Human-climate-ecosystem interactions: learning from the past

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The annual discussion meeting of the Quaternary Research Association was held in the picturesque, winter landscape of the New Forest National Park in southern England. The overall theme of the meeting was "Quaternary Science and Society" and it proved to be popular, attracting over 100 attendees. The PAGES-Focus 4 sponsored open sessions "Human-climate-ecosystem interactions: learning from the past" took up four of the 10 sessions. PAGES helped to support eight early career researchers from Australia, Romania, the USA, and the UK to attend the Focus 4 sessions. The Focus 4 presentations were split into several groups. One group focused on the response of past human societies to climate change as reconstructed linking archeological and paleoecological data. Within that group Andy Dugmore (Edinburgh, UK) showed how resilience theory could be combined with detailed and interdisciplinary studies of past communities across the North Atlantic to explain the reasons for either social collapse or long-term sustainability. Michael Grant (Wessex, UK) described how the past trajectories of woodland species in the local New Forest were providing insight into modern day management of the woodlands. One of the PAGES-supported early-career researchers, Giri Kattel (Ballarat, Australia), used paleolimnological data to assess human-climate-ecosystem linkages illustrating how sediments in maar (crater) lakes could be used as recorders of climate regime shifts and to study adaptability of past ecosystems.

A second group of papers were methodology-centric with reports on the development of isotopic and biomolecular analyses, and on approaches to translate pollen records into land use cover. Virgil Dragusin (Bucharest, Romania) explored possible human-environment interactions during the Bronze and Iron Ages in SW Romania as recorded by carbon stable isotopes in speleothems. Joseph Williams (Kansas, USA) was drawn to the discussion of novel approaches in environmental and biodiversity change, such as the ongoing development of plant biomarkers and ancient DNA analysis. Hazel Reade (Cambridge, UK) assessed the paleoclimatic interpretation from the isotopic analysis of tooth enamel with regard to the archeological record of Northeastern Libya.

A third group linked paleoenvironmental studies to past and present

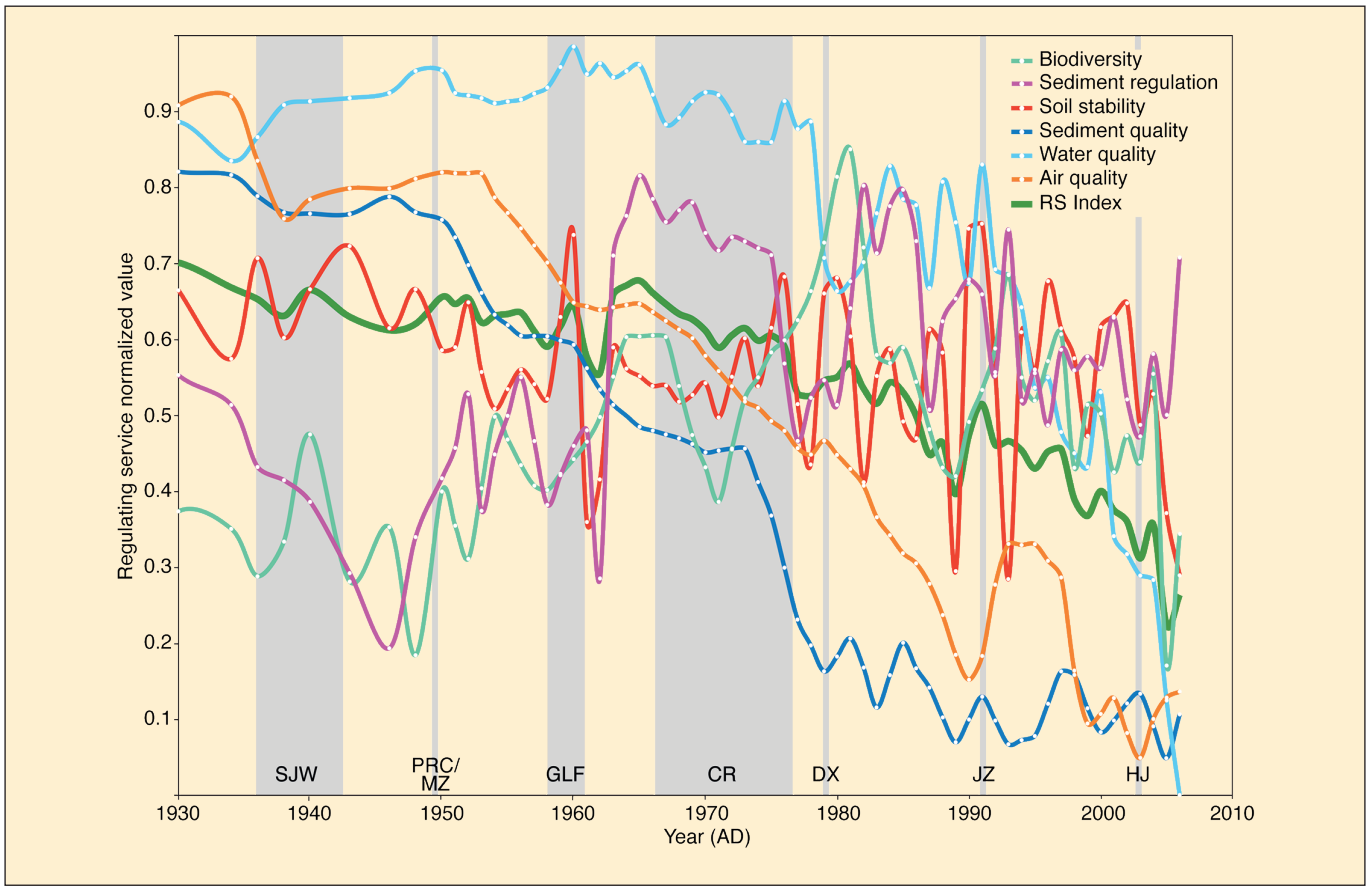

Figure 1: Lower Yangtze basin 1930-2006: normalized regulating service proxy records for biodiversity, sediment regulation, soil stability, sediment quality, water quality, air quality and regulating service (RS) Index based on lake sediment analyses, showing downward trends (losses of services) towards the present. Vertical bars show major 20th-21st century political events (from left to right): Sino-Japanese War 1937-1945 (SJW); People's Republic of China founded by Mao Zedong 1949 (PRC); Great Leap Forward 1958-1961 (GLF); Cultural Revolution 1966-1976 (CR); Deng Xiaoping's economic reforms from late 1970s-early 1980s (DX); leadership of Jiang Zemin from 1989 (JZ); leadership of Hu Jintao from 2003 (HJ). After Dearing et al. (2012).

socio-ecological resilience. Using multi-proxy records, this group of studies revealed long-term interactions between climate, human activities and ecosystem services, the presence of thresholds and early warning signals, and reference conditions for conservation. Zhang Ke from Southampton (UK) shed light on recent attempts to use paleoenvrionmental records as proxies for ecosystem services in the lower Yangtze basin (Fig. 1). The paper by Wang Rong (Southampton, UK) examined the evidence for early warning indicators of eutrophication in lake sediments from southwestern China. And Helen Shaw (Lancaster, UK) assessed paleoecological and historical contributions to understanding sustainability, resilience, and ecosystem services within traditional pastoral management. The wide range of questions that were addressed across many geographical zones, served to emphasize the growing use of paleoenvironmental archives to understand human-environment interactions. Reflections on the meeting by recipients of PAGES support gave a flavor of the intellectual atmosphere and rapport generated during the meeting. One recipient commented that the meeting was timely: taking place not only when ecosystems are increasingly threatened by rapid climate change and human activities but when scientific communities across the globe are trying to find the best possible approaches to mitigate these effects. This meeting was a significant step toward our efforts for a comprehensive understanding of the human-climate-ecosystem interactions during the 21st century that help promote societal and ecosystem resilience against future climate change. The use of a range of proxy indicators to understand ecosystem response to climate and human drivers can help us develop not only management tools but also our theoretical understanding of ecosystem responses to multiple and complex forcing.

References

Dearing J et al. (2012) *PNAS Plus* 109(18): E1111-1120

Report on the PAGES/CLIVAR Intersection Panel Meeting

WCRP, Denver, USA, 28 October 2011

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Since 1999, the PAGES/CLIVAR (Climate Variability and Predictability) Intersection Panel (www.clivar.org/organization/pages) has focused on benefitting from the combined expertise and insights of scientists working on modern climate observations and processes and those collecting and interpreting paleoclimate records.

The World Climate Research Programme (WCRP) Open Science Meeting in Denver, USA, in October 2011, featured many examples of paleoclimate information being used to extend the instrumental record, evaluate climate models, and place modern changes in a longer-term context. It was therefore an excellent backdrop for the annual committee meeting of the Intersection Panel.

Our Panel meeting was dedicated to finding the best strategies for boosting collaborations across the WCRP "seamless" community (not just CLIVAR). Panel member rotation was addressed with an objective of ensuring a wide range of interests and geographical spread in new members. This selection is now underway, and any readers interested in joining the panel are encouraged to contact the chairs.

Links with other panels and working groups were also an important topic of discussion. Representatives from the Global Monsoon working group, CLIVAR Atlantic panel, and others expressed great interest in increasing the paleoclimate component in their discussions and projects. In particular, the PAGES Ocean2K synthesis project (www.pages-igbp.org/workinggroups/ocean2k) (motivated by our Panel thanks to CLIVAR Scientific Steering Committee inputs) that focuses on bringing together high-resolution ocean proxy data for the last two millennia was highlighted as an important bridge to the observational oceanographic community. The Panel has instituted a new mailing list (clivar-pages-open@clivar.org) that we hope will be a resource for notifications of cross-cutting projects and workshops, and a platform for ideas on how to engage wider community participation. To subscribe, please go to www.clivar.org/clivarpages-mailing-list.

The centerpiece of discussion at the meeting was the Coupled Model Intercomparison Project (CMIP5) and database. For the first time within the CMIP protocol, paleoclimate simulations for the Last Glacial Maximum (21 ka ago), mid-Holocene (6 ka ago) and last millennium (Paleoclimate Modelling Intercomparison Project, PMIP3) have been included alongside historical simulations for the 20th century and future projections. This allows for a much greater analysis of whether and how paleoclimate model/data comparisons are informative of future projections.

The Panel organized a workshop focused on this topic in March 2012 (Schmidt et al., this issue), and the outcomes were presented to the wider CMIP5 community. The Panel is working to produce a refereed "white paper" on the best practices for using the PMIP3 simulations to help constrain projections. The white paper will address issues of statistical robustness, dataset synthesis, comparison strategies and quantification of uncertainties due to the model structure, data set uncertainty and forward modeling approaches.

Overall, this is an exciting time to be bringing these communities together, and the resulting new initiatives have enormous potential.