Grand Challenge Agendas in Environmental Archaeology

Association for Environmental Archaeology Autumn Conference
Edinburgh 2017

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Abstract Book
Edited by Andrzej Romaniuk, Katharine Steinke, Roxanne Guildford, 2017

Dear Participants,

How do we approach today's great themes in international environmental archaeology? How will this feed into the next research agenda? What are environmental archaeology's grand challenges? 'Grand challenges for archaeology' have recently been proposed to focus the disciplines efforts and capabilities on the most important scientific challenges (Kintigh *et al*. 2014, *PNAS* 111, 879-80). Those identified focus on investigating the dynamics of complex socio-ecological systems, addressing key questions of emergence, complexity, demography, mobility, identity, resilience, and human-environment interactions. Environmental archaeology is ideally situated to contribute directly to these challenges, concerned, as it is, with the human ecology of the past – the relationship between past human populations and their physical, biological and socio-economic environments – through the analysis and interpretation of animal and plant remains within the depositional environment of the archaeological site and its surrounds. These approaches allow analysis of the dynamics of socio-ecological systems at varying spatial and temporal scales. Combined with the continued advancement of scientific methodological applications this is enabling increasingly powerful insights into human paleoecology, for example via analyses of palaeodiets, disease ecology, and past climatic change. Particular challenges lie in how to integrate data generated from diverse methodological approaches, and how to model and test cultural and ecological agency in the past, and how to tap the full potential that lies in increasingly large and disparate datasets being generated by the different practitioners of environmental archaeology. Public and fiscal responsibility also challenges environmental archaeological research to contribute to debates of relevance to the modern world, with its important potential insights on human-environment interactions, biodiversity, food security, and societal resilience.

Robin Bendrey

Grand Challenge Agendas in Environmental Archaeology
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Edinburgh 2017

Conference organisers:

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Programme

FRIDAY 1ST DECEMBER

Start time	
1330	**Optional conference visit:** Behind-the-scenes tour at the National Museums Collection Centre (https://www.nms.ac.uk/collections-research/research-facilities/national-museums-collection-centre/). An opportunity to see highlights from the archaeology and vertebrate zoology research collections in the care of the National Museums of Scotland.
From 1700	**Conference registration**
1800	**Keynote address:** **SOCIAL AND CLIMATE CHALLENGES FOR ENVIRONMENTAL ARCHAEOLOGY** Prof Marco Madella ICREA Research Professor in Environmental Archaeology; Complexity and Socio-Ecological Dynamics Research Group; Humanities – Universitat Pompeu Fabra, Barcelona
1900	**Wine reception and photographic exhibition viewing** Wine reception sponsored by *International Journal of Osteoarchaeology* http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1099-1212 Photographic Exhibition: ***St Kilda: The Last and Outmost Isle*** (Historic Environment Scotland)

SATURDAY 2ND DECEMBER

Start time 0900	Introduction to the conference
0910	**SESSION: HUMAN-ENVIRONMENT INTERACTIONS** **The chicken age? An environmental archaeological contribution to the Anthropocene debate** Richard Thomas, Carys E. Bennett, Mark Williams, Ian Zalasiewicz, Matt Edgeworth, Molly Miller, Ben Coles, and Alison Foster
0930	**People-plant relationships in Mesolithic-Neolithic Scotland** Rosie Bishop
0950	**The land below the Waves: maritime geoarchaeology and human-environment interactions in the southern North Sea basin** Alex Brown, Andy Bicket, Louise Tizzard, and Dave Norcott
1010	**Landscapes of Fire: The Impact of Controlled Burning Regimes on Vegetation in Neolithic Wadi Sana, Yemen** Abigail Buffington
1030	**Can inherent environmental differences explain patterns of landscape change after the Norse settlement of Iceland?** William Hiles, Ian T. Lawson, Richard T. Streeter, and Katharine H. Roucoux

1050-1130	Coffee break and poster session
1130	**SESSION: LANDSCAPE AND SUSTAINABILITY** **Is the development of farmed landscapes in the late Holocene a case of econiche replacement and ecosystems engineering?** David Smith, Geoff Hill, and Harry Kenward
1150	**Wooded or not wooded; that is the question. Downlands and beyond and its relevance to human societies** Michael J. Allen
1210	**Stepping into the Same River Twice: Water and Sustainability in Roman Ostia** Mark A. Locicero
1230	**Sustainable energy and construction: Examples from the Zagros and Anatolia *c*. 10,000-6,000 BCE** Wendy Matthews
1250-1350	Lunch
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1410	**Animal domestication and zoonotic disease: modelling brucellosis transmission in Neolithic goat populations** Robin Bendrey, Guillaume Fournie, and Dirk U. Pfeiffer
1430	**Fossilised environments above the ground – an interdisciplinary approach to the ecology of medieval castle construction** Mark Thacker
1450	**Optimizing zooarchaeological research on cetaceans** Youri van den Hurk
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1540	**SESSION: COLONISATION, MOBILITY AND ENVIRONMENT** **Ancient Invasive Species: Insights, Collaboration, and Policy** Catherine F. West and Courtney A. Hofman
1600	**Accidental travellers, uninvited guests - Fossil insects, farming and ecological imperialism** Eva Panagiotakopulu and Paul Buckland
1620	**Thriving in the unexpected: permanent life on an open salt marsh** M. Schepers
1640	**The Easter E.g. - Changing Perceptions of Cultural and Biological "Aliens"** Tom Fowler, Joel Alves, Carly Ameen, Greger Larson, Luke John Murphy, Philip Shaw, and Naomi Sykes
1500	**Searching for Migrants: a multi-proxy approach** Laura Bonsall, Catriona Pickard, Jane Evans, Andrei Soficaru, Alan Dalton, Gordon Cook, Ülle Aguraiuja, Clive Bonsall
1720	END

1730-1830 **Association for Environmental Archaeology AGM**

1930 **Conference Dinner**
"Spoon", 6a Nicolson Street, Edinburgh, EH8 9DH. https://spoonedinburgh.co.uk/

SUNDAY 3RD DECEMBER

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0920	**Beyond the Braidwoods: Grand Challenges in the Environmental Archaeology of Iraq - Past, Present, and Future** Elizabeth Farebrother, Charlene Murphy, Ulrike Sommer, Hanna Sosnowska, Chris Stevens, and Dorian Q. Fuller
0940	**Answers to questions. The New National Archaeological Research Agenda of the Netherlands** Inge M.M. van der Jagt
1000	**Heritage Science and Historic Environment Scotland** Lisa Brown
1020	**Archaeological Palaeoenvironmental Archives: The Challenges and Opportunities Ahead** Paul Flintoft
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1120	**SESSION: CLIMATE CHANGE AND ADAPTATION** **Meeting the grand challenge of climate change through a new social contract for archaeology** Rowan Jackson, Andrew Dugmore, and Felix Riede
1140	**Coasting along?: climate change, coastal erosion and environmental archaeology - challenges and opportunities** Ingrid Mainland, Jane Downes, and Alison Keir
1200	**Rice, rain, and lack-of: How rice agriculture crossed environmental zones in India and lessons for a changing climate** Eleanor Kingwell-Banham
1220	**Climatic Variability and Resilience: Lessons from the past in north-central Nigeria** Emuobosa Akpo Orijemie
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1400	**Cultural Choice or Climatic Determinism? Understanding the Spread of Agriculture in the Western Balkans** Anne Sommières
1420	**Conviviality and Landscape** Michael Given
1440	**Integrated approaches to investigating early farming systems: microarchaeology of livestock dung** Marta Portillo
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1540	**SESSION: APPROACHES IN PALAEOENVIRONMENT STUDIES**

	From micromammals to paleoenvironments: an actualistic model Orr Comay and Tamar Dayan
1600	**Changing distribution of the Mastic tree (*Pistacia lentiscus*) in Western Iberia. Inferences from archaeobotanical finds** Leonardo Gondim Carvalho da Fonte, and Pedro Beja, and João Pedro Tereso
1620	**Counting Sheep: coprophilous fungal spores as a proxy for herbivore abundance** Althea L. Davies
1640	**Stable C and N isotopes in crops from Neolithic and Bronze Age Poland: sample accessibility and agriculture development at the edge of the world** Aldona Mueller-Bieniek, Maria Lityńska-Zając, Marek Nowak, and Joanna Pyzel
1700	END

ORAL PRESENTATIONS

Wooded or not wooded; that is the question. Downlands and beyond and its relevance to human societies

Michael J. Allen[1,2]

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The chalk downland of southern England – wooded or not wooded? That was a question being strongly addressed by the environmental research of John Evans over 50 years ago. The lack of evidence for woodland on the chalk landscape was largely one of the lack of pollen evidence comparable to that from many other areas of NW Europe. Land snails, however, did survive. Armed with this technique, and the premise that the downlands were not unique and were clothed in post glacial woodland, seminal Evans' work demonstrated woodland on the chalklands.

This paper addresses two themes: re-exanimating the nature of the lowland woodland and its implication to early prehistoric societies, and then examining a more fundamental issue of what do we mean by 'woodland'. Ecologists at the Vera meeting in the summer of 2017 at the Knepp Estate showed, their terminology in relation to wooded places was poor (King forthcoming) - and archaeologists' is worse. How we conceive tree-ed places is poor, and the multitude of different types of woodlands are fundamentally very different landscapes with different with very different human and animal interactions – and provide contrasting opportunities and resources and would have been used and exploited very differently. A label of 'woodland' is not adequate – there are many, varied tree-ed landscapes.

King, M. forthcoming. The Vera thesis 20 years on: the case for creating new wood pastures. British Wildlife.

Animal domestication and zoonotic disease: modelling brucellosis transmission in Neolithic goat populations

Robin Bendrey[1], Guillaume Fournié[2], Dirk U. Pfeiffer[2,3]

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Human and animal health are inextricably linked. Zoonotic diseases represent some of the greatest health challenges facing the world, with some 60% of human pathogens of zoonotic origin. Zoonoses are frequently hypothesized as emerging with farming, but evidence of this is elusive in the archaeological records. To explore the potential impact of animal domestication on zoonotic disease dynamics and human infection risk, we developed a model simulating the transmission of *Brucella melitensis* within early domestic goat populations. The model was informed by archaeological data describing goat populations in Neolithic settlements in the Fertile Crescent, and used to assess the potential of these populations to sustain the circulation of *Brucella*. Results show that the pathogen could have been sustained even at low levels of transmission within these populations due to the creation of dense populations and major changes in herd demography. Interactions between Neolithic settlements would have further promoted pathogen maintenance. Results further highlight the relevance of the study of the past to current global challenges. For what is the most common bacterial zoonosis in the world, the study provides new data on the impact of host population size and age structure on the likelihood of pathogen persistence in a major domestic animal reservoir and also the very small critical community size estimates are of great relevance for veterinary epidemiology and public health.

People-plant relationships in Mesolithic-Neolithic Scotland

Rosie Bishop[1]

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The nature of human–environment interactions in hunter-gatherer and early farming communities before and during the transition to agriculture is a major international inter-disciplinary research focus, and is a theme which has been identified as a key future challenge for archaeology (Kintigh et al 2014). The breakdown of the traditional rigid distinction between ‘hunter-gatherers’ and ‘farmers’ has led to increased interest into the different types of human-plant relationships that existed in hunter-gatherer and early farming societies during the Mesolithic-Neolithic transition. It has been claimed that Mesolithic hunter-gatherers may have actively managed 'wild' plants like domestic crops and that not all Neolithic farmers carried out large-scale cultivation. The 'transition' may therefore have been a continuum and its nature remains a matter of considerable contention. In the last decade, new synthesises of Mesolithic and Neolithic archaeobotanical data in Scotland have highlighted the large number of sites where archaeobotanical remains have been recovered and the potential of this data for investigating past plant use in the region. This paper will consider the challenges in integrating this data to understand human-environment interactions, and will discuss new experimental archaeology results which seek to provide novel insights into plant exploitation during this key period of change.

Searching for Migrants: a multi-proxy approach

Laura Bonsall[1], Catriona Pickard[1], Jane Evans[2], Andrei Soficaru[3], Alan Dalton[1], Gordon Cook[4], Ülle Aguraiuja[1], Clive Bonsall[1]

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[2] NERC Isotope Geosciences Laboratory, Nicker Hill, Keyworth, Nottingham, NG12 5GG
[3] Francis J. Rainer Institute of Anthropology, Romanian Academy, Eroii Sanitari nr. 8, sect. 5, Bucharest, 050474, Romania
[4] Scottish Universities Environmental Research Centre, Rankine Avenue, East Kilbride South Lanarkshire G75 OQF

From the 4th century AD, the Late Roman-Early Byzantine frontier province of Scythia Minor, on the Lower Danube, suffered repeated 'barbarian' attacks, culminating in the economic collapse and abandonment of the province in the 7th century. Hitherto, historians and archaeologists have focused on the military, political and economic ramifications of these events through the study of settlements and artefact distributions. This paper looks at population movements through the vehicle of stable isotope analysis of skeletal populations. We report the results of a pilot study in which stable C, N, S, O and Sr isotope ratios are used as diet pattern biomarkers.

The land below the waves: maritime geoarchaeology and human-environment interactions in the southern North Sea basin.

Alex Brown[1,2], Andy Bicket[1,3], Louise Tizzard[1], Dave Norcott[1]

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[2] Department of Archaeology, School of Archaeology, Geography and Environmental
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Recent decades have witnessed a renewed interest in the archaeology of submerged palaeolandscapes, in part stimulated by the large increase in commercial offshore developments. The palaeogeographic datasets produced during marine geoarchaeological surveys represent valuable archives for investigating the mechanisms of past landscape and environmental change, which radically altered the geography of the North Sea basin and the land available for human occupation. In this paper, we consider the contribution of maritime geoarchaeology to questions of human-environment interactions, using data from sites across the southern North Sea. In particular, we consider how large-scale palaeogeographic datasets and site-specific palaeoenvironmental studies are essential to investigate landscape change at the multiscalar level necessary for considering the intricacies of human-environment relationships.

Sea-level rise was a major driver in landscape change, but how did human communities perceive and respond to its impact on cultural landscape, if at all? What is the evidence for the impact of both gradual and rapid processes of environmental change? How can we more seamlessly integrate data from both offshore, intertidal and onshore sites, and what lessons does it teach modern societies faced with the likely impact of projected future sea-level climate change and environmental degradation?

Heritage Science and Historic Environment Scotland

Lisa Brown[1]

[1] Archaeology & World Heritage Team, Heritage Directorate, Historic Environment Scotland, Àrainneachd Eachdraidheil Alba, Longmore House, Salisbury Place, Edinburgh EH9 1SH

Historic Environment Scotland (HES) is active in heritage science, from the stimulation and funding of research, through to participating in practical application of archaeological, conservation and environmental analyses, including partnerships all over the world. This paper will present some of the ways in which HES is connecting with, and prioritising, archaeological and environmental science.

Scotland's Archaeology Strategy is a ten year strategy for the archaeology sector, which is helping to guide the way that Scottish archaeology is delivered, understood, cared for and celebrated. Archaeological science is a key part of aim 5 of the Strategy, innovation and skills, the delivery of which is being led by the Chartered Institute for Archaeologists, with support from HES and other organisations. The Archaeology Strategy is one of the ways in which projects are prioritised for funding through HES's Archaeology Programme grant stream; projects have included the Scottish Archaeological Research Framework, which had a panel looking specifically at scientific research in Scotland, assessing the current state of research, identifying gaps, and making recommendations for future work. Recommendations from this panel have led to the Programme funding a variety of projects, from training events through to archaeological science PhDs.

This presentation will also discuss how HES is engaging with some of the global environmental challenges, such as climate change, through the development of a climate change risk assessment for cultural heritage sites in Scotland.

Landscapes of Fire: The Impact of Controlled Burning Regimes on Vegetation in Neolithic Wadi Sana, Yemen

Abigail Buffington[1]

[1] PhD in Anthropology, The Ohio State University, 76 W. 8th Ave. Apt A3, Columbus OH 43201

Pastoral landscapes are constructed savannah rangelands maintained by humans and their animals. These anthropogenic environs are created both by explicit behaviors aimed at augmentation or reduction of vegetative, hydrological and sedimentary resources, and by the feedback effect of grazing and waste disposal practices. One of the most common practices of landscape modification is controlled burning. Small fires are set at intervals to extend grasses (favored by livestock), increase productivity of fire-induced woodland taxa and reduce often noxious shrubs. Remains of such burning episodes have been identified in Early-Middle Holocene silt accumulation along the Wadi Sana in southeastern Yemen. Within these sediments, and those that do not reflect burning episodes, archives of microfossils of plant material (opal silica phytoliths) remain. In this paper, I tested how well a phytolith assemblage could correlate to controlled burning episodes. If these assemblages are statistically significant in distinction from those of other horizons absent burning activities, then the resulting phytoliths would be indicative of the practitioners of these fire regimes' desired and undesired vegetative landscapes. As these sediments are temporally associated with locally developed pastoralist economies, positive comparison between these ecologies and those of modern herders inhabiting arid and semi-arid climates would suggest a continuity of practice and the sustainability of development.

From micromammals to paleoenvironments: an actualistic model

Orr Comay[1], Tamar Dayan[1]

[1] Department of Zoology and the Steinhardt Museum of Natural History, Tel Aviv University, P.O. Box 39040, Tel Aviv 6997801

Although micromammals are often used in paleoecological reconstructions, methodologies differ greatly. Many scholars dismiss relative abundance data despite their potential inferential value. Often, little empirical evidence from recent ecology is presented to support the methodology, and taphonomic issues introduce a bias that is rarely addressed. Here we present a study of Mediterranean Levantine micromammals demonstrating their use in paleoecology. Analyzing thousands of barn owl (*Tyto alba*) prey, we used advanced statistical methods to identify the dominant environmental variable suitable for reconstruction and to specify how species relative abundances vary with the environment. We validated our model using historical maps and barn owl prey data. Moreover, we tested the repercussions of misidentifying the owl species in archaeological assemblages by applying our model to recent assemblages collected by other owl species. We found that vegetation structure has the strongest effect on micromammal assemblages in the Mediterranean Levant. Our model differentiated forested environments from garrigue or grassland dominated ones. However, urban environments were not well distinguished from others, and misidentifying the owl species severely compromised model performance. Our results stress the potential insights deducible from micromammal assemblage, given their reliance on empirically tested relationships between fauna, environment and taphonomic agent (predator).

Counting sheep: coprophilous fungal spores as a proxy for herbivore abundance

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Human interactions with the environment have often occurred via animals, particularly amongst upland farming communities. Pollen analysis remains the most widely used palaeoecological proxy for pastoral activity. However, in upland environments pollen may be relatively insensitive to grazing because the mineral soils required by most palynological 'grazing indicators' are scarce where peat- and moorlands form the dominant land cover. Coprophilous fungal spores (CFS) have emerged as a powerful independent proxy for assessing changes in herbivore abundance, but this method has yet to be tested in upland ecosystems. I will present findings from an ongoing study using experimental grazing plots and historical agricultural census records to test the comparative sensitivity of CFS and pollen to changes in stocking patterns at a range of UK upland sites. The relationships between CFS, pollen and stocking data are often complex. Potential reasons include grazing impacts on flowering and 'background' CFS production from small herbivore activity (e.g. grouse). Replication is proving essential to identify thresholds above which we can confidently infer large herbivore activity. The findings are relevant for understanding the 'ecosystem engineering' effects of large herbivores in past socio-ecological systems and strengthening the connections between palaeoecology, and historical and neo-ecological records.

Beyond the Braidwoods: Grand Challenges in the Environmental Archaeology of Iraq – Past, Present and Future

Elizabeth Farebrother[1], Charlene Murphy[1], Ulrike Sommer[1], Hanna Sosnowska[1], Chris Stevens[1], Dorian Q Fuller[1]

[1] Institute of Archaeology, University College London, 31-34 Gordon Square, London WC1H 0PY

With geopolitical uncertainty resurfacing in the Kurdistan Region of Iraq, it is timely to reflect upon the potential of the deep-time perspective that environmental archaeology uniquely offers. This paper provides a retrospective view from the UCL Jarmo Project, which resumed excavation at the site in 2012. Integrating recent research with that of the past original team from the University of Chicago, we reappraise the pivotal legacy left by Robert and Linda Braidwood on Environmental Archaeology in the Near East. Today with the increasing instability in the region and the difficulties of obtaining new archaeological material it is now more important than ever to re-analyse environmental archival collections and materials from the Braidwoods' previous excavations. Jarmo, once again, offers innovative opportunities and challenges on how we can marry multiple datasets generated across different methodological/generational approaches in the various sub-disciplines of Environmental Archaeology. By combining interdisciplinary archaeological research and excavation results, we will once again situate Jarmo not only within the larger narrative framework of the Neolithic but also explore how to tap into the full potential of a large, complex and potentially disparate datasets scattered across time and space to unite an interdisciplinary and still relevant record of early Environmental Archaeology.

Archaeological Palaeoenvironmental Archives: The Challenges and Opportunities Ahead.

Paul Flintoft[1]

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Archaeological palaeoenvironmental archives are something of an enigma to our friends and colleagues in museum services. Not quite artefact, often not quite ecofact and all requiring some degree of specialist consultancy on their stabilisation and curation, curators' reticence to accept and appropriately manage such troubling materials is understandable. Unfortunately, as a consequence, the way in which soft biological materials have been sub-sampled for archive, stored and curated has left a somewhat puzzling legacy. We often find ourselves struggling to identify where environmental residues are located, discovering them in various states of condition and, more often than not, come up against obstacles when trying to access them to conduct destructive analysis. In addition to these challenges, contractors and researchers outside of our niche still fail to understand the value which environmental remains can have for future research. As part of collaborative doctoral research, I intend to ask searching questions of the critical aspects of England's curation practices in an attempt to make access to archives more usable and to guide future policy with regards to collection, archive submission and curation of palaeoenvironmental remains.

Changing distribution of the Mastic tree (*Pistacia lentiscus*) in Western Iberia. Inferences from archaeobotanical finds.

Leonardo Gondim Carvalho da Fonte[1,2], Pedro Beja[1,2], João Pedro Tereso[1,2,3]

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Environmental archaeology can reveal long term changes in species distributions, helping to understand the interplay of ecological and human factors driving range shifts. Here we investigate changes in the distribution of the mastic tree *Pistacia lentiscus* in western Iberia, and explore the role that changes in climate, environment and society could have played in shaping its present distribution. In the first half of the 2010s, archaeological interventions in the Sabor valley (Northwest Iberia) unearthed preserved fragments of *P. lentiscus* in several distinct sites, whose chronology ranged from the Iron Age to late modernity. Detailed analysis of these fragments clearly excluded the possibility of misidentification with *Pistacia terebinthus*, which is common locally and elsewhere in the northern Iberian Peninsula. This finding was surprising because *P. lentiscus* is currently absent from the region, though it is common in the southern half of Iberia, with populations edging north along the Catalonian coast and up along the Ebro valley. Noteworthy, in the region there is a single, old tree, which has become the focus of local folklore, with inhabitants attributing its evergreen habit to the supernatural. Overall, results suggest a regional extinction of a *P. lentiscus* population, requiring further research to understand its causes.

The Easter E.g. - Changing Perceptions of Cultural and Biological "Aliens".

Tom Fowler[1], Joel Alves[2], Carly Ameen[3], Greger Larson[4], Luke John Murphy[5], Philip Shaw[6], Naomi Sykes[1]

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Human immigration and biological invasions are high-profile topics in modern politics, but neither are modern phenomena. Migrations of people, animals and ideas were widespread in antiquity and are frequently incorporated into expressions of cultural identity. However, the more recent the migration, the more negative attitudes are towards them. Generally, native is positive and 'natural', whereas the term 'alien' is attached negatively to cultural and environmental problems. These perceptions often translate into societal attitudes and policy making, especially those relating to biodiversity, even though they may be erroneous. This paper will explore the validity of such judgements through the example of Easter, the most important event in the Christian calendar.

The Easter festival and its animals - the brown hare, rabbit and chicken - are all 'alien' to most areas where Easter is celebrated. This paper focusses on the integration of scientific approaches (genetics, GMM and isotopes) with evidence from traditional (zoo)archaeology, art history, and historical linguistics to investigate the human-mediated dispersal of the brown hare and rabbit in connection with the Easter cult. It will argue that the cultural and temporal context of these introductions are key factors for understanding the origins of Easter and challenging negative attitudes towards cultural and biological 'aliens'.

Conviviality and landscape

Michael Given[1]

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Conviviality is a means of engaging with and evaluating the mutual interdependencies, symbioses and tensions of all players in the landscape, nonhumans and humans alike. As a theoretical and practical tool, it challenges anthropocentric and reductionist models which undermine the richness, diversity and complexity of this interaction. Human decision-making can push hitherto convivial and resilient landscapes over a tipping point into a new state where interdependencies and symbioses are broken down, and the diversity of the players and the interactions between them are radically, sometimes catastrophically, reduced.

The industrial sugar plantations and refineries of Medieval Cyprus were inherently unconvivial: by their very structure, they were chronically short of fuel, water and labour. By contrast, the Roman copper industry in Cyprus retained sufficient conviviality within its supply systems of both food and fuel that the otherwise oppressive and destructive industry was sustained over several hundred years. Ironically, to protect what they constructed as ‘nature’, the British colonial authorities separated nature from culture through a network of forest boundaries, thereby breaking the convivial links between people and their landscape. The same alienation can be seen today on a global scale, which makes the need for a convivial approach all the more pressing.

Can inherent environmental differences explain patterns of landscape change after the Norse settlement of Iceland?

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Understanding human-environment interactions in palaeoenvironmental research is complicated by the multiple anthropogenic and natural forcing mechanisms that can drive landscape change. Many drivers exhibit spatial variations across environmental gradients, although comparisons between sites can be complicated by chronological uncertainties. Iceland was settled in the 9th Century AD, and this date is constrained by a robust tephrochronology in sedimentological archives. This presents an opportunity to generate reliable comparisons between sites based on isochrones. The settlement period is characterised by a climatic transition from the Medieval Warm Period to the Little Ice Age, a climatic shift that introduced new environmental challenges and potentially led to ecological thresholds being crossed, particularly in marginal areas. This paper will present new multiproxy data from two sites in the Mývatnssveit region, northeast Iceland. Sandvatn, a 230 ha upland lake, will be compared with Hoskuldsstaðir, a 12 ha lowland lake, to test the hypothesis that inherent environmental differences have affected the responses of environments to human activity in Iceland. Pollen, sedimentological and geochemical data will be presented to assess landscape-scale system responses and identify potential drivers of change. Understanding the relative contributions of different forcing mechanisms is essential for a better understanding of Iceland's post-settlement environmental change.

Optimizing zooarchaeological research on cetaceans

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One of the grand challenges within the field of zooarchaeology is identifying cetacean fragments to the species level. Cetacean remains are often only identified as “cetacean”, “whale” or even “marine mammal”, without any other details provided. This can partly be ascribed to the fact that their remains are often extremely fragmented and the lack of high-quality osteological reference collections. These factors render identification to the species level problematic, resulting in a poor understanding of human-cetacean interaction in the past.

In order to fully understand human-cetacean interaction to the species level, an osteological cetacean reference manual has to be created. Osteological manuals are an invaluable source to zooarchaeologists to help identify zooarchaeological remains to the species level, however one for cetaceans does not exist. As part of my research I am attempting to create an extensive manual at the Natural History Museum, Smithsonian, Washington DC and this will hopefully optimize research on zooarchaeological (and palaeontological) research on cetaceans and will lead us to reconstruct the early beginnings of cetacean exploitation.

Meeting the grand challenge of climate change through a new social contract for archaeology

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This paper will present a practical framework for archaeology's increased role in and engagement with the grand challenge of climate change in the form of global change research (GCR). We address this engagement in terms of research design, publication and dissemination strategies. We outline in detail an explicit strategic framework consisting of: (i) transdisciplinary engagement with natural sciences, social science and humanities to design projects engaged with GCR themes and contribute to aims of disseminating impacts of climate change to civil society; (ii) synthesising research to highlight long-term human adaptation to climate change, for publication in high-impact interdisciplinary journals that are cited in mainstream GCR literatures and reports with the aim of increasing visibility to the IPCC and policy-makers; and (iii) encouraging museums to disseminate this research to the public by outlining the impacts of climate change and environmental hazards in the past through novel multi-media engagement with deep-time human-environment interactions. This framework collectively forms the basis for a new *social contract* in archaeology to become more engaged with contemporary global change research and highlight the relevance of understanding the past to inform possibilistic scenarios and processes underlying human vulnerability, adaptation and cultural transformation toward sustainability.

Answers to questions. The new National Archaeological Research Agenda of the Netherlands

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Research requires focus. Most archaeologists would agree. More than ten years after publication of the first edition, the new version of the Dutch National Archaeological Research Agenda (NOaA 2.0) was launched in April 2016. The National Archaeological Research Agenda 2.0, like its predecessor, is a joint product of the entire archaeological community in the Netherlands, and is designed to feed and guide development-led archaeology, providing topical and relevant research questions. In this paper I'll explore the background to and creation of this updated, user-friendly digital edition of the Dutch National Archaeological Research Agenda and the way we incorporated bioarchaeological research. The NOaA 2.0 centers on 117 specific research questions that highlight the most pressing issues of the day. Only archaeological (cultural heritage) questions have been included. Specialisms relevant to archaeology play an instrumental role, and thus relate largely to the operationalisation of the cultural heritage research questions. The idea is that this will firmly associate such input with good-quality archaeological fieldwork, making it less easy to omit it for budgetary or other reasons.

Rice, rain and lack-of: How rice agriculture crossed environmental zones in India and lessons for a changing climate.

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Agricultural systems in India are heavily influenced by the monsoons which bring the majority of annual rainfall in just a few short months. Prolonged rains fall heavily in some areas, creating a tropical ecology, and very lightly in others, resulting in arid environments. Nevertheless, today rice agriculture is common across the whole of the subcontinent and can be found in nearly every environmental zone.

This paper presents some of the results from the 'Comparative Pathways to Agriculture' and the 'Early Rice' projects which have begun to address four major questions using archaeobotanical data: when and how did rice begin to be cultivated in areas outside of its natural environmental zone; how and when did people alter arid environments to allow for rice agriculture; how did this tie in to the development of urban polities in India; and how can this inform future agricultural challenges in a changing environment?

Stepping into the Same River Twice: Water and Sustainability in Roman Ostia

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Water is increasingly used as a lens to explore new challenges of our urbanizing world. Although issues of sustainable water usage appear to be a uniquely modern problem, similar issues affected ancient civilizations. Aqueducts and massive bath buildings are often viewed as the only scale of Roman hydraulic technology. On a much smaller scale, many Roman cities adapted to local hydraulic situations, dynamically reacting to changing patterns of water usage and availability. The city of Ostia existed as one of the harbour cities of ancient Rome, connecting it with the wider Mediterranean world. Aspects of Ostia's water system have been well-researched, but often in isolation. This paper presents the *Roman Water Footprint* method, developed to quantitatively integrate hydraulic systems with environmental and social data. Based on leading models of sustainable resource usage, this method provides a more contextualized interpretation of Roman water systems, highlighting their diversity, complexity, and resilience over centuries. Initial results indicate that viewing ancient water usage as "sustainable" may not be anachronistic, and reinforces the potential for placing modern and ancient water usage in dialogue with each other. This dialogue offers a historical account of solutions and possible pitfalls for developing the complex yet flexible water solutions needed in future cities.

Coasting along?: climate change, coastal erosion and environmental archaeology - challenges and opportunities

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This paper take as its 'Grand Challenge' climate change. It is now widely accepted that anthropogenically-driven climatic change on a global scale is a reality and that we are facing unprecedented climatic shifts and consequent environmental impacts during the coming centuries. There is increasing recognition that archaeologists can, and should, contribute to wider political and social agendas on climate change and in particular have a significant role to play both in promoting an understanding of human response to climatic and environmental change and as a vehicle for education for sustainability (EfS). In this presentation we will use coastal erosion of heritage (both cultural and natural) to explore how environmental archaeology can contribute in raising awareness of climate change, and whether research to date is leading to behavioural change. While environmental archaeology (and archaeology) in general has great potential in this area, we will argue that to make a positive contribution to wider agendas and policies on climate change there is a need to develop mechanisms which evaluate the contribution we make in effecting climate change literacy within diverse audiences - from policy makers to the general public and our students. Case studies will draw on ongoing research in Scotland and Oceania.

Sustainable energy and construction: Examples from the Zagros and Anatolia *c.* 10,000-6,000 BCE

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The aim in this paper is to evaluate ways in which theoretically-informed interdisciplinary environmental archaeology can contribute to investigation of sustainable energy sources and construction. It is widely accepted that burning fossil fuels has increased CO_2 emissions and poses a major threat to health today. Less well recognised is the impact that concrete construction has on energy consumption and health and the built environment globally. This paper explores ways in which studies of past energy sources and construction of earthen architecture can provide examples of potentially sustainable and healthy options in the present and future, as the demand for sustainable energy and housing is a major global challenge. As a case-study, this paper examines theories and approaches in investigation of the inter-relationships between environment, socio-economic strategies, technology, cultural practices, and selection of energy and construction materials. Theories and approaches are drawn from ecology, anthropology, archaeology and studies of the built environment. The analytical techniques reviewed and applied include micromorphology, biomolecular analyses by GC-MS and FTIR. The data-sets examined are from early sedentary agricultural communities in one of several genetically-identified cores in the spread of early farming populations, the Zagros in Iraq and Iran, and in Anatolia *c.* 10,000-6,000 BCE.

Stable C and N isotopes in crops from Neolithic and Bronze Age Poland - sample accessibility and agriculture development at the edge of the world

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Plant macroremains are an important source of data for both archaeobotanical and geophysical studies, from radiocarbon dating and isotope analysis to reconstruction of paleodiet. Despite the possible interregional importance of such data, analysis and comparison is hindered by the lack of modern comparative studies as well as selective depositional processes. The territory of Poland lays on a border between oceanic and continental climatic zones, a situation which brings a unique possibility for studying human-environment interaction in densely forested area in the Neolithic period and with substantial potential for modelling landscape changes caused by agriculture in temperature Europe. In the stable N isotopic studies from Neolithic and Bronze Age Poland we were able to collect less than 70 samples from 12 microregions (18 archaeological sites). Charred, well preserved crop grains are scarce in the early Neolithic sites, which are rarely properly sampled or sieved, and are mainly found in storage pits on sites corresponding to agricultural societies giving yearly crop surpluses. Extensively sampled sites, such as LBK site Ludwinowo 7 (Central Poland), does not provide any reliable samples, suggesting societies not fully reliant on agriculture instead. As the northern territories were covered by ice during the last glaciation, whereas the south belonged to the loess belt with fertile soils, the fragmentary isotopic data from Poland suggests patterning reflecting the impact of geographical area rather than archaeological period.

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Linking International and Interdisciplinary Data to Enable Data-Intensive Research on Long-Term Human Ecodynamics in the North Atlantic: The DataARC Project

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The DataArc Project brings together information from the social sciences, natural sciences, and humanities in a data exploration tool explicitly designed for interdisciplinary research. The aim is to facilitate and encourage research on long-term human ecodynamics in the North Atlantic that draws on data from multiple, normally disconnected, specialist sources. Project researchers are pursuing questions like how legal and social systems develop to manage resources in an environmentally fragmented landscape, and how we can see the effects of global changes in climate in local patterns of consumption and economic activities. By aiding researchers to find and contextualize specialist data from outside their own expertise, but related to their research, the DataArc tool will enable researchers to address questions like these more robustly.

The data discovery tool is currently in prototype and integrates data from archaeological survey, zooarchaeology, the Icelandic Sagas, historic land registers, and paleoenvironmental records to address broad scale, multidisciplinary questions. Additional outreach tools and stories will be created throughout the project to engage the general public. This presentation will provide an overview of DataARC objectives and progress, including the introduction of the prototype data exploration tool for feedback from the wider environmental archaeology community.

Climatic Variability and Resilience: Lessons from the past in north-central Nigeria

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The range and damage accompanying environmental variability witnessed in the last two decades have been phenomenal. Some of the worse hit areas include those in developing countries, the economies of which are based on a subsistence, such as traditional agriculture, that is largely climate-dependent. Learning how humans managed similar periods of past environmental instability hold some of the answers to food insecurity. We tested this hypothesis in the context of palaeoenvironmental and archaeobotanical data from the rock shelter of Tse Dura, a Later Stone Age site in north-central Nigeria. Three major periods of drier climatic conditions, which were interspersed with humid conditions, were recognised namely (i) AD 933 ± 29 BP, (ii) AD 802 ±29 BP, and (iii) shortly after AD 1485-1650. Despite these periods of dry conditions, water resources were managed such that water-dependent crops such as *Dioscorea* spp. (yams) were available while drought-tolerant plants such as *Pennisetum glaucum* (pearl millet) were cultivated. Furthermore, a wide variety of wild plants was collected for dietary and ethnomedicinal purposes, while game was hunted. In addition, artefact (iron, lithics and pottery) analyses indicated regional migration, resulting in the exchange and creation of new technologies necessary in the adaptation process.

Accidental travellers, uninvited guests – Fossil insects, farming and ecological imperialism

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The biogeography of insects dependent on man, as seen from evidence from floors, middens and storage, gives information on the spread of pests and parasites and also introductions, agriculture, landscape management and disease. These species provide a proxy which can effectively trace the beginnings of storage based farming in the Neolithic Near East and expansion across Europe, where large scale storage of cereals was established during the LBK. Insect evidence would support the hypothesis of a retreat to smaller scale local organisation and emphasis on pastoralism during the Bronze Age in northern Europe. Roman expansion sees the spread of a wider range of invasive species, including insect pests and parasites, to the northerly parts of the Empire. During the medieval and post medieval period, further expansion takes place via trade networks and provided mechanisms for the spread of epidemic diseases such as Plague. Progressive introductions became established, leading eventually to the homogenised environments we live in today.

Integrated approaches to investigating early farming systems: microarchaeology of livestock dung

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Livestock dung is a key interdisciplinary research area as it provides valuable information on a range of environmental and ecological issues and socio-economic and cultural aspects. A core question is to disentangle the theoretical and methodological issues related with this ubiquitous material in many settlements, which is regularly overlooked in most archaeological programs. Its potential has not been fully realized in the archaeological literature and particularly in syntheses on the emergence of early farming systems. This talk showcases interdisciplinary approaches to debates surrounding the identification of dung using multi-proxy techniques in archaeobotany, geoarchaeology and biochemistry (phytoliths, dung spherulites, micromorphology, GC-MS). Geo-ethnoarchaeological and experimental research provide comparative data-sets and models on factors affecting its formation and preservation, and the natural and anthropogenic pathways influencing these. A selection of case-studies spanning critical periods of transformation from ca. 10,000 cal BC are presented here from the Near East, one of the key heartlands in which plants and animals that were domesticated occur naturally, and from northern Africa, a potentially critical area with implications for surrounding regions including the Mediterranean and the Sahara. These case-studies demonstrate the value of the still needed interdisciplinary studies of dung for tracing human-animal interactions in key episodes of environmental and social change.

Archaeology has no relevance

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Archaeology in general, and environmental archaeology in particular, is under growing pressure from various directions to demonstrate the contemporary relevance of its results. These include the demand for 'impact' that largely stems from REF and the need to tap into large funding streams that are increasingly supporting 'sustainable development' - for example 60% of the European Commission's Horizon 2020 total budget is earmarked for this alone. Currently, we, as a specialism and as a wider discipline, are extremely good at suggesting ways in which our data might be, could be, may be, or should be of relevance to wider-world issues, particularly those within sustainable development, but concrete examples of applied research remain rare. This paper presents some of these reasons for this, and argues that a fundamental shift in the way in which we undertake research needs to occur if we are ever going to be able to effectively demonstrate this relevance in a planned manner. Using the insights from the ERC-funded project The Archaeology of Agricultural Resilience in Eastern Africa, we set-out a method for undertaking research that is both relevant and useful to us as environmental archaeologists as well as to important wider-world issues.

Thriving in the unexpected: permanent life on an open salt marsh

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The organizers of this conference justly point out the significant potential contribution of environmental archaeology to the grand challenges in archaeology. In times of serious climate change and sea level rise, contemporary society could benefit from its findings as well. This is particularly true in coastal environments where problems such as salinization of crop fields are posing severe challenges. Along the Wadden Sea coast of the Netherlands, Germany, and Denmark, people were settling on open salt marshes on artificial dwelling mounds, so-called terps, between ca. 600 B.C. and A.D. 1200. Archaeologists working in the area traditionally emphasize the challenges people were facing, underestimating the opportunities the landscape offered. Their traditional view is, due to current research, now shifting towards the acceptance that people allowed the general dynamics of the ecosystem to continue, but used a constantly changing combination of adaptations to, and modifications of the landscape to make it meet their needs (Nieuwhof and Schepers 2016). A currently ongoing project targeting crop cultivation on salt marshes, including experimental crop cultivation, has been approached several times by the media as well as agricultural organizations to share insights, results and ideas. Do we have something to offer indeed?

Nieuwhof, A., and M. Schepers, 2016: Living on the Edge. Synanthropic Salt Marshes in the Coastal areas of the Northern Netherlands from around 600 BC. *Archaeological Review from Cambridge* 31 (2), 48-74.

Is the development of farmed landscapes in the late Holocene a case of econiche replacement and ecosystems engineering?

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The origin and spread of insects that are associated with human landscapes, in particular farmed landscapes, is an issue of growing international importance, especially as clearance and intensification of farming continue worldwide. This paper examines the development of the beetle (*Coleoptera*) fauna from a range of intensively farmed archaeological landscapes in the UK. The analysis suggests that the archaeoentomological fauna of farmland typically consists of a range of very generalist species which still dominate modern farmed landscapes today. We consider what the origin for this 'farmland beetle fauna' might be. Statistical analysis suggests that there is an essential similarity of the 'core' taxa from these faunas, regardless of the period or nature of the archaeological feature involved. This suggests that, once established, this fauna is relatively stable. We will argue that this process is a clear example of human econiche replacement and ecosystem engineering. Finally, the approach taken here is applicable elsewhere in the world; therefore, we conclude with a number of suggestions for further international research strategies.

Cultural Choice or Climatic Determinism? Understanding the Spread of Agriculture in the Western Balkans

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At the onset of the sixth millennium BC Neolithic farmers began to spread out of Greece and Bulgaria and into the western Balkans (Serbia, Bosnia and Herzegovina, Croatia and Montenegro). They carried their domesticated crops and animals into increasingly northerly latitudes with ever changing landscapes, environments and climatic conditions. Some domesticates were abandoned whilst other species later cultivated in Europe make a first appearance. This paper presents recently acquired data on the spread and development of agricultural practices during the Neolithic of the western Balkans (c.6000-4500 cal. BC). It combines changes in crop packages with evidence for ecological and climatic parameters, in order to explore the interplay between cultural and climatic influences on the development of crop agriculture. Differences in the use of crops between distinct cultural groups are seen within the same ecological and climatic zones, as are similarities in farming regimes across various ecological zones. This paper demonstrates that Neolithic farmers were resilient, resourceful and highly adaptable, and shows that unique adaptations to climatic and ecological environments enabled farmers to grow and expand under distinct cultural signatures.

Fossilised environments above the ground – an interdisciplinary approach to the ecology of medieval castle construction

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Medieval and later castles and churches are often the most visible monuments within Scottish landscapes and contribute enormously to a sense of identity and place. Many of these buildings are associated with historical figures and events of national and international importance, and present resident communities and visitors alike with a continuing, even ancestral, link to the past. The intellectual discourses surrounding these structures are, therefore, of significant cultural and economic importance. In this paper I will introduce an ongoing research project which is exploring the archaeological and palaeoenvironmental potential of masonry building materials across Scotland, with a particular focus on the upstanding seigniorial buildings of the medieval period. As compulsory legal representations of European lordship which often emerge quite suddenly within regional archaeological records, I will demonstrate that Scottish medieval castles and churches contain important physical evidence for the interactions between particular people and particular past environments at various times, and how increasingly refined chronologies enable a more holistic narrative for the physical and cultural development of the built environment to be constructed. I will argue that drawing together the various disciplines concerned with the study of historic buildings and landscapes is one of the 'grand challenges' for archaeology, and one that an environmental approach is uniquely placed to overcome.

The chicken age? An environmental archaeological contribution to the Anthropocene debate

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Accelerating human-driven physical, chemical and biological changes to the Earth system have been profound, sparking suggestions that we have entered a new geological epoch, the Anthropocene. Scientific attention is focusing attention on the identification of the 'golden spike': a marker that characterises the start of this period, that will remain permanently visible within the geological record. Until now, no individual morphospecies has been suggested as a distinct and characteristic representation of this change. In this paper, we highlight the enormous potential value of environmental archaeological data in this arena. Drawing upon an analysis of osteological and isotope data from archaeological chickens, we argue that the broiler chicken is one such potential marker. Resulting from human-directed changes in breeding, diet and farming practices, domesticated chickens demonstrate at least a doubling in tibia bone width from the Roman era to present. Moreover, the skeletal morphology, pathology, bone geochemistry and genetics of modern broilers are demonstrably different to their ancestors. Physical and numerical changes to chickens in the second half of the 20th century have been the most dramatic, with significant increases in individual bird growth-rate and population sizes. Broiler chickens are now unable to survive without human intervention, and are a symbolic species that demonstrates the unprecedented reconfiguration of the Earth's biosphere.

Ancient Invasive Species: Insights, Collaboration, and Policy

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Applied zooarchaeology makes significant contributions to both environmental archaeology and contemporary resource management. In this paper, we will use a series of case studies to address the role of zooarchaeology and archaeogenomics in island invasive species management. We will highlight how such projects develop, and argue that interdisciplinary collaboration, skills in data communication, and understanding the political landscape are critical in applied archaeology. Two North American case studies - the California Channel Islands and the Gulf of Alaska - provide evidence of long term interaction between humans and ancient invasive species. The results of these projects confront our understanding of invasive species histories and, therefore, necessitate further discussion about existing management policies.

Using agent-based models to test the effect of environment circumscription on the evolution of social complexity

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The emergence of complex, hierarchical societies is a major feature of human history. Researchers have proposed a variety of competing hypotheses to explain this phenomenon. Yet, these ideas are generally presented as verbal arguments and often rely on implicit assumptions. Agent-based simulations enable us to test the logic of arguments by making explicit assumptions about how individuals and groups behave within different environments. Here we apply the conceptual framework of Evolutionary Ecology to assess one hypothesis. This hypothesis argues that complex societies were more likely to develop where population movement was hindered by environmental circumscription. In our simulations agents correspond to villages which compete over limited resources through warfare. Defeated polities decide whether to become subordinate or attempt to move elsewhere based on the relative costs and benefits of these actions. Results show that increasing the severity of environmental circumscription accelerates the rate of hierarchy formation. We will assess the plausibility of such models by testing them against settlement pattern data in the Valley of Oaxaca in Mexico. Our model will provide further insight into the potential role of conflict and interactions between people and the environment in the emergence of social complexity.

POSTER PRESENTATIONS

The AGRICHANGE Project (2018-2021): an integrated approach to agricultural change and climate during the Neolithic period in Western Europe

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This project (SNSF Professorship funding scheme) focuses on agricultural decision-making among smallholders during the Neolithic (5600-2300 cal. BCE), particularly in connection to climatic fluctuations. The study region includes the territories between the rivers Po, High Rhine and Ebro. This area witnessed the contacts between farming populations arriving from SW Asia from either continental or maritime routes, with different crops and presumably different cultures. Observing agricultural changes over the Neolithic in this region poses questions such as whether cultural influences had a role in crop choice, or if resilient strategies such as increasing crop diversity were adopted in periods of higher climatic variability. In order to shed light on this topic, the abundant archaeobotanical data available for the region will be compiled and used as a basis for an extensive radiocarbon and stable isotopes' measurement program. Underground storage features will be used to calculate storage capacity. This will allow observing major trends in agricultural dynamics and also obtaining proxies for local climatic conditions and crop husbandry strategies. Besides, new research will be done in selected sites with optimal preservation conditions, with an emphasis on wetland sites. Integrated approaches will be performed combining archaeobotany, archaeozoology (particularly considering small animals) and archaeoentomology.

Isotopes, Microscopes, and Fish Bones: Applying Analytical Science to Iron Age Archaeofaunal Study

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It has been argued that no fishing occurred during the British Iron Age. However, sites in the Northern Isles have been producing large assemblages of small fish bones, complicating the picture. This project reconsiders this argument by investigating fish bone assemblages excavated from the site of Swandro on Rousay, Orkney. Multiple analytical methods, such as scanning electron microscopy and light isotope analysis, were applied to the fish bone assemblages in order to determine the range of species present, the method of capture and treatment of the fish, and their influence on diet. Results from these analytical approaches indicated the occurrence of low intensity fishing activity and consumption that had no significant effect on diet. However, intensification in fishing would begin to occur during the Later Iron Age, as evident by a shift in the composition of fish bone assemblages. This project can be considered a pilot study in the successful application of analytical science to faunal assemblages in order to develop a more detailed interpretation of the environmental aspects of a site. It also demonstrates a need for a more scientific approach to further current zooarchaeology research.

How can archaeological sites contribute to environmental education?

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Climate change, soil degradation and pollution are only few of many challenges to environmental sustainability and food security around the world. In a time when approaches towards agriculture and food production are being reconsidered, archaeology is in a great position to contribute to this discussion with knowledge about past human interactions with the environment. Connection to past that archaeologists develop with communities through public engagement have had profound effects on people's attitudes towards their local heritage. This can be seen across many archaeological sites around Scotland such as Dundonald Castle, which has become a focal point for communal gatherings and educational events. This presentation aims to explore the potential archaeology has in educating people about sustainable environmental development through examples of land management and agriculture in local archaeological record. By connecting the importance of sustainable lifestyle with past narratives about successes and failures of different attitudes toward landscape, archaeology can hopefully raise awareness about the importance and necessity of a responsible and sustainable approach towards future environmental development.

Agency and Artefacts

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There has recently been an increased interest in examining and attempting to understand the thoughts and beliefs behind practices in past cultures. It is often considered difficult to gain an understanding of deeper thoughts and beliefs of peoples and the choices they make as these can be hard to infer from archaeological remains. Consideration of additional sources of information, such as anthropology and iconography, could give insight into these hidden ideas. The use of animal astragali in various forms of divination is common across the world, from at least as early as the Bronze Age and even in modern western culture. Divination is a great part of human thinking, relating to ideas of cosmology, ritual and religion. The use of astragali in relation to this could give useful insight into understanding thoughts and beliefs of past cultures. This poster examines the agency of animal bone artefacts focusing on the widespread use of astragali. Their use in different cultures is considered as well as whether the material itself held a greater meaning, reflecting on or leading to their mystical purpose.

Aliens: A Tool for Documenting the Archaeology of Invasive Species

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Human have translocated plants and animals to islands for millennia. However, systematic documentation of the global history of ancient invasion is challenging due to differences in archaeological practice across the world, varying definitions and types of evidence of translocation, and dispersed datasets. Building on recent attempts to establish criteria for evaluating possible ancient translocations, we developed a web-based resource for archaeologists, managers, and stakeholders to document ancient translocations. With the help of the research community, our goal is to amalgamate these data sets from published and grey literature to investigate the role humans have had in constructing the ecosystems we see today and ultimately, to bring archaeological data to the table in policy discussions of resource management.

How agricultural practices adapted to diverse environments? A case study from Southwest China

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How can Environmental Archaeology provide insights into past changing agricultural systems? Using case studies from Southwest China, this poster aims to explore how a multidisciplinary approach that combines archaeobotany, ecology and climatic data can help us gain a deeper understanding of early human-environment interactions in the adoption of agriculture. Moreover, this poster will also investigate what role human behaviours and environmental constraints played in the adaptation of agricultural practices to different climatic and environmental conditions. By exploring how early farmers adapted to changing environmental conditions, important lessons could be learnt for modern farming practices facing an increasingly rapid change in climate.

The portrayal of rabbits and hares in the Medieval period and their religious associations

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Traditionally, zooarchaeologists have paid little attention to rabbits and hares as they often comprise low proportions of animal bone assemblages. Yet both rabbits and the brown hare were imported to Britain by people and their representations are widespread in iconography and architecture. Culturally, they are often associated with long-standing traditions such as Easter, and both rabbit and hare's feet have been worn for good luck. My poster will focus on the Medieval period (12th -15th centuries) and consider the role of lagomorphs (rabbits and hares) in society and how they were portrayed through different media e.g. drawings in manuscripts, pictures on tiles, and sculptures in churches. This will include looking at the three hare and four hare symbols which originated in Asia and gradually gained prominence in Europe and Britain during the 13th to 18th centuries, particularly in association with religious sites such as churches. Can zooarchaeological and iconographic data be fused to provide new insights into the spread of people, animals and ideas?

Did domesticated rice originate in south-western Sri Lanka independently?

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In East, South and Southeast Asia, one of the driving forces behind the emergence of complex civilisation is the rice (Oryza sativa L.) farming. The widespread cultivation of domesticated rice and the use of various rice landraces over thousands of years have created a rich tapestry of biological diversity interlaced with an even richer diversity of cultural and spiritual traditions. However, the possible routes and rate of spread of domesticated rice from China are unclear, and there is no clear evidence for any independent southeast and south Asia domestication centre of rice, due to the lack of understanding the different stages of rice domestication processes (e.g. wild, pre-domesticated and domesticated) in the form of precise archaeological reconstruction. This paper reports well-preserved rice phytolith evidence from the secure sequence of human habitation deposits at the Fahien rockshelter in Sri Lanka which is indicative of the use of pre-domesticated and/or domesticated rice types around 6.2 ka suggesting a possible domestication centre of rice.

"Of rodents and men" - The evolution and nature of human-micromammal relationships in prehistoric Orkney and Scotland

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Micromammals, such as rodents, shrews, hedgehogs and bats, consist of the majority of known mammal species, both taxonomically and demographically. Contemporary studies reveal not only their significant impact on the environment but also the involvement of humans, intentional or not, in their spread throughout the Earth and their impact on micromammal population dynamics. Archaeological studies rarely engage in research on their remains, mainly due to technical restraints and a lack of unified methodological framework as well as qualified staff. However, recent research on the Skara Brae sample demonstrated the importance of studying rodent osteological material from archaeological assemblages through the UK. It revealed the possible reason behind introduction of the most common Orcadian species, Orkney voles, to the isles, and suggested the commensal relation between wood mice and humans. The author proposes an investigation on a broader range of archaeological sites from Scotland, with a particular focus on Orkney, in order to provide long-term and exhaustive data on rodent population dynamics and their relationship with humans. The research will also provide an exhaustive analysis of current methodology and present a unified and replicable approach to such studies.

Bones of Transition: Iron Age-Roman Zooarchaeological Assemblages from East Wear Cliff, Kent

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This poster will present a PhD research project to analyze the major zooarchaeological assemblage from East Wear Bay, Kent. The site consists of an Iron Age settlement and a Roman Villa. The large assemblage offers the potential to explore issues related to animal husbandry and its economic implications, diet, and site function, which all can help interpret human-environment interactions. Due to its location and various evidence of contact with the European continent, it has been suggested that this site was an Iron Age port. This highlights the significance of the site, as it could be one of the few known Iron Age ports; thus, this research could expand our knowledge on Iron Age ports and the nature of trade with continental Europe. Additionally, close contextual dating of material across the Late Iron Age-Early Roman periods at the site provides significant potential to explore the nature of this major transition. This research will thus add a key case study to explore the social and economic dimensions of this transition, which is regionally under studied. The zooarchaeological remains can also explore ethnic identity and the extent of the Roman influence on the Iron Age population at this site.

The Landscape of Medieval Bərdə, Azerbaijan 6th-13th Centuries AD.

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The Landscape of Medieval Bərdə, Azerbaijan 6th - 13th Centuries AD' project is a pioneering environmental archaeological research initiative aiming to chart the history of the medieval Caucasian regional capital of Bərdə, Azerbaijan though the study of archaeobotanical material. In studies of medieval Azerbaijan, traditional approaches to archaeological recording are employed, focussing on artefacts and structures, with no environmental sampling occurring. This has resulted in a lack of archaeobotanical material for analysis, and consequently no research has been conducted in the field of archaeobotany. This represents a major knowledge gap in Transcaucasian medieval archaeology and its study is a new frontier for environmental archaeologists. This project will bring scientific approach, pioneering the use of modern environmental techniques, previously undeveloped in medieval archaeology in Azerbaijan, and apply them to Bərdə to understand the social, agricultural and economic practices of the region in this period. This project will generate new archaeobotanical data through analysis of plant remains from a current fieldwork project, The Archaeological Exploration of Bərdə (AEB), based at the Faculty of Oriental Studies, University of Oxford. This research will draw from and feed into the larger AEB project, revealing new insights into agriculture, society and urban rural interactions in the region.

Investigating the feasibility of reinstating the 'natural' woodland of the Highlands by using long-term palaeoecological records

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From the 1980s upland areas in the Scottish Highlands have been extensively covered with non-native conifer plantations which drastically affected the landscape and present ecosystems. Over the last few years, plantations have started to be felled in order to reinstate peatland ecosystems. As an addition, the Scottish Forestry Commission (SFC) who maintain most of the afforested peatland is keen on developing policies on the reinstatement of the natural woodland of the Scottish Highlands. The anaerobic conditions of the peat are suitable for the preservation of pollen grains, plant macrofossils and non-pollen palynomorphs which can inform on long-term vegetation patterns and climate change cycles, e.g. vegetation changes in response to human impact or changing climate. In this presentation I will present palaeoecological data from upland peatland areas under the care of the SFC, showing long-term vegetation records with particular attention on former native woodland. The aim of my PhD is to understand what these woodlands would have looked like, what caused the demise of these woodlands, what was the interaction between humans and past woodland and whether it is feasible to replant these woodlands within contemporary climate and ecosystem. This information will then have implications for future conservation strategies in the Highlands and potentially across Scotland.

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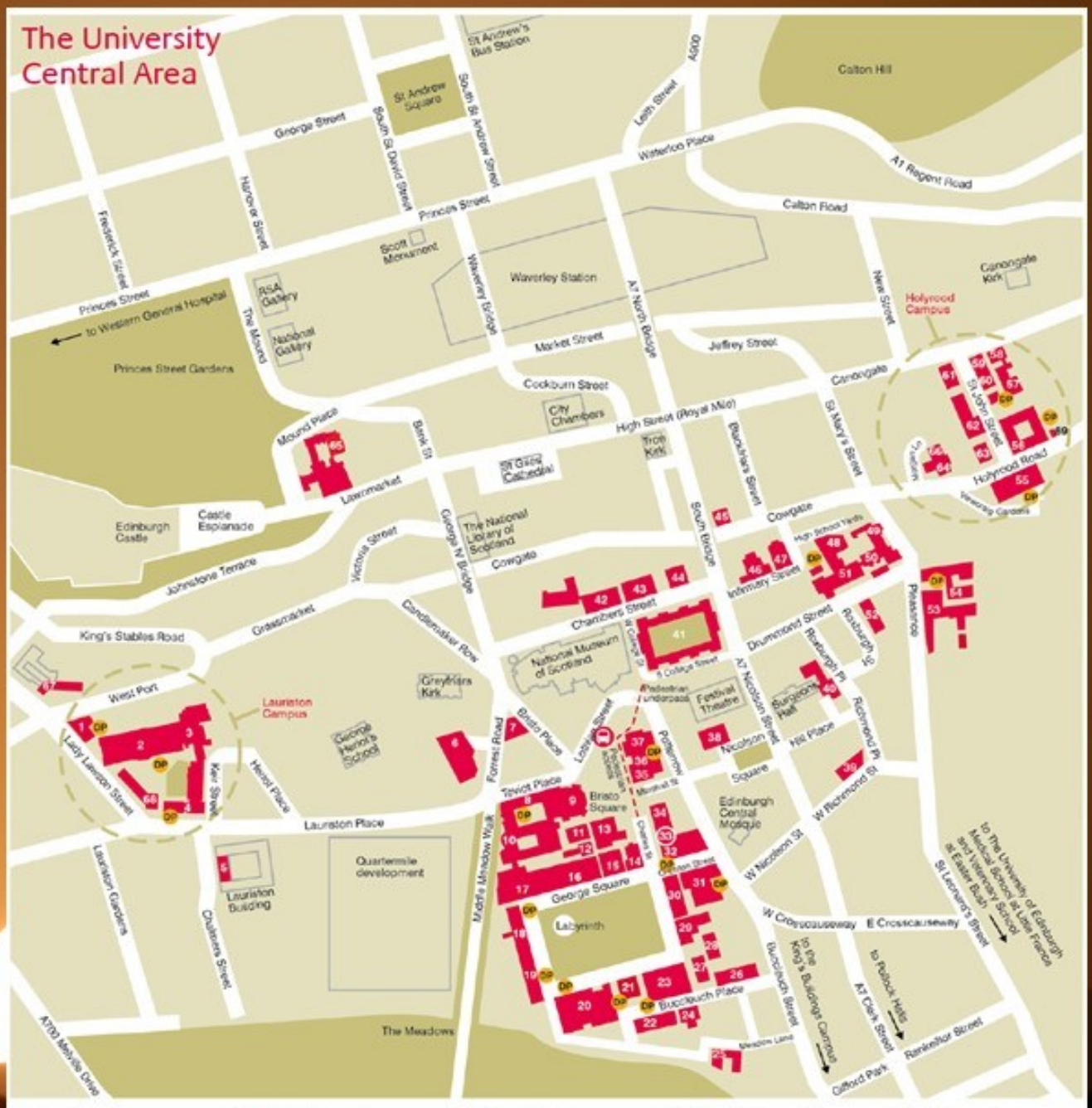
School of History, Classics and Archaeology is located in the Old Medical School Building, William Robertson Wing (10 on the map) - entrance from the Teviot Place street.



1 Evolution House
2 ECA Main Building
3 N-E Studio Building
4 Hunter Building
5 Edinburgh Dental Institute
6 5 Forrest Hill
7 Bedlam Theatre
8 Old Medical School
9 McEwan Hall
10 William Robertson Wing
11 Reid Concert Hall
12 Wilkie Building
13 Teviot Row House Student Union
14 1 George Square
15 7 George Square
16 Hugh Robson Building
17 Chrystal Macmillan Building
18 16–22 George Square
19 27–29 George Square
20 Main Library: Careers Service: Student Counselling Service: Student Disability Service
21 George Square Lecture Theatre
22 17–25 Buccleuch Place
23 University of Edinburgh Business School
24 14–16 Buccleuch Place
25 Hope Park Square
26 30–34 Buccleuch Place
27 David Hume Tower
28 David Hume Tower Lecture Theatres
29 50 George Square
30 55–60 George Square
31 Appleton Tower
32 Informatics Forum
33 University Visitor Centre: information, exhibition and shop
34 Dugald Stewart Building
35 The University Health Centre
36 7 Bristo Square
37 The Potterrow Student Centre: Edinburgh University Students' Association; Chaplaincy Centre
38 Alison House
39 MacKenzie House (34 West Richmond Street)
40 Lister Learning and Teaching Centre
41 Old College and Talbot Rice Gallery
42 Minto House
43 Charles Stewart House
44 Adam House
45 St Cecilia's Hall
46 9 Infirmary Street
47 13 Infirmary Street
48 ECCI
49 Chisholm House
50 Old Surgeons' Hall
51 Old Infirmary Building (1 Drummond Street)
52 1–7 Roxburgh Street
53 Pleasance
54 Centre for Sport and Exercise
55 St Leonard's Land
56 Paterson's Land
57 Thomson's Land
58 Old Moray House
59 St John's Land
60 Dalhousie Land
61 Simon Laurie House
62 Charteris Land
63 Old Kirk
64 Outreach Centre
65 New College
66 Institute for Academic Development
67 Argyle House
68 Lauriston Fire Station
69 Moray House Lodge
DP Disabled permit parking
Shuttle bus to the King's Buildings

The timetable for the shuttle bus between the Central Area and the King's Buildings can be viewed at **www.ed.ac.uk/shuttle-bus**