Drought, fire, rising seas: discovering the nature of ecosystem change

March 21, 2017

National Science Foundation, 4201 Wilson Boulevard, Arlington, Virginia

Even as sea-level rise, drought, and fire increase pressures on some ecological systems, others are benefitting from protection and restoration efforts. But some changes are not reversible. Long-term research employs observations of past changes, together with long-running experiments and modeling to understand the processes responsible for sustaining ecological functions. Drawing on concrete examples and synthetic frameworks, five researchers from across the Long-Term Ecological Research (LTER) Network describe science that can help discern which changes may allow for recovery and which are more likely to irreversibly transform ecological systems.

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| 8:30 a.m. | Coffee, posters, display of Schoolyard LTER book series |
| 9:00 a.m. | National Science Foundation Introduction, TBD |
| 9:05 a.m. | **Introduction: the nature of ecological change**  *Peter Groffman, Chair, LTER Executive Board, Cary Institute of Ecosystem Studies and City University of New York, Co-principal Investigator, Baltimore Ecosystem Study LTER*  Change, stability, thresholds, and resilience have long been among the greatest challenges in ecology. These challenges can only be met with the types of coordinated, long-term science supported by the LTER program. |
| 9:15 a.m. | **Beyond desertification: new models for state change in drylands**  *Brandon Bestelmeyer, Research Leader, USDA-ARS, Jornada Experimental Range, Co-principal Investigator, Jornada Basin LTER* |
| 9:35 a.m. | **Fire and ice: carbon cycling feedbacks to climate in a warming Arctic**  *Michelle Mack, Professor of Ecosystem Ecology, Northern Arizona University Co-principal Investigator, Bonanza Creek LTER* |
| 9:55 a.m. | **Climate-resilient coasts: how long-term research and restoration informs management**  *Karen McGlathery, Professor, Department of Environmental Sciences, University of Virginia, Lead Principal Investigator, Virginia Coast Reserve LTER* |
| 10:15-10:45 | **Break** |
| 10:45 a.m. | **De-acidification of Northeastern forests: an altered baseline?**  *Charles Driscoll, University Professor of Environmental Systems Engineering, Syracuse University, Co-principal Investigator, Hubbard Brook LTER* |
| 11:05 a.m. | **Plausible freshwater futures: Yahara watershed, Wisconsin, USA**  *Christopher Kucharik, University of Wisconsin–Madison, Co-Principal Investigator, Northern Temperate Lakes LTER* |
| 11:25-12:15 | **Panel Discussion: How can science contribute to management decisions?**  Moderator: Frank Davis, Director, LTER Network Communications Office  Possible panelists:   * USDA (ARS/Forest Service)/USGS * NOAA * EPA * Peter Groffman, Chair, LTER Executive Board |
| 12:15-1:00 p.m. | **Lunch reception???** |

**The nature of ecological change**

*Peter Groffman, Chair, LTER Executive Board, Cary Institute of Ecosystem Studies and City University of New York, Co-Principal Investigator, Baltimore Ecosystem Study LTER*

**Beyond desertification: new models for state change in drylands**

*Brandon Bestelmeyer, USDA-Agricultural Research Service, Jornada Basin LTER*

One of the classic state-change stories is that over-grazing and drought turn grasslands into shrubby, degraded landscapes. Land managers strive to avoid such irreversible changes, using strategies based on models of how ecosystems change. But misapplication of models can lead to poor management outcomes. Researchers at the Jornada Basin LTER site and its host the USDA Jornada Experimental Range have developed a new model of desert grassland ecosystem dynamics that is grounded in long-term data and experiments indicating possible trajectories. Even after abrupt vegetation change, gradual recovery appears to be possible–sometimes along unexpected pathways–as long as critical thresholds in species abundance and soil erosion rates are not crossed.

**Fire and ice: carbon cycling feedbacks to climate in a warming Arctic**

*Michelle Mack, Northern Arizona University, Bonanza Creek LTER*

About 30% of global carbon stocks reside in the vegetation and deep, carbon-rich soils of Arctic tundra and boreal forest biomes. Wildfires—which are becoming more frequent with warmer and drier weather in the Arctic—have the potential to either stabilize or accelerate regional and global warming through carbon feedbacks. By comparing the impact of fire in the boreal forests of Interior Alaska, where fire has been common for the past 10,000 years, with Alaska’s North Slope, where fire is a novel disturbance, researchers are understanding the ways that fire interacts with plant species composition, nutrient availability, and permafrost integrity to influence ecological and climate stability.

**Climate-Resilient Coasts: how long-term research and restoration informs management**

*Karen McGlathery, University of Virginia, Virginia Coast Reserve LTER*

Coastal habitats are the first line of defense against sea-level rise and storms. At the same time, they are vulnerable to change, and can be pushed past tipping points and lost. A long-term, landscape-scale experiment with seagrass at Virginia Coast Reserve LTER is the first of its kind to show the role of restoration in reinstating ecosystem services, particularly 'blue carbon' sequestration. Fifteen years of data on recovery trajectories, thresholds, and resilience to high ocean temperatures provide novel insights that are integrated into predictive models of future change and inform management and policy.

**De-acidification of Northeastern forests: an altered baseline?**

*Charles Driscoll, Syracuse University, Hubbard Brook LTER*

Air pollution control efforts have succeeded in reducing sulfur dioxide and nitrogen oxide emissions, but decades of acid rain have leached calcium and magnesium from Northeastern forest soils. These changes have increased the mobility of dissolved organic matter, and possibly altered soil organic matter dynamics, altering the long-term trajectory for forest ecosystems. What does the acid rain story say about when, where, and how recovery is possible?

**Plausible freshwater futures: Yahara watershed, Wisconsin, USA**

*Christopher Kucharik, University of Wisconsin–Madison, Northern Temperate Lakes LTER*

Scenarios can help communities think about alternative futures, but using them to drive decisions requires data. In Wisconsin’s Yahara Watershed, researchers are combining data and modelling from the Northern Temperate lakes LTER with qualitative scenarios based on trends and events from the global scenarios literature and stakeholder perspectives. The resulting assessments can help guide decisions about changing land and water use in ways that meet needs for human wellbeing, conserve the capacity of environments to provide services (such as water quality, quantity, and agricultural production), and build resiliency for unpredictable changes in climate or other environmental drivers.