

# Editorial: Integrative paleoscience for sustainable management

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**New integrations of historical information at regional scales are needed in order to provide a stronger basis for developing strategies for sustainable management and adaptation to global environmental change.**

Increasingly, international and national reports (e.g., Millennium Ecosystem Assessment, 2005; UK National Ecosystem Assessment, 2010) highlight the need to understand how interactions between society and the environment have evolved over multi-decadal timescales to create modern landscapes. Only with the perspective afforded by a relatively long timescale of observations can modern landscapes be effectively treated as complex interacting systems and analyzed for complex behavior, such as thresholds. Direct observations and measurements obtained from long-term survey or monitoring programs are usually too short or too limited in scope to provide a comprehensive record on their own (Fig. 1). As an alternative, reconstructing long and comprehensive records can potentially be achieved through integrating instrument, document, paleoenvironmental and archeology records within regions to produce “socio-environmental profiles”. These profiles can provide the basis for assessing the relative degradation of different ecological services more effectively, identifying and modeling complex socio-environmental interactions, defining system behavior (e.g., trajectories and thresholds), identifying baselines, and providing the means to drive and validate local process-based simulation models (Dearing et al., 2006a, 2006b, 2010).

However, while there is a wealth of historical information available for many regions, much of it lies uncoordinated by virtue of disciplinary divisions or unidentified need. Thus the “Regional Integration” Theme, the newest to emerge from the PAGES Focus 4 “Past Human-Climate-Ecosystem Interactions” ([www.pages-igbp.org/science/foci/focus-4](http://www.pages-igbp.org/science/foci/focus-4)), aims to promote interdisciplinary efforts for the compilation of recent multi-decadal historical data as an essential prerequisite for understanding contemporary system functioning at the regional scale.

The Theme also shares complementary approaches with the IGBP-IHDP-AIMES program “Integrated History and Future of People on Earth” (IHOPE; [www.stockholm-resilience.org/Ihope](http://www.stockholm-resilience.org/Ihope)).

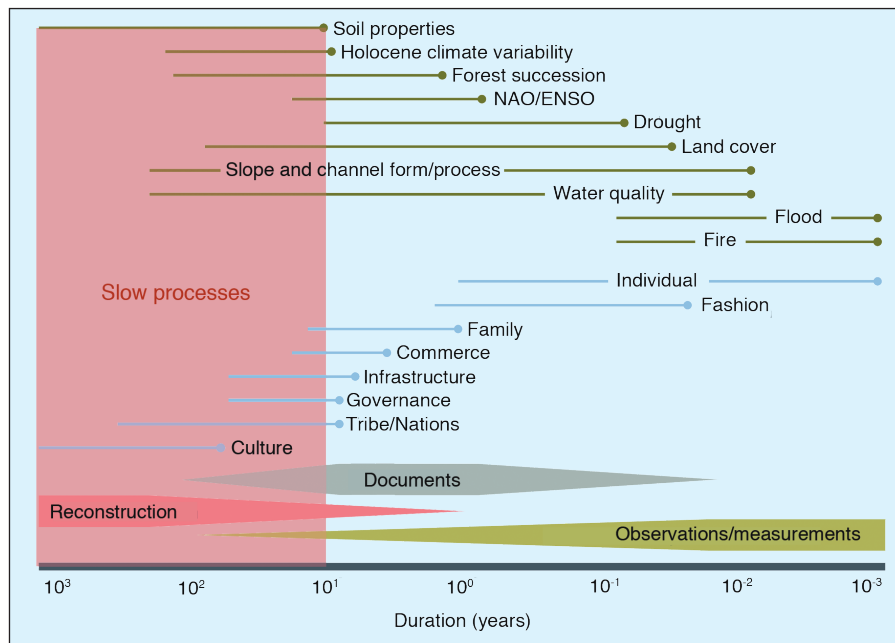


Figure 1: Slow and fast processes. Timescales for a range of biophysical and socio-economic phenomena range from “fast” subannual events (e.g., floods, fire) to “slow” multidecadal and centennial changes (e.g., culture). Understanding contemporary socioecological systems may require information from a similar range of timescales, but sources of information become more limited for longer timescales. The sources of information available for each segment of timescale with respect to the present are depicted by the horizontal lenses. Observations and measurements (e.g., instruments, remote sensing, censuses, economic statistics) and documents (e.g., diaries, gazetteers, land use descriptions) may only be available for relatively short timescales. Changes over longer timescales that are essential for assessing the role of “slow” processes (red shading) may need to be reconstructed. Reconstruction covers all the paleoenvironmental fields, including paleoecology, paleoclimatology, paleohydrology and archeology, which interpret artifacts and natural sediment archives (e.g., lake sediments, stalagmites, peat) in terms of past environment and society. Reproduced from Dearing et al. (2010), after Oldfield (1983) and Brand (1999).

An understanding of socio-environmental dynamics is important for the development of adaptive policies and strategies in all regions, especially where successful management of key environmental processes and their interaction with human activities is viewed as critical. For example, within natural wildernesses, biodiversity hotspots or regions projected to be particularly vulnerable to combinations of social and biophysical stressors. The priority over coming years is to provide socio-environmental profiles for “climate change hotspots”, taking particular advantage of links to ongoing regional assessments of climate change being undertaken in PAGES Focus 2 “Regional Climate Dynamics”.

In this issue of *PAGES news*, dedicated to the new Regional Integration Theme, we have selected a range of case studies that were either presented at the inaugural meeting in Southampton or have been compiled from recent peer-reviewed

publications. They show a wide range of regions and contemporary issues that can be addressed through integrating paleo and other records. We would like to thank all the contributors for their speedy production and turnaround of manuscripts.

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For full references please consult: [http://www.pages-igbp.org/products/newsletters/ref2011\\_2.pdf](http://www.pages-igbp.org/products/newsletters/ref2011_2.pdf)

