrasound to navigate the vast ocean?	EOES	£115,991.76	£115,991.76	£115,991.76
PI	Worden RH (Prof)	Equinor (Norway)	Chlorite Consortium-Phase 3	EOES	£75,000.00	£75,000.00	£75,000.00
PI	Worden RH (Prof)	BP International Ltd (UK)	Chlorite Consortium-Phase 3	EOES	£75,000.00	£75,000.00	£75,000.00
PI	Williams RG (Prof)	NERC	Southern Ocean carbon indices and metrics (SARDINE)	EOES	£344,951.00	£275,960.80	£275,960.80
PI	Moore TE (Dr)	Power To Change Trust (UK)	Homes in Community Hands: Community-Led Housing Evaluation	G&P	£23,200.00	£23,200.00	£23,200.00
PI	Williamson P (Dr)	ESRC	Safepod network	G&P	£30,000.00	£30,000.00	£30,000.00
PI	De Angelis S (Dr)	NERC	Ixchel: Building understanding of the physical, cultural and socio-economic drivers of risk for strengthening resilience in the Guatemalan cordillera	EOES	£35,507.00	£28,405.60	£28,405.60
PI	Lea JM (Dr)	UK Research and Innovation (UK)	Ice sheet and glacier stability in a warming world: using innovative modelling and satellite image analysis for the first comprehensive estimates of sea level rise and iceberg rise	G&P	£1,000.00	£1,000.00	£1,000.00
PI	Plater AJ (Prof)	Department for Communities and Local Government (UK)	LCEI Extension research	G&P	£1,448,069.89	£724,034.95	£724,034.95

Local authority housing and planning capacity in an era of austerity

Dr Richard Dunning and Dr Thomas Moore

The Great Financial Crisis, arising in 2007, sent economic shockwaves across the globe. National governments responded in very different ways. Since 2010, in England the government's response was to reduce public sector spending significantly. One outcome was reducing funding available for local authorities by 49%, particularly affecting housing and planning functions. But, this was not a spatially balanced approach and has had significant and disproportionate impacts on local government in the North.

The Northern Housing Consortium commissioned Dr Hincks (Sheffield), Dr Dunning and Dr Moore to describe the spatial distribution of funding changes since 2010-11, in particular the impact on housing and planning provision.

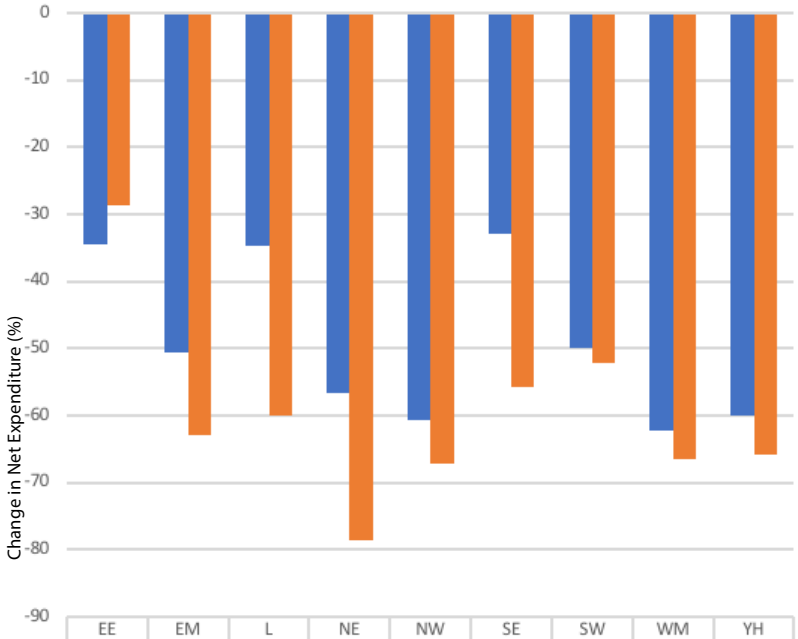
In 2010-11, local authorities spent slightly less than £2.5 bn on housing services and £1.7 bn on planning and development services. By 2018-19 there was a difference in net spend of -50% for housing services and -79% for planning and development services.

In regional terms it is clear that the reduction has not been proportionate. In absolute terms London and North West England have seen the highest reductions in net expenditure on housing and planning. However, in relative terms, the largest reductions in housing and planning and development services were in the North East, North West and Yorkshire and the Humber along with the East and West Midlands

Unsurprisingly, case study interviews described themselves as being "stretched", "under strain", "challenging", "just about manageable" or "operating on a skeleton model". This is creating a disproportionate challenge for housing and planning in the north of England. There was also a sense that local government was being underutilised or by-passed in efforts to address issues like climate change or even the housing crisis.

Against this context, this research is intended to stimulate further discussion of what the implications of changes to housing and planning capacity might mean for the future of the North under increasing challenging political-economic, social and environmental circumstances.

Figure 1
Change in Net Expenditure in Housing and Planning and Development Services by Administrative Region (%)



	EE	EM	L	NE	NW	SE	SW	WM	YH
Housing Services (2010/11-2018/19)	-34.5	-50.6	-34.7	-56.7	-60.7	-32.9	-49.9	-62.3	-60
Planning and Development Services (2010/11-2018/19)	-28.7	-63	-59.9	-78.6	-67.1	-55.8	-52.1	-66.4	-65.9

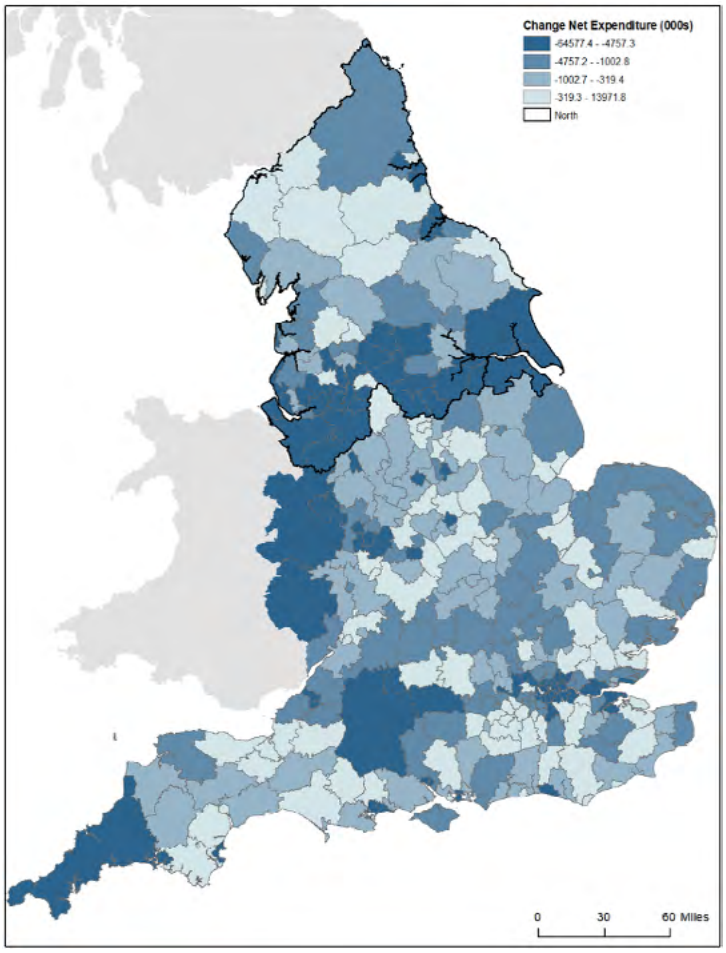


Figure 2
Change in Net Expenditure on Housing Services (2010-11/2018-19)

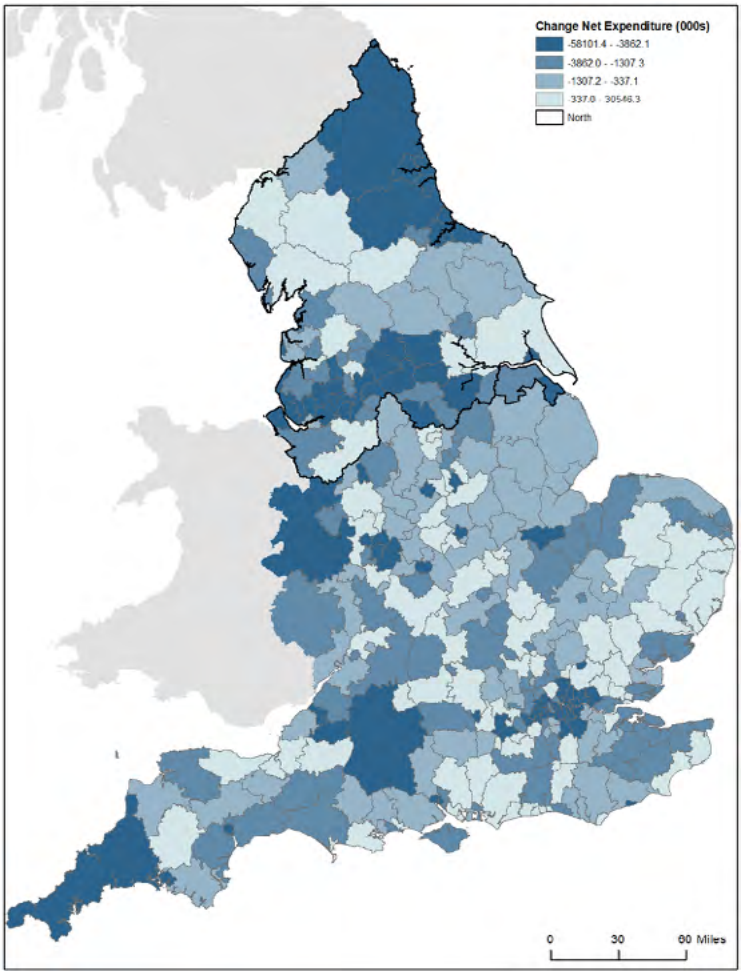
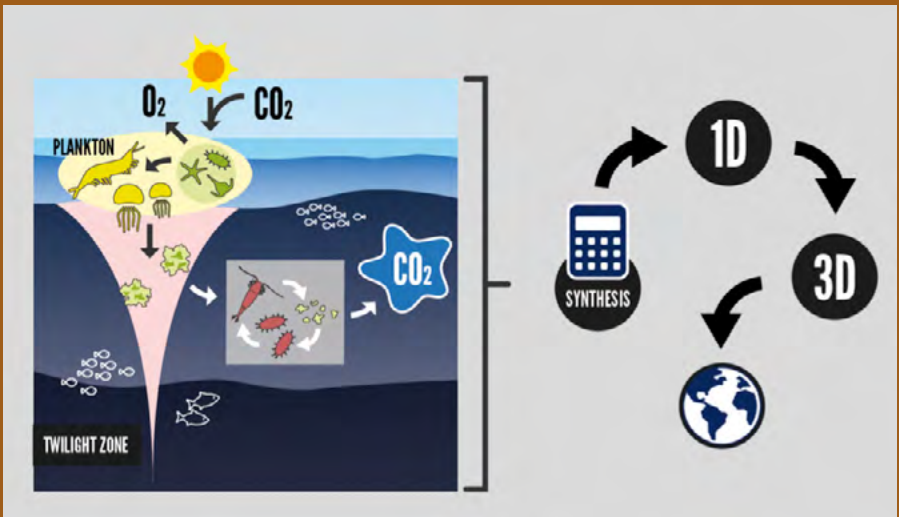


Figure 3
Change in Net Expenditure on Planning and Development Services (2010-11/2018-19

COMICS zoom in



Professor George Wolff and Dr Calum Preece attended an online Zoom COMICS meeting between 30 March to 3 April. Although it was comical at times (see our screen capture), the meeting went really well.

COMICS stands for "Controls over Ocean Mesopelagic Interior Carbon Storage" and is a four-year programme funded by NERC that focusses in the flow of carbon in the ocean's "twilight zone" in order to more accurately model global climate change.

The "twilight zone" is the part of the ocean between 100 and 1000m below the sea surface; this zone is critical in controlling the efficiency of carbon transport from the atmosphere to the interior ocean and is key to regulating atmospheric CO_2 levels.

Liverpool were involved in two major research expeditions to South Georgia and Benguela, both in the South Atlantic Ocean. We chose regions with contrasting primary production, temperature and oxygen concentrations in order to try to understand the main controls on the recycling of organic carbon.

After two days of virtual presentations, we split into discussion groups which again worked really well. Is this the way to work in the future? It would certainly save money and travel! There will be a special volume of *Deep-Sea Research II* to be published in 2021, and we are hoping for high impact papers in *Nature* or *Science* to present our exciting results and ideas!

Green Cities as urban models – contributing to new urban agendas, but how? Special Issue of Town Planning Review

Dr Olivier Sykes, Dr Alexander Nurse

Image by Johnnie Shannon from Pixabay

There is an increasing recognition that the sustainable planning and development of cities is no longer solely a matter of local, regional and national concern. What happens in cities in the remainder of this century will impact more widely on a host of international and global agendas, notably responding to the climate emergency, biodiversity, resource use, public health (e.g. addressing air pollution and responses to pandemics), and promoting greater environmental justice.

Reflecting this, Sustainable Development Goal (SDG) 11 of the UN's 2030 Agenda for Sustainable Development, focuses on making "cities and human settlements inclusive, safe, resilient and sustainable". Similarly, the UN's New Urban Agenda, promotes Environmentally sustainable and resilient urban development" and its International Guidelines on Urban and Territorial Planning states that "Urban and territorial planning contributes to increased human security by strengthening environmental and socioeconomic resilience, enhancing mitigation of, and adaptation to, climate change and improving the management of natural and environmental hazards and risks". Informed by this context and the EU's promotion of the European Green Capital Award (EGCA), the French and British Planning Studies Group organised two seminars on the theme of green cities as policy models. The first was held in Bristol, (European Green Capital 2015), and organised jointly organised by University of the West of England and Bristol University on the theme of "European Green Cities: building urban resilience and sustainability in an era of austerity". The second in Nantes, (European Green Capital 2013), on the theme of "Urban models, 'best practices' and policy transfer: exploring the legacies of European Green Capitals" and was organised by the Ecole Nationale Supérieure d'Architecture de Nantes and the Université de Nantes. A selection of the papers given at these two events has now been assembled as a special Liverpool edited issue of the Town Planning Review with the goal of contributing to the sharing experiences of being a Green Capital and the implementation of Green City models.

The articles explore the application of the Green City as an urban policy model in different national contexts, reflecting on how far labels and awards such as the EGCA, and the circulation of international concepts and exemplars of the Green City, shape (or perhaps fail to) material practices of urban planning and governance towards genuinely more sustainable trajectories.

Pirates of the Caribbean offer a wing in aid of regional-scale conservation science

Co-leads: Dr Jonathan Green and Dr Rhiannon Austin
Project: Regional-scale conservation through multi-territory tracking of frigatebirds.
Funder: Darwin Plus Scheme, Department for Environment, Food and Rural Affairs

This DEFRA-funded project, focused on regional-scale conservation science in the Caribbean UK Overseas Territories (UKOTs), has now reached the end of its first year. Dr Jonathan Green and Dr Rhiannon Austin, from the Seabird Ecology Group (SEGUL), have been co-leading this project since it started in April 2019, and are working with partners in all six of the Caribbean's UKOTs: Anguilla, the British Virgin Islands, the Cayman Islands, Turks and Caicos, Bermuda and Montserrat.

This project was developed in direct response to previous territory-specific projects in the region by this collaborative group, as well as an acknowledgement that effective protection of highly mobile marine vertebrates requires multilateral management cooperation. The main aim of this work is to use movement data from Magnificent Frigatebirds, known locally as the Pirates of the Skies owing to their propensity to steal food from other birds, to develop an approach for defining priority areas for protection. Previous work by Rhiannon and Jon[1] demonstrated the unique ability of magnificent frigatebirds to connect productive marine foraging areas in offshore and coastal environments to terrestrial roosting sites. This species, which traverses extensively across waters under the jurisdiction of multiple nations, is thus being used as an indicator to identify marine, coastal and onshore biodiversity hotspots at a regional scale. It is hoped through this approach, and the management discussions that it initiates, that the project will aid the development of regional marine and coastal management strategies in the Caribbean.

The project is managed day-by-day by Rhiannon, who has spent the last year running field campaigns, liaising with project partners, and combining and analysing data to develop methods.

In March 2020, Rhiannon and Jon travelled to Anguilla in the Eastern Caribbean to present findings to date at the project's Initial Workshop, which was attended by participants from all six of the Caribbean's UKOTs, as well as BirdsCaribbean, one of the largest regional conservation bodies operating in the region.

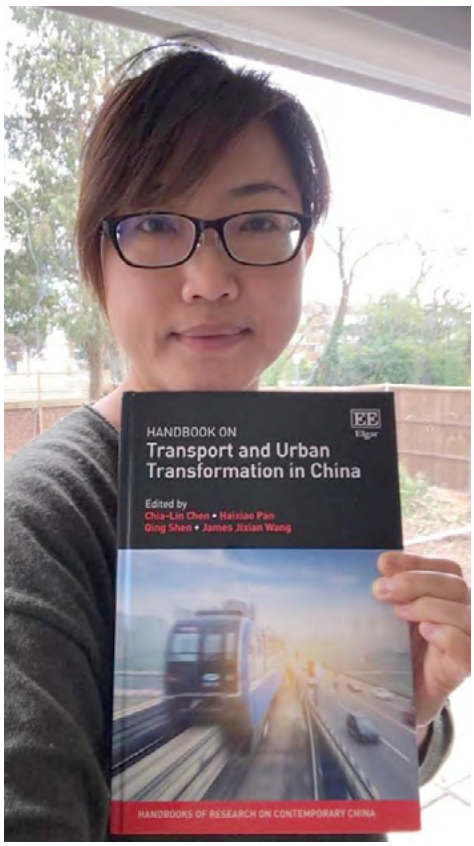
Over a three-day period, workshop participants **1)** discussed the use of the project's outputs to help address their particular marine and coastal conservation issues and management challenges, **2)** developed "plans of action"

[1] Austin RE, De Pascalis F, Arnould JPY et al. (2019) A sex-influenced flexible foraging strategy in a tropical seabird, the magnificent frigatebird. Marine Ecology Progress Series 611:203-214.

for supporting activities to be undertaken in the six UKOTs during the project, **3)** identified needs for future long-term project work, and 4) further fostered inter-partner relations.

The workshop ended with a planning session for a Final Workshop that will take place during the BirdsCaribbean Conference in Trinidad in 2021, at the end of the project. This meeting will be themed on "Connectivity of both ecosystems and stakeholders in the Caribbean"', and opened up to multiple non-UK states and territories. The project team hopes that discussions and new working partnerships that arise from this workshop will enhance biodiversity conservation in the Caribbean UKOTs and across the region.

Dr Chia-Lin Chen and the new handbook



New handbook on Transport and Urban Transformation in China

A new book *Handbook on Transport and Urban Transformation in China*, co-edited by Dr Chia-Lin Chen, Department of Geography and Planning in University of Liverpool, UK and three international collaborators: Haixiao Pan, Tongji University, China; Qing Shen, University of Washington, US; James Jixian Wang, Belt and Road Hong Kong Centre, Hong Kong. The role of transport has proved indispensable in the unprecedented rapid urbanisation and urban transformation after China embarked economic reforms in 1978. This book, setting the scene over a period of four decades since the reforms, is the first research-focused book dedicated to these important inter-relations and offers new insight into the various opportunities and challenges brought by fast-paced motorisation and urban development through broad spatial-economic, environmental, social, and institutional dimensions.

The book is structured in four themes: Transport Planning: Territorial Restructuring and Development (Part 1); Transport, Environment and Technology (Part 2); Travel, People and Social Justice (Part 3); and Reform, Governance and Development Models (Part 4).

All 25 chapters contributed by over 40 authors are written by either international leading academics, emerging researchers or policy makers with extensive expertise in the corresponding topic area.

It is part of the *Handbooks of Research on Contemporary China Series* initiated and edited by Professor David Goodman, Vice President Academic Affairs and Professor of China Studies at Xi'an Jiaotong-Liverpool University.

This book took a little over three years from an initiative to a publication that attempts to explore the unique dual system —market economy conditions with state control on a large scale which underlies the urban transformation, telling Chinese stories that could be related to an international audience with comparative perspectives.

In addition to the editorial work, Dr Chen contributed to a chapter on "High-speed rail and its wider spatial-economic impact on transformation of Chinese cities and regions: a multi-level analysis", which was a snapshot of her first empirical research examining high-speed rail and territorial transformation in China over a three-year lectureship in Xi'an Jiaotong-Liverpool University before joining University of Liverpool in September 2018.

The white woolly maggots have eaten some of the heart out of our uplands, and it takes a long time to recover. . . .

Photo: R H Marrs

Sheep, the white-woolly maggots or hoofed locusts, have been blamed for the poor species diversity of the British Uplands since Frank Fraser Darling described them as "Wet Deserts" in the 1950s. George Monbiot has popularised this view in the National Press that our uplands are sheep-wrecked.

Recent research at the University of Liverpool led by Professors Rob Marrs and Richard Chiverrell tackled this problem using a series of long-term adjacent sheep-grazed and ungrazed plots at Moor House National Nature Reserve, a site also included in the UK's Environmental Change Network register. The experiments are registered as of international importance under the Ecological Continuity Trust. A previous assessment of the nutritional impacts of sheep at the overall herbage scale within these experiments at Moor House showed no overall trend, but some species (we called them focal species) had either colonized or increased massively in abundance when sheep grazing was removed. New work recently published in the *Annals of Applied Biology* compared a number of these focal species to other plant species common to these sheep-wrecked uplands. The plants were assessed from the viewpoint of a sheep, measuring the concentration of major nutrients, micro-nutrients (trace elements), their palatability and digestibility, alongside a fifth ecological measure, the plant decomposition speed.

The focal species reappearing or increasing massively in abundance with the removal of sheep grazing were more nutritious, were easier to eat and digest, and they decomposed faster than the common species. Our findings confirm that the white woolly maggots have indeed eaten at least some of the heart out of the uplands.

With the reduction or removal of sheep these landscapes can recover, but our long-term monitoring showed it can take up to 60 years for these focal species to increase.

As a society we must be in it for the long haul if the rewilding/ wilding of our uplands with sheep removal is to produce substantive improvements in biodiversity without some seed addition and management to increase germination success.

It also emphasises the need for long-term manipulative ecological experiments, the experiments studied here were set up between the mid-1950s and the early-1970s and Professor Marrs has been working on them on-and-off for almost 40 years!

This work was co-funded by the Leverhulme Trust and the Heather Trust.

This research was a team effort involving two field-survey teams (Prof Marrs, his postdoc Dr HyoHyeMi Lee from the National Institute of Ecology, Seocheon-gun, Republic of Korea and Rob Rose and John O'Reilly from the UK Centre for Ecology & Hydrology's (Lancaster) Environmental Change Network); the Data analysis team (Professors Marrs and Smart of CEH Lancaster), and Prof Chiverrell who led the X-ray fluorescence and Near Infra-Red Spectroscopy (NIRS) analyses. A critical role was played by members of our Professional Services Staff who provided analytical expertise – Les Connor (macro-nutrients), Mike O'Connor (micro-nutrients) and Sabena Blackbird (carbon and nitrogen), plus Dr Susan Girdwood from IBERS, University of Aberystwyth, an expert in animal nutrition (and Professor Marrs' niece) who decoded the NIRS scans. Plus, of course, Suzanne Yee produced the final graphics.

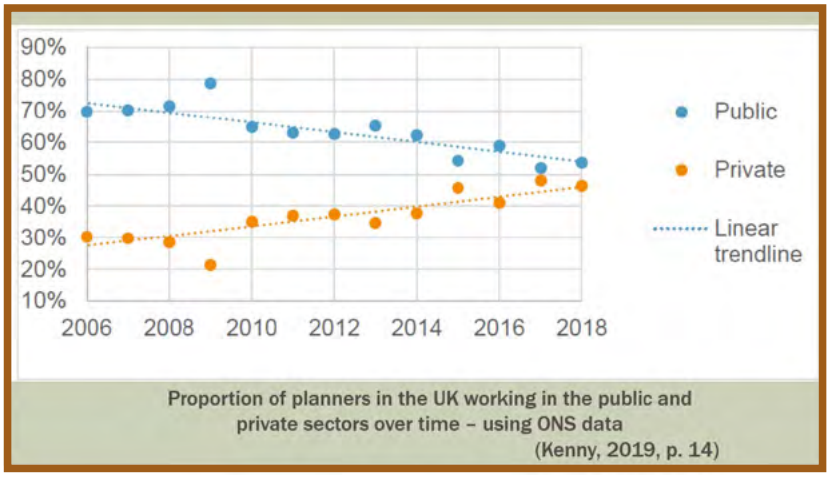
This work could not have been contemplated without the substantial investment in equipment within the Central Teaching Laboratories.

Virtual Planning Seminar Series

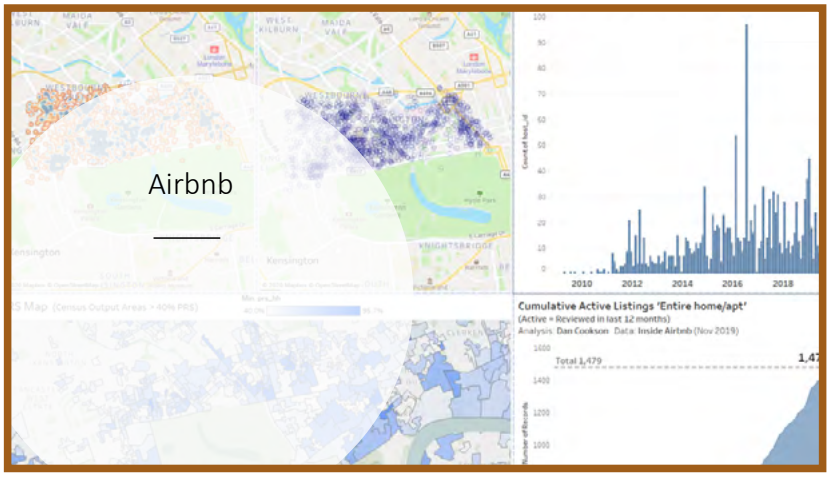
Colleagues in Planning ran a virtual seminar series, comprising three talks presenting the findings of ongoing and completed research projects and reflecting on teaching practice.

Each of the authors listed here would be happy to share slides/ notes with colleagues in the School on request.

- Dr Richard Dunning: Empty and Under-Utilised homes in Greater London
- Dr Tom Moore: Pedagogy, Podcasts and Planning: What role does podcasting have in planning education?
- Dr John Sturzaker: Ethics and the public interest in a newly diverse planning profession



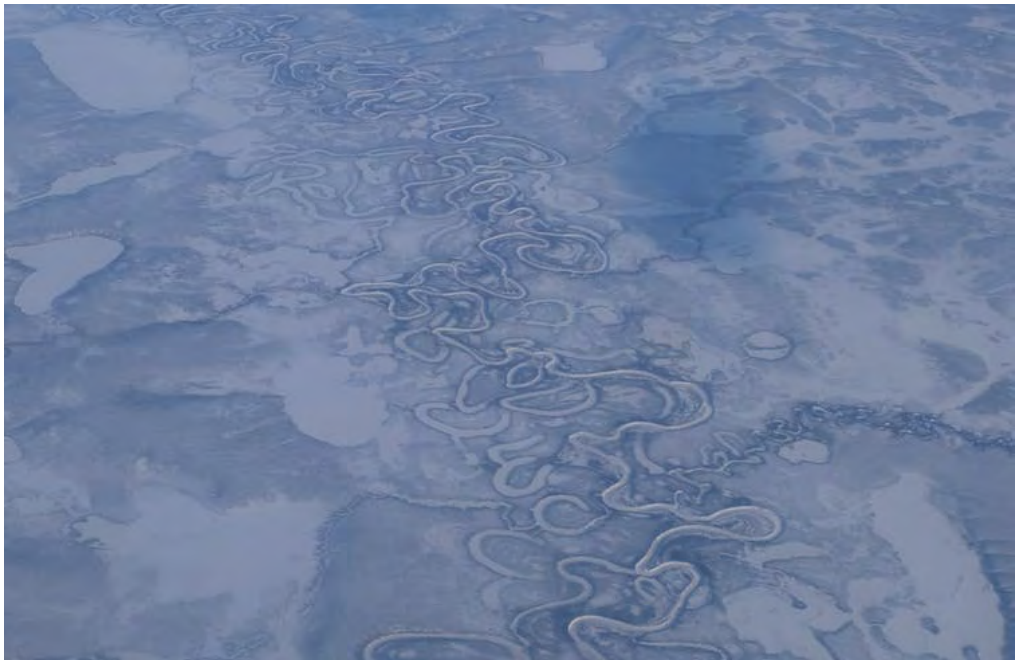
Seminar slide from: Ethics and the public interest in a newly diverse planning profession



Seminar slide from: Empty and Under-Utilised homes in Greater London

Arctic climate change – it's recent carbon emissions we should fear, not ancient methane "time bombs"

Dr Joshua Dean



Arctic landscapes are changing rapidly as the region warms.
Photo: Joshua Dean provided

The Arctic is predicted to warm faster than anywhere else in the world this century, perhaps by as much as 7°C. These rising temperatures threaten one of the largest long-term stores of carbon on land: permafrost.

Permafrost is permanently frozen soil. The generally cold temperatures in the Arctic keep soils there frozen year-on-year. Plants grow in the uppermost soil layers during the short summers and then decay into soil, which freezes when the winter snow arrives.

Over thousands of years, carbon has built up in these frozen soils, and they're now estimated to contain twice the carbon currently in the atmosphere. Some of this carbon is more than 50,000 years old, which means the plants that decomposed to produce that soil grew over 50,000 years ago. These soil deposits are known as "Yedoma", which are mainly found in the East Siberian Arctic, but also in parts of Alaska and Canada.

As the region warms, the permafrost is thawing, and this frozen carbon is being released to the atmosphere as carbon dioxide and methane. Methane release is particularly worrying, as it's a highly potent greenhouse gas.

But a recent study suggested that the release of methane from ancient carbon sources – sometimes referred to as the Arctic methane "bomb" – didn't contribute much to the warming that occurred during the last deglaciation – the period after the last ice age. This occurred 18,000 to 8,000 years ago, a period that climate scientists study intently, as it's the last time global temperatures rose by 4°C, which is roughly what is predicted for the world by 2100.

This study suggested to many that ancient methane emissions are not something we should be worried about this century. But in new research, we found that this optimism may be misplaced.

"Young" versus "old" carbon

We went to the East Siberian Arctic to compare the age of

Arctic lakes are growing sources of methane emissions to the atmosphere.
Joshua Dean, provided

different forms of carbon found in the ponds, rivers and lakes. These waters thaw during the summer and leak greenhouse gases from the surrounding permafrost. We measured the age of the carbon dioxide, methane and organic matter found in these waters using radiocarbon dating and found that most of the carbon released to the atmosphere was overwhelmingly "young".

Where there was intense permafrost thaw, we found that the oldest methane was 4,800 years old, and the oldest carbon dioxide was 6,000 years old. But over this vast Arctic landscape, the carbon released was mainly from young plant organic matter.

This means that the carbon produced by plants growing during each summer growing season is rapidly released over the next few summers. This rapid turnover releases much more carbon than the thaw of older permafrost, even where severe thaw is occurring. So what does this mean for future climate change? It means that carbon emissions from a warming Arctic may not be driven by the thawing of an ancient frozen carbon bomb, as it's often described. Instead, most emissions may be relatively new carbon that is produced by plants that grew fairly recently.

What this shows is that the age of the carbon released from the warming Arctic is less important than the amount and form it takes. Methane is 34 times more potent than carbon dioxide as a greenhouse gas over a 100-year timeframe. The East Siberian Arctic is a generally flat and wet landscape, and these are conditions which produce lots of methane, as there's less oxygen in soils which might otherwise create carbon dioxide during thaws instead. As a result, potent methane could well dominate the greenhouse gas emissions from the region.

Since most of the emissions from the Arctic this century will likely be from "young" carbon, we may not need to worry about ancient permafrost adding substantially to modern climate change. But the Arctic will still be a huge source of carbon emissions, as carbon that was soil or plant matter only a few hundred years ago leaches to the atmosphere. That will increase as warmer temperatures lengthen growing seasons in the Arctic summer.

The fading spectre of an ancient methane time bomb is cold comfort. The new research should urge the world to act boldly on climate change, to limit how much natural processes in the Arctic can contribute to the problem.

Climate and insects interact to determine the reproductive success of trees

The impacts of climate change on forests can be dramatic but can also play out via more subtle interactions between different species. A new study involving the University of Liverpool and published in Nature Plants demonstrates how the overall effect of climate change on tree reproduction depends on complex interactions between climate, the trees, and the insects that eat their seeds.

Co-author Dr Andrew Hacket-Pain (University of Liverpool) explains, "Many tree species produce large seeds which are packed full of energy and nutrients giving the seedlings the best possible chance to establish as new trees. However, such energy-rich seeds are highly attractive to seed-eating animals, and so trees have evolved various strategies to minimise the loss of seeds to these 'seed predators'."

One of these strategies is to suppress the populations of seed-eating animals by switching between years of "bumper" seed production, and "famine" years with very few seeds. In the famine years, seed-eating animals are starved and so their numbers decrease. Then, during a bumper year, the supressed populations of seed predators are overwhelmed with a surfeit of seeds, and so more seeds can survive to establish the next generation of trees.

"In this research, we use data from four decades of long-term monitoring to investigate how climate change has affected the reproduction of one of the UK's most widespread trees, beech", explains Dr Jonathan Lageard at Manchester Metropolitan University. "We show that seed production has increased over that time period – but this does not tell the whole story".

The team found that the long-term increase in seed production has been accompanied by a reduction in the degree of year-to-year variability in seed production, and specifically a reduction in the frequency of the "famine years" which suppress the populations of seed-eating animals. Lead author Dr Michał Bogdziewicz from Adam Mickiewicz University, Poland, explains why this is important: "The main seed predator of beech is a specialist moth (Cydia fagiglandana), whose larvae feed on the developing beech seeds. Frequent 'famine years' enable the beech trees to suppress populations of this seed-eating insect.

However, the disappearance of the characteristic 'boom and bust' seed production patterns in UK beech trees has led to an increase in moth populations. As a result, we have seen a dramatic increase in the percentage of the seeds that are eaten by the larvae – up from around 1% in the 1980s to 40% in recent years."

Dr Hacket-Pain explains the implications of the study for understanding how beech trees are responding to changes in the climate: "Climate change is leading to an increase in the seed production of beech trees – but we show that any benefit the trees might gain from this increased reproductive effort has been almost entirely offset by higher seed consumption by the moth larvae. The trees are producing more seeds but gaining almost no return on their increased investment. It is an excellent example of how the overall response of forests to climate change is dependent on a complex web of interactions between species – it is far from straightforward".

The study was published in the journal *Nature Plants*, and was supported by NERC grant NE/S007857/1.

The School welcomes new members of staff

James Brookes – Impact Officer
I joined SoES in February 2020 to provide REF-related support to Faculty across SoES and the School of Electrical Engineering, Electronics and Computer Science, particularly relating to Geographic Data Science. I completed my PhD in History and American studies at the University of Nottingham in 2019 and have since worked with Newman University as a Visiting Lecturer and the Rights Lab at the University of Nottingham as a Research Fellow in Comparative Antislavery History. In this latter role, I examined past Antislavery strategies and tactics to gauge their appropriateness for combatting slavery and human trafficking in the present day. I have previously held research fellowships at the Library of Congress and the Smithsonian Institute (Washington, DC).

Joanna Hayes – Project Manager
I joined the School in January 2020 to work on SIMAtlantic, which is a two-year, EU-funded project to support the establishment and implementation of maritime spatial planning in France, Ireland, Spain, Portugal and the UK.

My background is in architecture and regeneration, including working for ten years as part of Liverpool City Council's Policy and Programmes team on a range of area-based initiatives. I am enjoying working within a research environment, gaining knowledge of maritime spatial planning, getting to know the project partners and communicating the activities and results of the project.

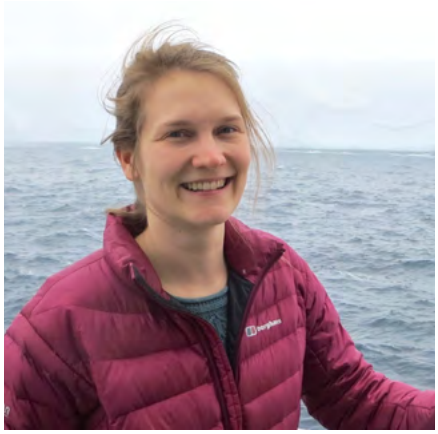
Brian Wall – Graduate Teaching Assistant After nearly 25 years as a Measurement Scientist at Unilever R&D helping to give the world better hair products, I joined the School as a part-time GTA, supporting students in the labs and on field trips for the next five years. At Unilever, I was involved in the creation of their Environmental Management Manual and supported its implementation as part of the company's sustainability agenda within the Hair R&D Division. Since leaving Unilever, I completed a PgDip in Environmental Management at the OU, and in the other half of my life here at Liverpool I am starting out on a PhD, looking at greenhouse gas emissions from urban waterways.

Outside of work and study, I am a Trustee of an animal rescue. I enjoy playing badminton and going ice-skating every week, and I am currently researching my family history. I am learning Welsh at night school, so I can chat to the locals in their own language whilst on holiday and I am making good use of my new e-bike.

New staff snapshots

Joe Sheridan – Student Experience Administrator
Before joining the School of Environmental Sciences I worked across Electrical Engineering and Electronics and Computer Science looking after all aspects of PGR from the application process to when the student is awarded.

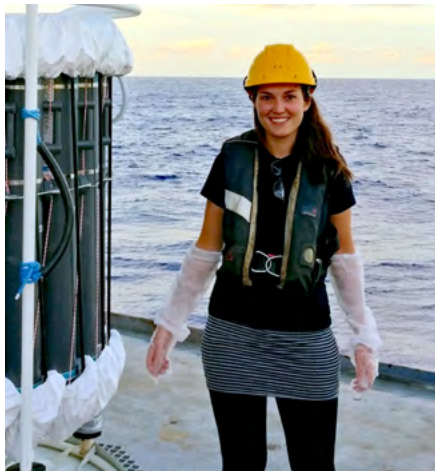
I have been in my new role since December, have settled in well and I am surrounded by friendly and supportive colleagues. I am looking forward to progressing further in my role and hoping to make a positive impact by implementing new initiatives and processes.



Isabel Nias – Lecturer, G&P, Geography I joined the Department in April 2020 as a lecturer in glaciology. In my research I use ice flow models to help improve our understanding of ice sheet dynamics and to make probabilistic projections of sea level rise from Antarctica and Greenland. I am particularly interested in quantifying uncertainty in ice sheet model predictions, and how we can use satellite observations to reduce this uncertainty. I completed my PhD at the Bristol Glaciology Centre, University of Bristol. Prior to starting at Liverpool, I was based in the Cryospheric Sciences Laboratory at NASA's Goddard Space Flight Center in Maryland, USA.

Kate Williams – Graduate Teaching Assistant In October 2019, I joined SoES after completing my MESci Geology and Physical Geography here in Liverpool. My PhD research is focused on flow dynamics within intrusions (specifically mafic sills) as part of the MAGMA Laboratory with Dr Janine Kavanagh. I currently use gelatine analogue experiments to visualise flow within experimental intrusions, with plans to make observations of flows within ancient solidified exposures of sills. Within my role as a teaching assistant, I demonstrate on a number of 1st and 2nd year laboratory-based modules.

I am looking forward to continuing my research within the school, as well as supporting and interacting with the students.



Hannah Whitby – Lecturer, EOES, Ocean Sciences
I joined the department in February 2020, upon completion of my ISBlue and Marie Curie PRESTIGE Fellowship at the Université de Bretagne Occidentale (France). My work centres on the nutrient properties and toxicity of dissolved metals, and seeks to gain a quantitative understanding of the relationship between trace metals and marine ecosystem productivity. I work on a variety of sample types, from the coast to the deep ocean, and from ice to hydrothermal systems.

After several years working abroad since the completion of my PhD at Liverpool, I am looking forward to returning to a fantastic working and learning environment in a vibrant city.

The Herdman Symposium 22nd February 2020 – "Climate Variation Through Earth's History"

Alice Glover and Harriet Williams (Herdman Committee Symposium Reps)
Dr Janine Kavanagh (School Outreach and Public Engagement Lead)

The Herdman Symposium 2020 was centred around the theme "Climate Variation through the Earth's History". As Earth scientists, we wanted to explore how we can use geological and geophysical techniques to determine past climates and how this can be applied to future climate studies.

The symposium was a great success and attracted 291 attendees, from school students, teachers, university students and academics to local and national geoscience groups and industry partners. This year, the range of subjects and the passion of our speakers have also allowed us to address the controversial subject of Climate within our society and our role in it as Earth scientists. Several attendees remarked how impressed they were with the symposium overall and how they appreciated the note on "Women in Geoscience" at the end. The symposium was preceded by a very successful alumni event on the Friday evening, where several of our graduates shared their knowledge, expertise and industry connections with our current students who had undertaken some "network training" earlier in the week.

Our six invited speakers represented a variety of expertise in climate studies, representing several universities across the UK. We had the pleasure of listening to Professor Bridget Wade and Professor Mark Maslin, both of UCL, who discussed the use of deep-sea sediments in determining the past climates and the anthropogenic impacts on climate with the introduction of the "Anthropocene", respectively. Professor Laura Robinson from the University of Bristol discussed the use of deep-sea corals for determining climate, whilst Dr Katrien Van Landeghem of the University of Bangor delivered an interesting talk on the use of sound to determine the retreat of ice streams. Dr Will Hutchison (St Andrews) highlighted volcanic impacts on climate and society, and our own Dr Chris Stevenson explored Cenozoic climate with a fun, interactive talk involving the use of balloons!

This year's symposium was supported by sponsorship from Bibby Hydromap, the Liverpool Geological Society, Badleys and the University of Liverpool. Their financial support of the symposium allowed the Herdman Committee to repeatedly reach out to younger students and the general public with an interest in geoscience and provide insight into the cutting-edge research involved in this subject.

Inside an environmental time machine of Abercromby Square

Jenny Bradley

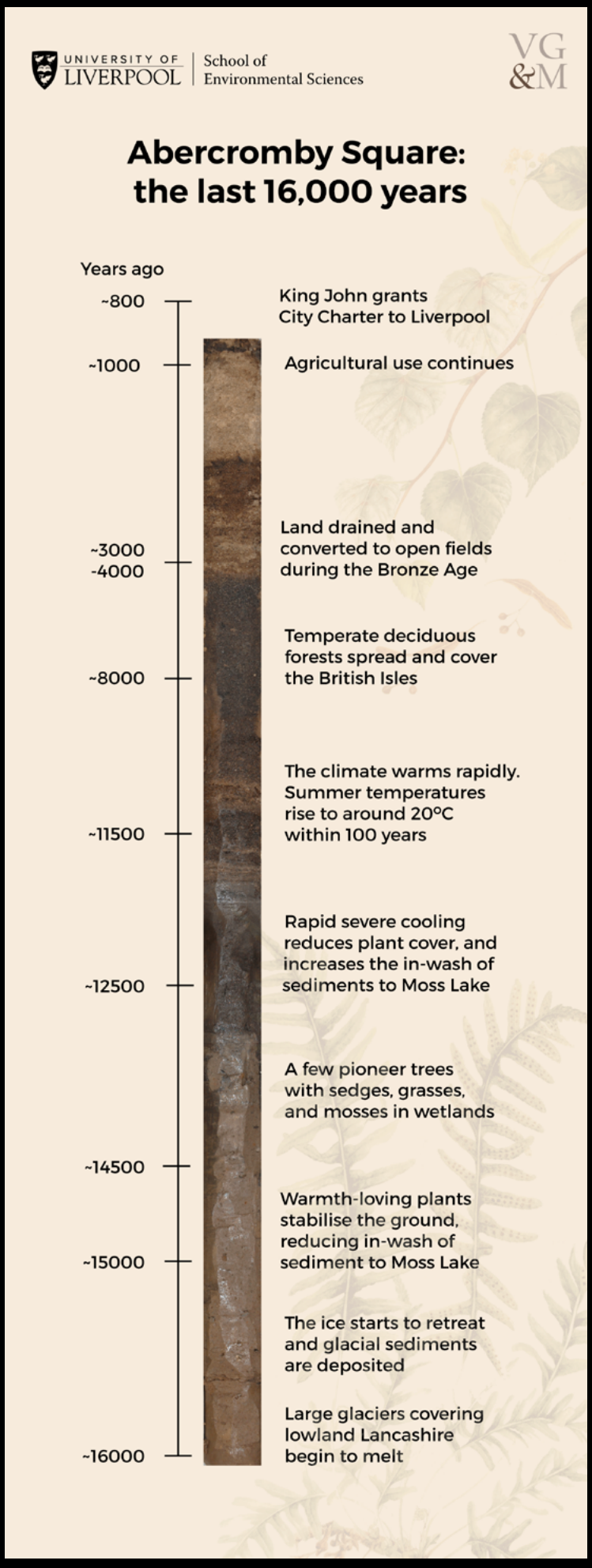
This activity was due to be part of the School's fantastic Earth Day event; these banners are too good (thanks to Suzanne Yee) to hide away, so we thought we'd share them with you all!

The intention was to make the activity as hands-on as possible; it was to be in the Mountford Hall and so would hopefully have seen a lot of traffic from school children and University of Liverpool students and staff.

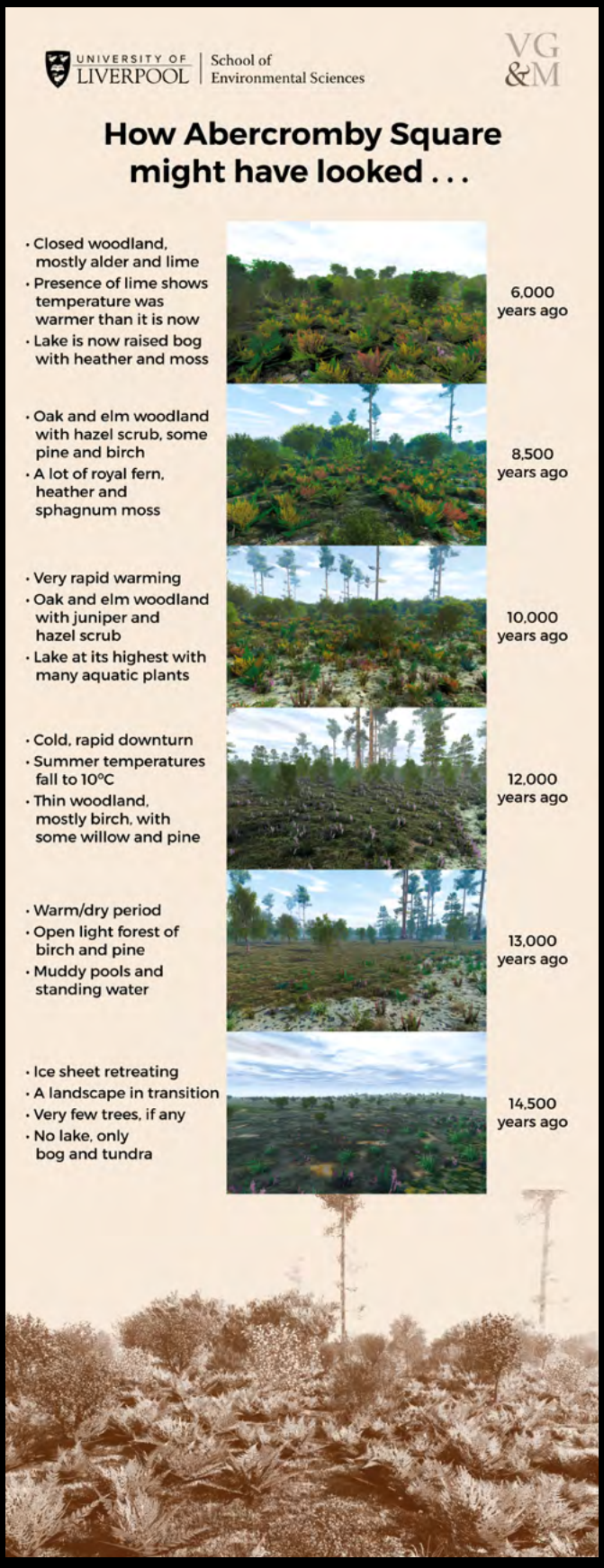
The plan was to display a sediment core for people to get up close and personal with (read: take sub-samples and explore the variations and what they could indicate); have an XRF gun (indicates pollution changes) and a couple of microscopes to look at pollen, diatoms and grain sizes. We were also hoping to have lots of leaves, seed pods and twigs so people (mainly focussing on the school children) could have identified differences in plant species and how these correlate with different environments. We had lots of posters lined up, and rolling slideshows filled with some great photos and videos of field and lab work.

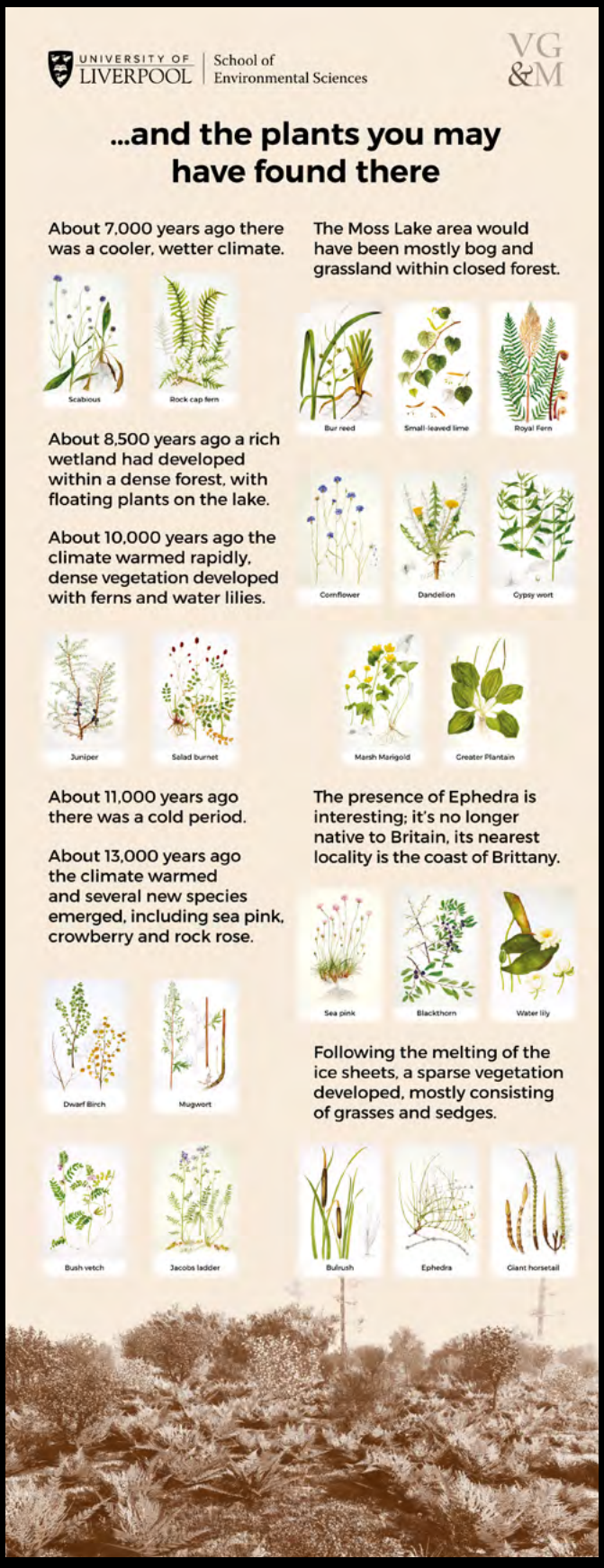
What brings this activity all together is the information we have on Abercromby Square. In 2008 Richard Chiverrell (and team) cored Abercromby Square; we have radiocarbon dates and a detailed pollen history.

We've been able to re-create these banners (from an original exhibit in the VG&M) to display all this great information. We also have some brilliant created images showing what the landscape may have looked like through history.



Hopefully visitors would have left the activity having had a great experience; they would know how we go about reconstructing past environments, why this is useful, and how it's important in the wider context of climate change. We're looking forward to being able to display this activity at an event in the future!





Builder aims to help UK construction industry kick its plastic habit

Maxwell's Arctic expedition. Photo: Neal Maxwell

Neal Maxwell wants trade to go from 50,000 tonnes of plastic waste each year to zero by 2040

A builder from Merseyside has launched a project that aims to remove plastic from the British construction industry within two decades. Neal Maxwell, who has worked in the trade for more than 30 years, co-founded the non-profit organisation Changing Streams after a trip to the Arctic.

Appalled by the levels of plastic pollutants in the Arctic Ocean and the often-lethal impact on animals in the polar region, Maxwell and researchers from the University of Liverpool have drawn up a programme that they say could make construction plastic-free by 2040.

The sector is the second largest producer of plastic waste in the UK, after packaging. It is estimated the building trade generates 50,000 tonnes of plastic waste each year. Along with the architect Dr Gareth Abrahams from the university's School of Environmental Science, Maxwell has drafted a charter that they hope could become legally binding.

The programme for the construction industry includes:

- the phasing out of paint containing plastic;
- the establishment of a "traffic light" guide to warn which paints contain plastic to dissuade DIY consumers from buying them;
- the creation of a template house made without plastic;
- the end of the use of plastic wrapping for building materials such as bricks and cladding.

Maxwell co-founded Changing Streams in 2018 after he and his wife toured the Arctic on a scientific exploration ship. He said: "On board were 20 scientific specialists from all around the world who helped us understand about the environment and the impact global warming and plastic pollution was having.

"We were told about the walruses while out in kayaks and learned about their feeding habits and plastic ingestion via clams when in the water. But the moment of truth for me came when we got back to England, when I went on our first food shop at the supermarket to stock up the kitchen again. When I saw row upon row of things covered in plastic it turned my stomach – I had to get out of the shop.

"When I got home I realised I had to do something about plastic pollution. And I could only do that in the industry I've worked in for over 30 years. That trip and that moment in the supermarket afterwards convinced me that I should try to make my industry plastic-free."

Maxwell said he was even more shocked when he discovered how much plastic was used in the construction business. He and Abrahams hope a "carrot and stick" approach can win over builders, many of whom fear replacing plastic will raise their costs.

"We will not only ask Government eventually to adopt this as legally binding regulations, but also petition large pension fund providers which finance construction to adopt the charter as well," Maxwell said.

Abrahams says the University of Liverpool aims to construct plastic-free accommodation on its campus, which is undergoing a multimillion-pound rebuild.

He said: "*One of our projects is to create the first ever plastic-neutral commercially viable house. We want to show the building industry this can be done. And through things like coding paint we can hopefully change consumer behaviour as well.*"

Maxwell says plastic became widely used in the late 1950s and 60s. "*What did we do before [it] was ubiquitous? Pre-plastic, we built houses, factories, offices and buildings without it. We don't have to reinvent the wheel here. There are alternatives we have used before and new ones we can invent.*

"We used to use asbestos throughout our industry before we knew the damage it was doing to our lungs. We know the damage plastic is doing to our planet and other species. Shouldn't we treat plastic as the new asbestos?"

This article was published in The Guardian, 30 Mar 2020.

Award success for Low Carbon Eco-Innovatory

The Low Carbon Eco-Innovatory (LCEI), the low-carbon business support programme, scooped the Environmental Impact Award at the 2020 Mersey Maritime Industry Awards.

The award was in recognition of the contribution LCEI research collaborations have made to driving forward the region's maritime economy. A previous LCEI PhD researcher, Cai Bird, also won an award taking home the Rising Star Award for his work with Marlan Maritime. The company has previously won awards for its work with LCEI and its previous incarnation as the Centre for Global Eco-Innovation.

LCEI is a £12m partnership between the University of Liverpool, Liverpool John Moores University and Lancaster University to assist local SMEs to develop new and improved low-carbon products and processes.

Now in its sixth year, the Mersey Maritime Industry Awards celebrates the achievements of Liverpool City Region's booming £4bn maritime sector.

The glittering awards ceremony, hosted by BBC *Breakfast* presenter Louise Minchin, attracted more than 500 guests into St George's Hall to hear inspiring speeches and see awards given out to 13 businesses and individuals from across the diverse maritime industry.

The LCEI has funded 45 low carbon PhD projects across a number of Schools at the University, while reducing carbon emissions by over 40,000 tonnes, increasing employment by over 300, helping to create over 150 new products and services and attracting over £4m of additional inward investment.

Borehole project - in lockdown

Maggie and Peter Williams

After CNR International had reviewed their holdings of geological samples, transfer of ownership of cores from 20/5B-3 and 211/8-1 (two boreholes in the North Sea) was arranged so that Maggie Williams became the proud(?) owner of geological samples from the two boreholes. The intention was to set up a project with schools teaching science A-levels to provide teaching resources that would encourage students in each school taking part in the project to systematically record information shown in their rock core, compare the information with the geophysical data provided - and then collaborate with students in other schools working on different sections of the core from the same borehole.

After a recent successful bid for HEIF funding to support a REF case study, this borehole project became part of a plan to develop resources for GeoHubLiverpool. Before lockdown, work started on the first phase of the project which was to trace the UK petroleum-related information such as well, geophysical, field and infra structure data from the National Data Repository (NDR).

The second phase of the project is to photograph the core. After the two sets of rock core were transported from the university to our home on the Wirral, work on this phase of the project is continuing by making creative use of our garage during the recent lockdown.

Phase three will be to sort out rock storage and transportation boxes to send the cores out on loan to schools. It looks like this will also have to be done during lockdown, but it will be worth it. Believe it or not, we already have a waiting list for delivery of the borehole project resources!

Rock core collection

Photographing the rock cores. PPE to cope with the rock dust!

STUNNING images win SoES student photo competition 2019-20


Reflections of Neves-Stausee

The School of Environmental Sciences has announced the winners of its annual student photographic competition which is now in its ninth year.

The competition, which is open to undergraduate and postgraduate students in the SoES, attracted a stunning array of entries across three categories: Culture, Fieldwork and Landscape.

Dr Charlotte Jeffery, Lecturer and Programme Director for Geology, Environmental Sciences, who chaired the judging panel, said: "We hold a photography competition in the School of Environmental Sciences every year, and every year we are amazed by the quality and creativity of the entries. My thanks go to all of the students who submitted their images and made judging this competition sucha difficult and enjoyable task."

Overall winner
Isabel Ashman, a 2nd year PhD student in the Deformation and Microstructures Research Group, scooped top prize of £100 for her photo in the **landscape category** *Reflections of Neves-Stausee*, a reservoir in the Mühlwaldertal in South Tyrol, Italy.

Fieldwork category winner
James Ross, a 3rd year Ocean Sciences BSc student, for his photo *Off to Sea* which was taken on the *RV Canalus* as they headed out to sample the Sound of Mull as part of the 2019 Ocean Sciences Sea Practical.

Culture category winner
Vlad Ionete, a 1st year PhD student in Data Analytics and Society Research Group, for his photo entitled *The Emotional City*, taken during the 2019 Champions League trophy winners Liverpool FC victory parade in Liverpool city centre on 2 June 2019.


Off to Sea


The Emotional City

You can view all of the entries to the competition here:
https://www.liverpool.ac.uk/environmental-sciences/photo-competition-2019-20/

Study Abroad Experiences:
Blog by Rebekah Clark, BA Geography

In the latter months of 2019, I embarked upon a semester abroad at the University of Tennessee, Knoxville (UTK) in the United States of America. I left Heathrow airport at 9am for an eight-hour flight to Chicago which was followed by a four-hour layover period before a two-hour flight to Knoxville. My roommate Agnes, who is from Hong Kong, booked the same connecting flight as me, so we were very lucky to meet in Chicago O'Hare airport. We arrived, tired but wide eyed, with luggage coming out of our ears at 9pm Knoxville time. We were met by some lovely volunteers from the International House at UTK, an organization run by the Study Abroad Team to facilitate social events for international students. Agnes and I were taken straight to our accommodation, a typical American dorm room with bunk beds.

I settled into Tennessee quite quickly as we were literally thrown into welcome and initiation events with the other international students, including a trip to the farmers market, slapping the rock (a UTK tradition for new students) and the first football game of the season. Classes started rather rapidly and assignments were not far behind. The academic system in America is very different to the one that we have in the UK. They have lots of assignments and weekly quizzes, alongside mid-term and end-of-term exams. This means that I was almost always in a coffee shop studying or completing an assignment. A key difference I noticed, however, was that American students almost never work in the evenings or at weekends. Even during exam periods, I could always find a space in the library in the evenings, which is something unheard of in Liverpool.

As well as the classes, I joined the swim club at UTK, and took part in the international events that were run by the international house. The people I met through the swim club were very welcoming; we went pumpkin picking together and they threw me and the other international swimmer, Lorenzo, a goodbye party the weekend before we left. Everyone that I met on my semester abroad was lovely; whether I was in a restaurant, talking to people in my accommodation or walking around the campus, people were very helpful and kind towards me. I took part in a programme where an international student is paired with an American student based on similar personality traits. I was paired with a graduate student called Becca, and we get along

My 20th Birthday, lunch at a Pizzeria.

The first football game of the season. UTK lost but we had fun!

famously. I am hoping to see her later in the year when she comes to the UK for a conference.

Sports is a key aspect of student life in Knoxville. The city itself does not have any national sports teams, meaning that people look to college sports as a pastime and a source of entertainment. UTK supporters are called the "Vols", which is short for volunteers, as Tennessee is the "Volunteer State". Being a Vol and supporting the Vols is synonymous to being part of a large family; once you are a member, you will always be attached. I can say this is true as I have been keeping up with the basketball and football games quite avidly since I've been back. Going to sports games and different Tennessee events was so pivotal to my time there, as this sort of pride in university is something that you don't really find in the UK, making it a really unique experience for me.

I got to travel a fair amount whilst I was on my semester abroad, mostly in Tennessee with two trips out of state. We went to Nashville and Memphis but also explored the area around Knoxville as the city is situated in the Smokey Mountain National Park, which is a very beautiful mountain range in the east of Tennessee. One of my favourite local trips with the international house was to Dollywood, which is a theme park that is owned by Dolly Parton and has a country, mountain theme. The rides were fun, but the food was exceptional. I was very lucky to be able to take a trip to Washington DC with a friend during my fall break where we got to see all of the key political sights such as the Capitol and the Washington Monument. As well as this, my family came to visit during my thanksgiving break and we spent the holiday with some close family friends in Charlotte, North Carolina. On this trip, we also got to go to the Biltmore Estate, which is the home of the Vanderbilt family, one of the wealthiest and most prominent American families.

Despite the overwhelming and scary nature of a semester abroad, I am so proud of myself and so glad that I decided to embark upon such an adventure. The memories of exploring a new place, meeting interesting new people from all over the world, and being able to experience a different culture is something that I would recommend to any student wishing to expand their horizons. Even though I was only in Tennessee for a semester, I feel such an attachment to Knoxville and UTK. There's a saying in the university that once you become a Vol, you will be a "Vol" for life, and that is something I know to be true.

The group of exchange students that I was part of- UK, Germany, Poland, Italy, Australia and Hong Kong.

The first snow in Tennessee. Smokey (the dog) is the mascot for UTK and there are several statues of him round campus.

Five "Quick Wins" To Enhance Your Employability From Home

Social distancing and the current lockdown situation are affecting us all differently. Many of us are pressed for time as we balance competing priorities or are feeling overwhelmed and lacking motivation as we try to adapt to new ways of working.

We've compiled a list of activities that individually can be undertaken in an hour or less and can be picked up at a time that works for you. Five "quick wins" to enhance your employability from home. Each step forward is an achievement, no matter how small it may seem.

1) Update your LinkedIn Profile

LinkedIn is the world's largest professional networking site with over two million companies using the platform to advertise opportunities and source talent. Use our LinkedIn profile checklist to ensure you are showcasing your skills, experience and achievements as well as possible. Connect with individuals and organisations of interest to keep up to date with their activity and be part of the discussion by adding comments and posting your own updates.

2) Connect with Employers Virtually

While meeting employers in person is not possible at the moment, there are a lot of opportunities to engage with them virtually. Check out our #VirtualConnect series for details of virtual office tours, live webinars and Q & As, online masterclasses and more. You can view current job opportunities in CareerHub as many employers are still recruiting. It's worth following individual employers' social media channels to stay updated.

3) Have a Chat!

Sometimes referred to as "informational interviews", speaking to people about their career history and current job can provide a valuable insight into what a role involves, specific organisations and sectors. Consider if any family, friends or colleagues may be able to help by simply sharing their experiences with you. You can also reach out to contacts via LinkedIn and connect with alumni who are keen to support you through the Liverpool Connect platform.

4) Online Courses and Challenges

Developing new skills is a great way to enhance your employability and one way of doing this is through online courses. There are lots of providers to choose from covering a range of courses from coding, Excel skills and learning a new language. You can work through these courses at your own pace. Take a look at OpenLearn, FutureLearn and LinkedIn Learning. We're also organising exciting online challenges for you to develop your creativity and problem-solving skills while tackling real-life issues. The Sustainability Challenge 2020 is open now with more to come!

5) Consider Volunteering

Volunteering allows you to give back to your community and make a positive contribution to society. It is also an opportunity to gain skills and experience valued highly by employers, to explore different areas of work and expand your network of contacts. Lots of opportunities can be undertaken remotely and flexibly and give you the option to indicate how much time you are able to give before searching for roles. Do-it.org, The Trussell Trust and NHS England may be good places to start looking for opportunities.

Lib Golding
Career Studio
careers@liverpool.ac.uk

Career support at Liverpool

At the heart of our careers support is the Career Stu-dio. This is a space led by students, for students, empowered by career experts. Whether you have your heart set on a particular career, or don't know where to start, our dedicated and highly trained Career Coaches are here to guide you. We are here to support students from every degree subject and year of study – from first year undergraduates to postgraduate researchers. The Career Studio is structured into three zones: Explore; Connect; Apply.

Explore

If you're not sure what you want to do, or have an idea but are not sure where to start, then we can help you develop your career plan. We'll look at your skills and experience and how they relate to your career ambitions. You can research different sectors and roles, find out more about studying and working abroad, and discover what employers are looking for in graduate recruits. You can also learn about the latest internship, placement and graduate vacancies.

Connect

You are encouraged to take part in a wide range of careers events, employer-led talks, careers fairs, and skills workshops through our CareerConnect programme. They offer a chance to meet leading employers, professionals and recent graduates to build your professional network, discover opportunities, and pick up practical advice that will help with all stages of the recruitment process.

Apply

We offer focused support to help you perform well during all stages of the recruitment process for internships, placements and graduate jobs. Take advantage of advice on CVs and applications, practise psychometric tests, face-to -face and video interviews, and learn what happens in assessment centre tests.

Being employable is about attitudes and skills, confidence and drive – it means being able to choose a career, apply effectively and be successful. As the world of work changes and organisations evolve, employers are increasingly searching for graduates not just with a specific degree but with the right blend of skills, knowledge and experience –graduates who can make a difference in any situation.

By making the most of the support available in the Career Studio and engaging with employability activities in the curriculum you will gain the skills and experiences while you are studying that will prepare you for life after graduation.

"A good degree from the University of Liverpool will open lots of doors, but employers are also looking for graduates who can demonstrate that they have the skills and experience needed in the 'real world'. There are lots of opportunities open to students from all degree subjects, so make the most of the support and opportunities available while at university."

Caitlin, Career Coach

SOES Health & Safety News

Home working

Wellbeing
The current home working situation we have found ourselves in can be challenging for a number of reasons, whether looking after children, having other caring responsibilities, anxiety, loneliness, separation from family and friends, space constraints and just generally being confined to the house.

There is a multitude of advice on how to improve your wellbeing and build resilience to stress to be found in the links as shown below; Several organisations have published articles about how to look after your mental health and wellbeing during the COVID-19 pandemic:

- Times Higher Education - How to manage your mental health when the world feels uncertain
- Advance HE - Inclusive responses for difficult times - mental health and wellbeing
- Wonkhe - Five ways to wellbeing when working from home
- Wonkhe - Keeping emotionally fit for the long term – starting now
- Mind - Coronavirus and your wellbeing
- Mental Health Foundation - How to look after your mental health during the Coronavirus outbreak
- Mental Health Foundation - Look after your mental health and wellbeing if you are staying home
- March Network has put together a resource page of social, cultural and community assets of home-based, creative ways to support mental health - Creative Isolation

The University's Wellbeing Hub offers 24/7 access to telephone/ online counselling and information services via the Employee Assistance Programme – EAP. https://www.liverpool.ac.uk/intranet/wellbeing/services/

DSE Display screen equipment
There are some simple steps you can take to reduce the risks from display screen work:

- breaking up long spells of DSE work with rest breaks (at least five minutes every hour) or changes in activity
- avoiding awkward, static postures by regularly changing position
- getting up and moving or doing stretching exercises
- avoiding eye fatigue by changing focus or blinking from time to time

An HSE guide to making your home workstation suitable can be found at: https://youtu.be/Af7q5j14muc. Cushions and towels can be used to support your back and raise your seat; books and boxes used to adjust the height of your monitor.

Full University guidance for DSE can be found at: https://www.liverpool.ac.uk/intranet/safety/guidance/display-screen-equipment/

General advice on working from home can be found at the following: https://www.liverpool.ac.uk/intranet/safety/coronavirus-covid-19/

Image: Ikon