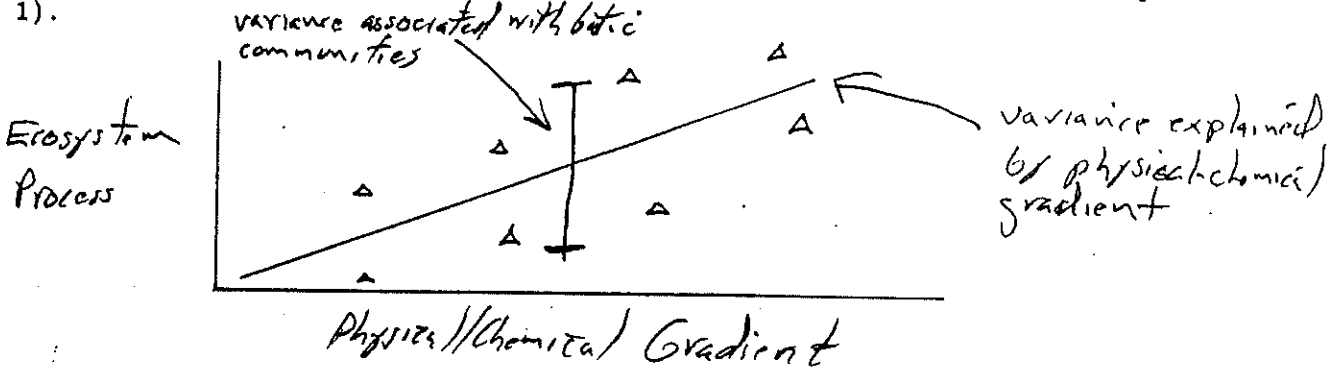
IDEAS FROM N Lakes

John,
Here are those thoughts I promised for a possible intersite comparison. T.

GENERAL INTERACTIONS BETWEEN COMMUNITY STRUCTURE AND ECOSYSTEM PROCESSES

The magnitudes of many ecosystem processes are controlled, to some extent, by physical and chemical habitat features. For example, across a range of lakes, annual phosphate loading is correlated with total primary production. Similarly, wood decomposition rates are correlated with habitat moisture or nutrient availability. However, in each of these examples and for ecosystem processes in general, a knowledge of physical or chemical habitat features is insufficient to explain all of the variance that is observed in ecosystem processes. There appears to be a growing awareness that a significant additional portion of the variability in ecosystem processes can be explained by features of the community that are involved, either directly or indirectly, with a process. In a sense, the physical/chemical environment provides a broad template within which a process occurs but the specific rates observed at a given time result from an interaction of the biotic community with that template (Fig. 1).



Although a significant added influence of community structure has been identified for some ecosystem processes (e.g., Carpenter et al. 1986, Schowalter personal communication), it seems likely that such interactions could be identified for a broad number of ecosystems and processes. The identification of such interactions could be a useful subject for an LTER intersite working group. Discussions could focus on two levels. The interplay between community structure and ecosystem process could be identified for individual sites and the nature of this interplay could be contrasted among sites. On a broader scale, different LTER sites might be considered as representing different physical/chemical conditions and discussions could focus on how different community features at each site further explain intersite differences in ecosystem processes.

To: John Magnuson

From: Dave Armstrong

Re: Possible LTER Intersite Activities

I'm listing and briefly describing a few areas of interest. If these areas were of interest to investigators at other sites, we might pursue them further.

1. Relative rates of phosphorus and nitrogen immobilization in sediments.

The relative rates of incorporation of phosphorus and nitrogen from the water column into lake sediments are important in determining the extent of recycling of these nutrient elements in the system. For example, a high efficiency of phosphorus incorporation into sediments would promote phosphorus limitation in the system. Differences in geochemical controls on diagenesis in sediments or differences in organic matter processing in the water column may lead to corresponding differences in immobilization rates among contrasting ecosystems. Intersite comparisons might lead to insight into the factors controlling immobilization efficiency.

Several approaches could be used to evaluate intersite differences in immobilization efficiency. Initially, ratios of phosphorus to nitrogen in sediment cores could be compared. Subsequently, geochemical controls and trophic interactions could be explored in both divergent and similar systems to identify the principal controlling factors.

2. Diagenesis of Pigments in Lake Sediments.

The chlorophyll and carotenoid pigments are highly useful in evaluating both current trophic interactions in lakes and historical changes in primary production, types of primary producers, and trophic interactions in lakes. However, the historical record contained within the lake sediments is only partially preserved. Partial degradation of the pigments in sediments complicates interpretation of the sediment record. Current work is focused on resolving the extent to which diagenesis has altered pigment profiles. Comparison of contrasting lake systems at different sites would facilitate resolution of the factors controlling diagenesis.

The approach would involve comparison of pigment profiles from contrasting lakes. Use of methodology (HPLC) for measurement of individual pigments would be required. Comparisons to the pigment composition of the material delivered to sediments

at the present time would be helpful.

3. Carbon cycling by bacterioplankton.

Although bacterioplankton may play an important role in carbon cycling, information on their importance in lakes is sparce. In general, the bacterioplankton utilize dissolved organic matter, resulting in either mineralization or transfer to other microorangisms.

Comparisons among contrasting lake systems would be useful in assessing the importance of the bacterioplankton in production and carbon cycling. Incorporation of tritiated thymidine combined with size fractionation would be used. Because uncertainty exists over the relation between thymidine incorporation and production of cell biomass, other techniques for confirming bacterioplankton production would also be investigated.