Freeing information to the people

Dr Philip Buckland discusses his recent project SEAD: the web-accessible scientific database that crosses archaeological and environmental disciplines

What is the driving force behind this project?

The project's driving force is open access, analytical empowerment, scientific transparency and making data freely available to the research and professional community by providing an integrated system for the storage, dissemination and analysis of data relating to past human activities, and environmental and climatic change. Large scale palaeoenvironmental datasets cannot be efficiently analysed without the help of databases and are often lost in archives or left unpublished. We aim to make them available through a system which smoothly facilitates complex queries and analyses, and saves people time.

What are the project's implications for future research agendas? Which fields will benefit most?

The implications are enormous. The Strategic Environmental Archaeology Database (SEAD) will allow online access to a range of data never before made available digitally, let alone in a single system. It will allow new kinds of research looking at complex cultural, social and environmental interactions over large geographical and temporal ranges. Archaeology, environmental science, geoscience, palaeoecology and related fields will perhaps benefit most; but so too will any field in which past organism distributions or soil and sediment changes, or their implications, are important. SEAD contains a considerable amount of data on insects and entomologists will benefit greatly by being able to examine past distribution patterns with respect to the origins of modern faunas. It also stores modern habitat and collection data for work on contemporary biodiversity, sustainability and conservation issues.

What can be learned from studying the past environments, climates and human impacts the project aims to help reconstruct?

These studies can yield a better understanding of past relationships between people and their surroundings; how the environment and climate influenced their possibilities and choices; and how their actions influenced both society and the environments themselves. For example, in any particular culture, in a particular landscape, climate can either enable farming, or, perhaps due to a series of bad summers, render it unsustainable.

What are some of the main challenges in creating a large-scale, web-accessible, GIS-ready database?

Initially, designing a powerful, flexible database which satisfies the data, access and analysis needs of a broad spectrum of power users. Secondly, developing intuitive interfaces tailored to the needs of these and other potential users. We have settled on a concept of multiple front ends to a single database, combining online and downloadable software. Thirdly, funding data entry and, finally, convincing people to share their data and take part in the project to create something greater than the sum of its parts.

The project is being undertaken as a collaboration between the Environmental Archaeology Lab and HUMlab. Could you give us a brief insight into these partners and what they will contribute to the project?

The Environmental Archaeology Lab is a Swedish National Resource Laboratory and has over 30 years experience in driving education, consultancy, and R&D in scientific methods in archaeology. We are directing the project and represent the domain science group, managing the initial datasets and forming the initial research and development strategies. HUMlab, the Humanities Computing Lab, is a creative meeting place and development environment for the digital humanities. They are running the development of innovative web-based interfaces for querying and visualisation, as well as networking across the humanities. Together we form a partnership with considerable experience and expertise in the science and business of both environmental archaeology and ICT.

How will the system be integrated into teaching and online learning interfaces in the future?

Initially, the system will be incorporated into Umeå University's campus and online archaeology courses. Material will then be made available to help others incorporate SEAD into their teaching. Online learning interfaces and supporting material will subsequently be developed in which students will be able to simulate the research process using real data and interfaces as used by the researchers themselves. This will better prepare future generations for answering complex questions on past, present and future environments through digital means. We will also be working with international partners, especially the Neotoma Consortium, based in the U.S., towards producing school level educational and museum orientated systems.

Is the database intended just for researchers and professionals or will amateurs have access to it as well?

Everyone will have access to the system, but it will, at least initially, be orientated towards researchers and professionals. Our funding is clearly research infrastructure-orientated and there are fundamental differences between designing interfaces for the latter and for the public. We are currently investigating funding and partnership opportunities for creating more publicly orientated interfaces.

Using the past to aid the future

Disciplines as diverse as anthropology and palaeoecology take an interest in our environment and how we have treated it. **The Strategic Environmental Archaeology Database** aims to create a multi-proxy, GIS-ready database for environmental and archaeological data to aid multidisciplinary research

LEARNING ABOUT THE PAST has a great impact on our ability to predict the future. The past relationships between people and their surroundings, such as how the climate, landscape or human decisions influenced their opportunities, can tell us a lot about our societies of today.

SEAD ONLINE WEBSITE

An agricultural society hit by continual bad weather, for instance, or a fishing society suffering from a low carrying capacity from its seas can help us realise the importance of careful decision making when it comes to sustainability. Research disciplines such as archaeology, environmental studies, geoscience and palaeoecology work to study the interactions between human societies and their environment, helping to better predict the potential impacts of modern activities and how our environment might change as a result.

Direct measurement of the evidence for past environments is not always possible, but changes often leave records in the remains of plants, animals and sediments. Proxy analyses allow researchers to use the relationships between these organisms or materials, their environments and the specific conditions needed for survival or formation,

to study past changes. Many scientists use Geographical Information Systems (GIS) to analyse, store, edit and integrate these geographical and temporal data and assist in decision making. Human activity often produces anomalies in the data, and their identification allows us to study the environmental impacts of past societies.

As is true in most scientific research, no single method of analysis can provide a full story of the past. With this in mind, the Environmental Archaeology Lab at Umeå University in Sweden set up the Strategic Environmental Archaeology Database (SEAD). The SEAD project aims to create a multi-proxy, GIS-ready database for environmental and archaeological data, which will allow researchers to study the interactions of past environments, climates and human impact. The system will also enable researchers to study the implications of these interactions for present or future research agendas such as cultural heritage, habitat or species conservation.

REACHING A LARGER DEMOGRAPHIC

The SEAD infrastructure is being created through a web-based database for environmental archaeology and palaeoecology. Data will be taken from a large number of archaeological and Quaternary geological sources and then made available online to provide the basis for many interdisciplinary research projects.

There has been a number of palaeoenvironmental and archaeological database projects in the past that have tried to make this sort of information available to a larger demographic of researchers. However, the majority of databases suffered from poor organisation, lack of funding or because the project worked on too small a scale.

Most existing projects have only concentrated on individual sites or a limited group of proxies and

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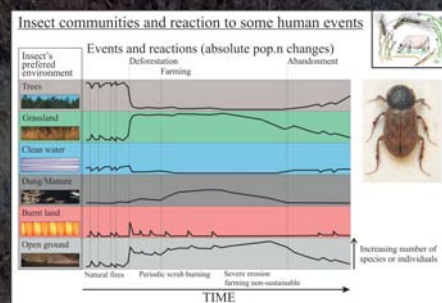
INSECTS AND RESPONSE TO EVENTS

focusing on only one of either the past, present or future. Many projects have fallen foul from building databases purely with technology in mind rather than a research community. Projects like these find it difficult to succeed over time.

BEETLE REFERECE COLLECTION

With this experience of past projects in mind, Buckland's SEAD project plans to address the issues of earlier systems and facilitate the almost unlimited potential for querying between data types, geographical location and time periods. The project also wishes to use the system as a link between modern ecology and modelling and past environments. "We believe that only by doing this can archaeology start to live up to the expectations and demands of a scientific and public climate where empirical support is increasingly demanded for any interpretation of the past or alternative models of the future," Buckland explains.

Enabling international research on past environmental and climatic change, the SEAD infrastructure will be backed up with quality assured empirical data. These datasets will initially come from the insect fossil database project BugsCEP and from 30 years worth of work in the Environmental Archaeology lab at Umeå University. Buckland and his team will be encouraging more labs and data managers to make their research available through SEAD and then, once the system is fully operational, SEAD will begin to accept datasets from any source that meets their quality assurance requirements.

AUGER SOIL PROFILE

FLY PUPAE

SHARING DATA AND BRINGING SCIENCE COMMUNITIES TOGETHER

The SEAD project courses over many disciplines and has the potential to impact and consequently connect research in many diverse areas including anthropology, biology, geology and climatology. Its ability to unite natural and humanistic science research makes the system especially desirable. "The more comprehensive

FOSSIL INSECT REMAINS

and interdisciplinary the data, the more robust and impacting the research enabled by the database will be," says Buckland.

The project is being funded by two large database infrastructure grants from the Swedish Research Council (c. 1 million euros). The project's overheads are co-financed by the Department of Historical, Philosophical and

FLY PUPARIUM

Religious Studies at Umeå University Faculty of Arts. Associated research has also been funded through Quality Based Resource Allocation

MACROFOSSILS AND BONE

Grants at the Faculty of Arts while aspects of the database and interface development have been co-financed through the shared development of other projects.

With its interdisciplinary research promise, Buckland's SEAD project has the potential to create a much closer scientific community. Project members working for different faculties and laboratories across Europe will no longer feel isolated from one another, as SEAD opens doors that many may never have realised were closed in the first place.

Buckland's project has already been met with plenty of interest from different research communities, as scientists begin to realise how much time could be saved with SEAD's analytical power. Interested parties include the Nordic Archaeobotany Group, International Flax Network and FieldNirce.

Most databases of SEAD's type would have acted as a single site archive and retrieval system in the past. SEAD aims to go much further, facilitating complex, multi-site research. "Many research projects would have been much easier had SEAD existed: weeks of data collation and mapping could have been reduced to a few mouse clicks," Buckland explains, "leaving far more time for the most difficult part: interpreting the results."

Even scientific researchers will find a design format a little flat sometimes. This is another area where SEAD excels. In addition to all the backend cross-disciplinary intelligence, SEAD looks better than most databases with an interface that is far less intimidating than in previous projects.

Buckland has plans to bring SEAD into teaching too, helping students find everything they need. The database will initially be integrated into Umeå University's campus and online archaeology courses. Assuming that is a success, other academics will then be invited to incorporate their course materials into the database. This sharing of data is a step in the right direction for Buckland as he hopes to eventually gain the necessary funding to expand SEAD's interface and demographic, making it available not just to scientific researchers, but to all.

INTELLIGENCE

SEAD

OBJECTIVES

To provide the scientific community with open facilities for the storage of and access to raw data on prehistoric changes in environment, climate and human activities, along with advanced tools for their interrogation and analysis, and furthermore, to make data currently of limited availability accessible online.

PARTNERS

Project management and development:

The Environmental Archaeology Lab, Sweden
HUMlab – The Humanities Computing Lab, Umeå, Sweden

Data partners:

The National Laboratory for Ceramic Research, Sweden
The National Laboratory for Wood Anatomy and Dendrochronology, Sweden

Development and database partners:

The Bugs Coleopteran Ecology Package
Neotoma Paleoecology Database

FUNDING

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DR PHILIP BUCKLAND obtained his PhD in Environmental Archaeology in 2007 and is now senior lecturer in the same at Umeå University, Sweden. He has been the director of the SEAD project since it began in 2008, and conducts research, development and teaching in archaeology and palaeoenvironmental science.