Reconstructing the Biogeochemical Consequences of Disturbances

Paleo Reconstructions of Biogeochemical Environments (PROBE) Workshop; Manhattan, Kansas; 19–21 April 2012

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Disturbances—discrete events that reduce plant biomass—commonly regulate material and energy flow in terrestrial ecosystems. Recent studies document an increase in the size and/or severity of disturbances such as native bark beetle outbreaks and large fires compared to the recent past. However, scientists cannot evaluate the potential consequences of these events for ecosystem dynamics without decadal to multimillennial records of disturbances and ecosystem response. The Paleo Reconstructions of Biogeochemical Environments (PROBE) workshop brought together ecosystem ecologists and paleoecologists for a 3-day workshop at the Konza Prairie Biological Station in Manhattan, Kansas. The focus of the meeting was the reconstruction of the biogeochemical consequences of disturbances (e.g., beetle outbreaks, wildfires, windstorms, and droughts) on different timescales, the assessment of the state of current knowledge, and identification of challenges and opportunities for future research.

A key organizing principle of the PROBE workshop was the idea that both fast and slow processes contribute to trajectories of ecosystem change and recovery after disturbance. This idea was addressed in a synthetic fashion by bringing together researchers from both the neo- and paleo-ecological scientific communities who have been separated by traditional disciplinary differences in the temporal and spatial scales on which their research focuses. This concerted effort at bridging temporal and spatial scales with scientific representation from academia, government agencies, and nongovernmental organizations ensured that the workshop output would be applicable for policy makers and land managers interested in strategic planning for maintaining ecosystem health.

The discussion was focused into three working groups that covered the impacts of disturbance upon (1) hydrology, (2) carbon cycling, and (3) nutrient cycling. Working groups were organized to ensure that each group would have members from a range of career stages and expertise that encompassed knowledge of data sets across timescales, including long-term instrumental measurements, chronosequence approaches, and analyses of sedimentary and tree-ring archives.

The group presentations on the final day of the workshop synthesized ideas developed by the working groups. Process-based ecosystem modeling was identified as a promising mechanism for bridging space/time gaps. A key issue raised during the workshop was the need to develop and validate reconstruction proxies for fundamental ecosystem metrics such as net primary productivity and terrestrial nutrient cycling. Additionally, encouraging the contribution of data to online repositories was identified as an important step and valuable resource, allowing later access as new proxies become available. Online-based contribution and discussion initiated at the workshop are ongoing to produce a detailed collaborative manuscript from all those who attended.

Over the next few years, the initial PROBE efforts will continue, funded by a Research Coordination Network (RCN) grant for the Novus network. The primary goal of this RCN is to improve understanding of terrestrial ecosystem disturbance dynamics from timescales of decades to several millennia and spatial scales of region to globe.

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