Climate Committee Report
2004 Fall Coordinating Committee Meeting, Fairbanks, AK
Douglas G. Goodin, Committee Chair

Recent activities of the climate committee have focussed on a new research initiative to study the effects of extreme climatic events. The Extreme Events Working Group (XEWG) formed as a result of a climate committee-sponsored workshop held at the 2003 All-Scientist's meeting in Seattle. The extreme events project is intended as a follow-on the highly successful Climate Variability Ecosystem Response (CVER) project headed by David Greenland during his tenure as Climate Committee chair. The XEWG project borrows many concepts and ideas from CVER including a cross-persepctive and use of a series of guiding framewrok questions. However, we hope to enhance the cross-site synthesis component of the project. Ultimatley, our goal is to create a "typology' of LTER sites according to their mode of response to various types of climatic extremes. We believe that this will provide insight into how various ecosystems can be expected to respond the changes in type, magnitude, and frequency of extreme climate events hypothesized to occurr under various global climate change scenarios.

A two-day workshop was held at Portland State University in June to outline the XEWG project and formulate a set of synthesis questions to guide the research. Attendees at the meeting included: Tony Brazel (CAP), Andrew Fountain (MCM), Doug Goodin (KNZ), Julian Hadley (HFR), Glenn Juday (BNZ), Brian Kloeppel (CWT), Alan Knapp (SGS & KNZ), Mark Losleben (NWT), and Melinda Smith (KNZ). Early in the discussion, we realized that in order to address our research objectives, we needed to consider both climate extreme events (as drivers) and extreme ecological responses. Much of the workshop was spent defining (and refining definitions of) these two types of extremes. Regarding climate extremes, we came up with two broad, definitional characteristics; 1) extremes exceed some sort of limit in terms of magnitude, duration, and frequency, and 2) extremes are sensitive to the context in which they occur (i.e. the local climate) relative to some predefined time horizon (e.g. 30-500 years). Based on these two characteristics, we agreed on the following definition:

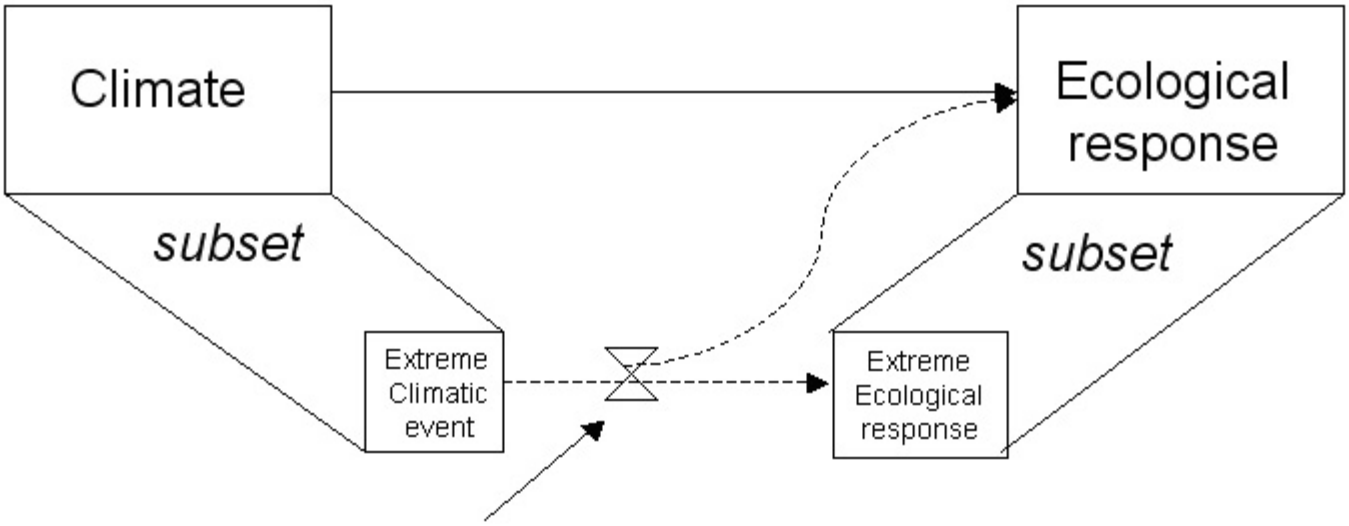
Extreme climatic events are statistically rare in frequency, magnitude, and/or duration for a single climate parameter or combination of parameters for a particular ecosystem. The ability to recognize and categorize extreme events is dependent upon the length of reliable observational records. An extreme climatic event may or may not induce an ecological response.

This definition conforms fairly well to existing definitions, but extends them by explicitly acknowledging the link between climate extremes and ecological response. The definition also “works” from a climatological, as opposed to a meteorological perspective. This is especially important for us, since most of the specific research goals we laid out assumed that we would search the LTER and other climate databases for longer-term anomalies.

Defining an extreme ecological response turned out to be a bit more complicated than the climatic definition. A number of definitional concepts were considered, most of which seemed to be framed in terms of ecosystem composition, process, or structure. Like the climatological definition, the definition of ecological response seemed to hinge on the idea of limits, but the complexity of ecological systems and their responses necessitated a more complex consideration of the concept of limits. Thus, extreme ecological effects might exceed limits at single or multiple hierarchical levels. Changes might be transient or persistent, and they may or may not affect the future response of the ecosystem of its components. Directional change and reestablishment of baselines were discussed. The consensus seemed to be that new baselines could result from a climatic disturbance, but that baseline change was not “required” in order to consider an ecological response to be important or significant. The following definition resulted from the discussion:

> *An extreme ecological response is a change in ecological attributes that is statistically rare in frequency, magnitude, and/or duration, or a persistent alteration of ecological properties at any level of organization.*

The remainder of the workshop was devoted to refining the definitions and devising a set of framework questions to guide the research. The guiding framework was summarized in a diagram proposed by Smith and modified by the group during the course of discussion:



Much of our analysis will be focussed on getting at the nature of the contextual “switch” that determines whether a system goes on to an extreme response, or shows a non-extreme response. Factors in this response are listed on the diagram. Other questions concern the nature of the extreme response; once it is determined that one has occurred.

Some of the questions relevant to this include:

Does an ecological impact involve the disruption of existing relationships or completion of a threshold change?

Does successional stage or community age effect the conditions for or consequences of an extreme climatic event?

What is the time scale of the response (to complete response cycle)?

Is response mediated by organisms?

Is effect direct or cascading?

What antecedent conditions are required for a response to occur/must effects occur in a certain sequence?

What is the role of biota (browsers, grazers, etc.) in conditioning system?

What weather/climate variables are associated with the highest productivity and lowest productivity in a system?

Are there any extreme climatic events associated with the elimination of species and/or the establishment of new species?

Is there a seasonal component of ecological response?

What weather/climate variables are most important (precip, thermal, wind, mixture, etc.)?

Does the ecological response result from novel combinations of climate extremes?

What ecosystem variable(s) respond(s)?

What limits or thresholds must be exceeded in order for the response to occur?

We recognized that trying to initiate this program over all LTER sites and including all possible climate extremes would be too unwieldy to carry out, thus we decided to begin with a limited pilot program considering just two types of climate extremes (temperature and precipitation) for a selected subset of LTER sites. Currently, we are in the process of gathering data and determining which sites will be part of this pilot project. Our goal is to complete this pilot analysis by next spring. Although participants in this project are, for the most part, associated in some way with the climate committee, we invite comments, suggestions, or participation from all interested LTER researchers.

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