

## 1. Core Research Questions

Initially, at least, only a modest number of research questions can be asked in a uniform and coordinated fashion at a majority of participating sites. The following are five areas of core research suggested for a majority of the sites, whether they are focused on terrestrial or aquatic systems.

(i) Dynamic patterns and control of primary production, over time, and in relation to natural and induced stresses or disturbances.

Evidence presented by several researchers indicates that several key measurements of the producer system (e.g., standing crop, photosynthetic surface area, water use, and others) provide a basis for inter-correlation with physical and climatological measurements at the site. These measures seem to have great potential for estimating derived parameters at the site or for longitudinal cross-sections of continental resource systems.

(ii) Dynamics of selected populations of seed plants, saprophytic organisms, invertebrates, fish, birds and mammals in relation to time as well as natural and induced stresses or disturbances.

The causes of population fluctuations, or sustained population declines, are among the most elusive of biological problems. Although observations cannot be maintained on even a majority of the species at LTER sites, certain indicator populations can be identified that have "equivalent" species at other sites. Records of the population variations in such species in a network context will permit testing and development of hypotheses central to the question of maintaining biotic diversity.

(iii) Patterns and control of organic accumulation (biomass) in surface layers and substrate (or sediment) in relation to time or natural and Induced stresses or disturbances.

Remineralization or accumulation of carbon and associated nutrients often is a dominant aspect of ecological regulation. While many of the important questions in this area require experimental manipulation, certain measurements of the annual organic additions and long-term accumulations are essential to designing and interpreting the experimental work.

(iv) Patterns of inorganic contributions (atmospheric or hydrologic) and movement through soils, groundwater, streams and lakes in relation to time and natural or induced stresses or disturbances.

Current research has shown unusual variations and trends in inorganic contributions to ecosystems from the atmosphere. These inputs reach aquatic systems, in part, through surface and subsurface hydrologic flows, which in turn vary in relation to precipitation inputs. Long-term measurement of the most prominent constituents of this geochemical system will provide benchmark measurements for comparative as well as manipulative research.

(v) Patterns and frequency of apparent site interventions (disturbances) over space and time (drought, fire, windthrow, insects or other perturbations) that may be a product of, or induce, long-term trends.

Virtually all of the potential LTER study systems (land and water) will include unusual but probably natural local disturbances, e.g., floods, fire, insect attack, etc. Study of the response of the system to these interventions is an essential part of the LTER program. Thus, a class of research to be pursued relates to the pattern and frequency of interventions (some may be very infrequent), and the status of the population recovery (which, in forest succession, may be very long).