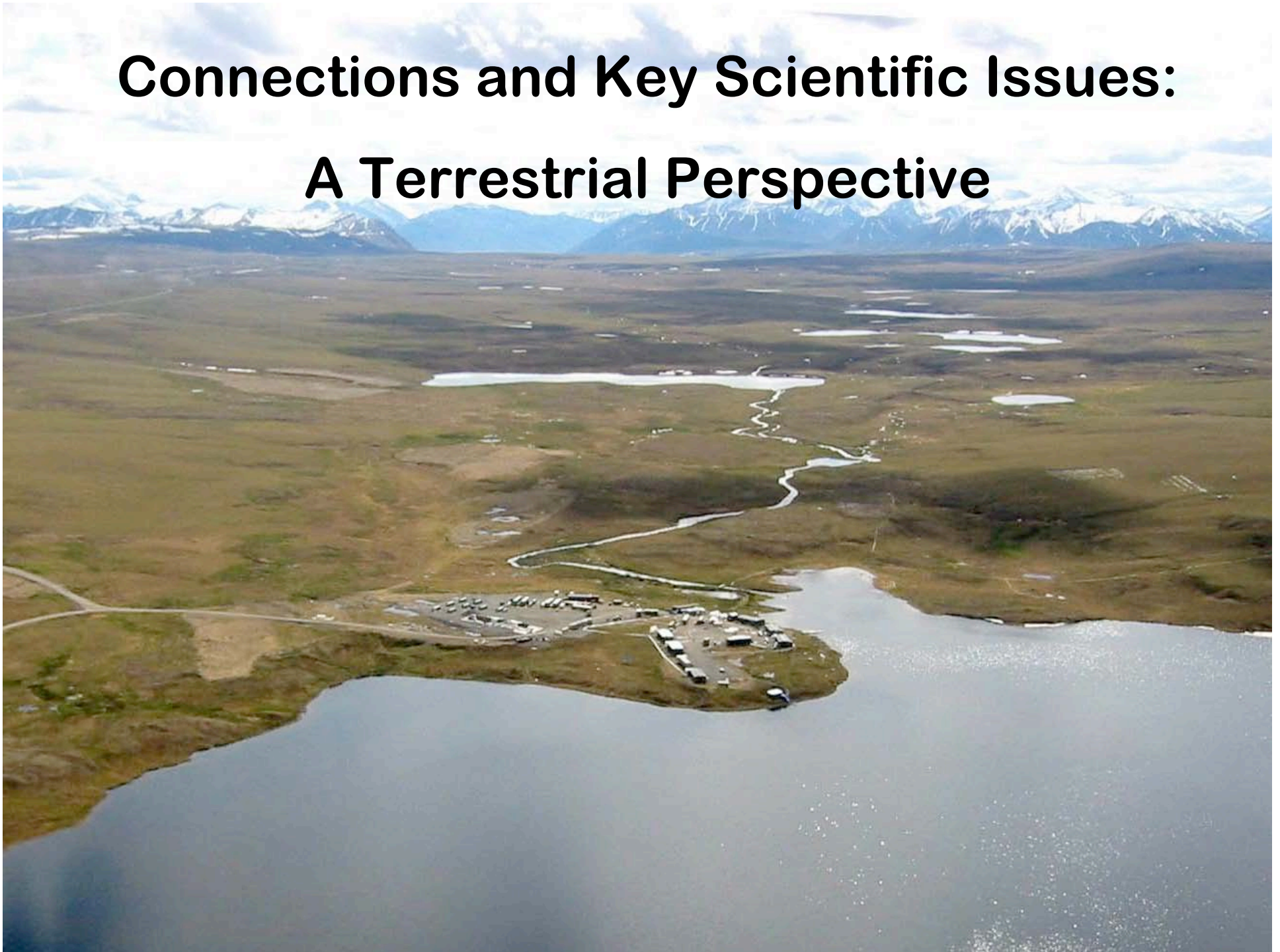
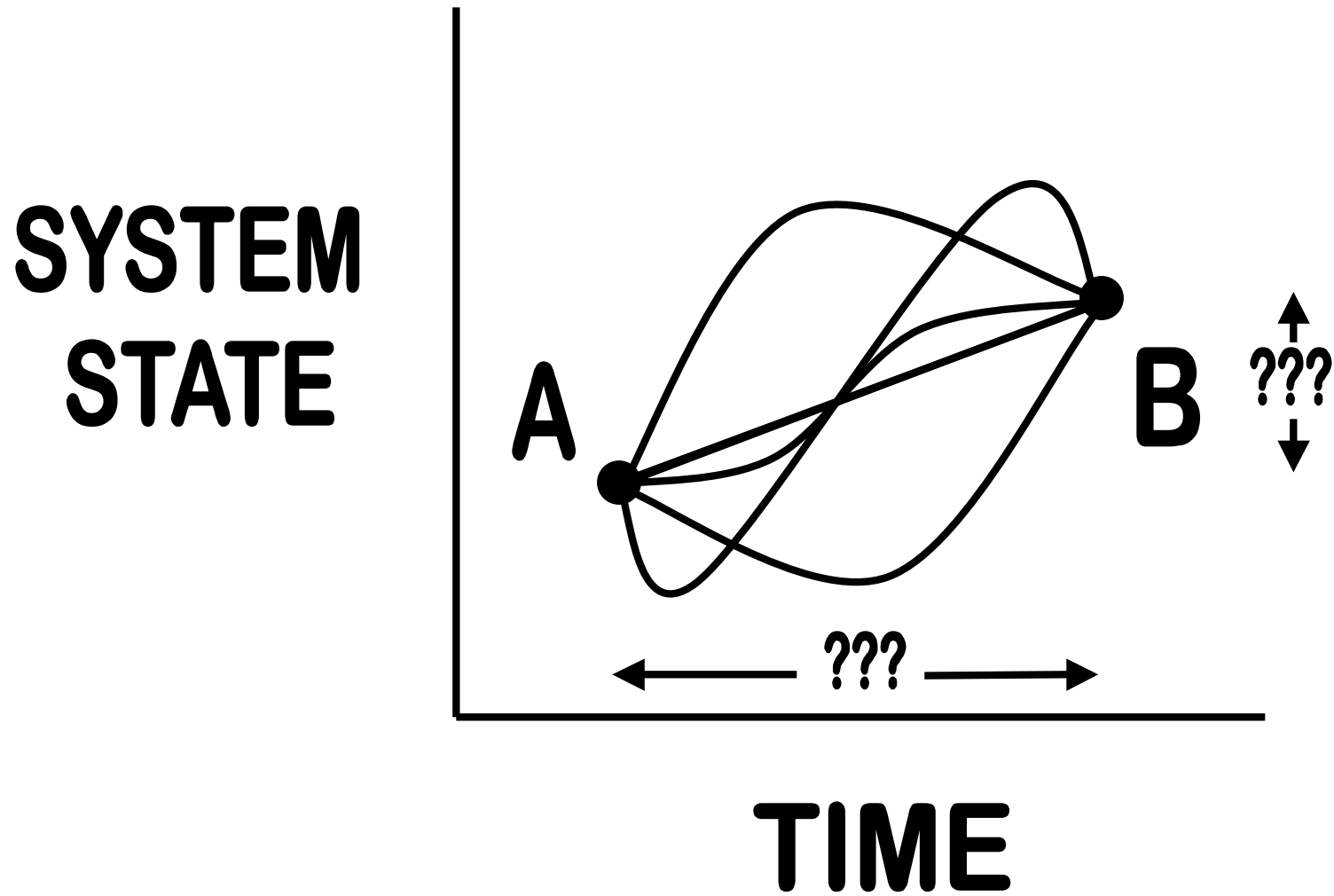
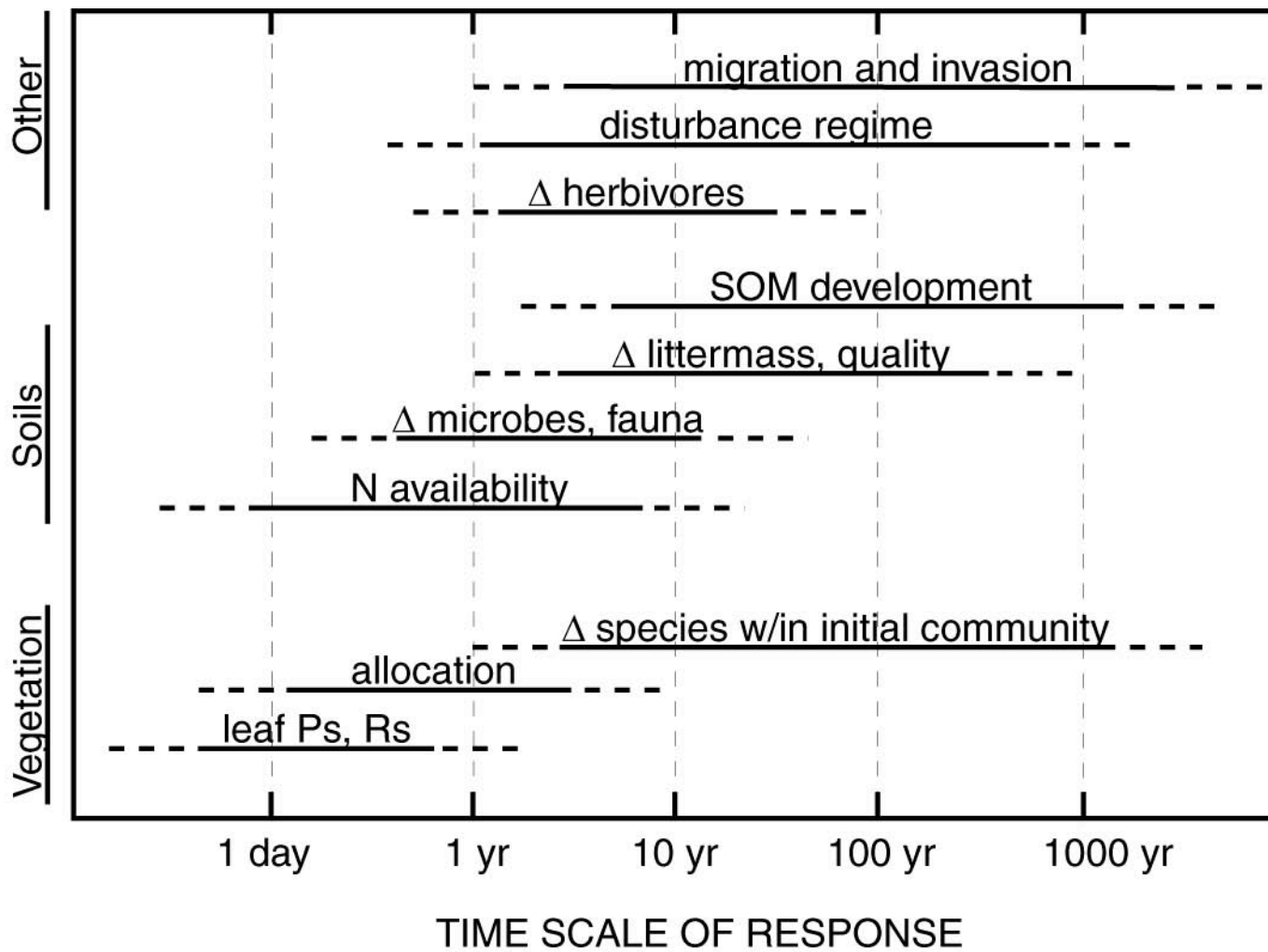


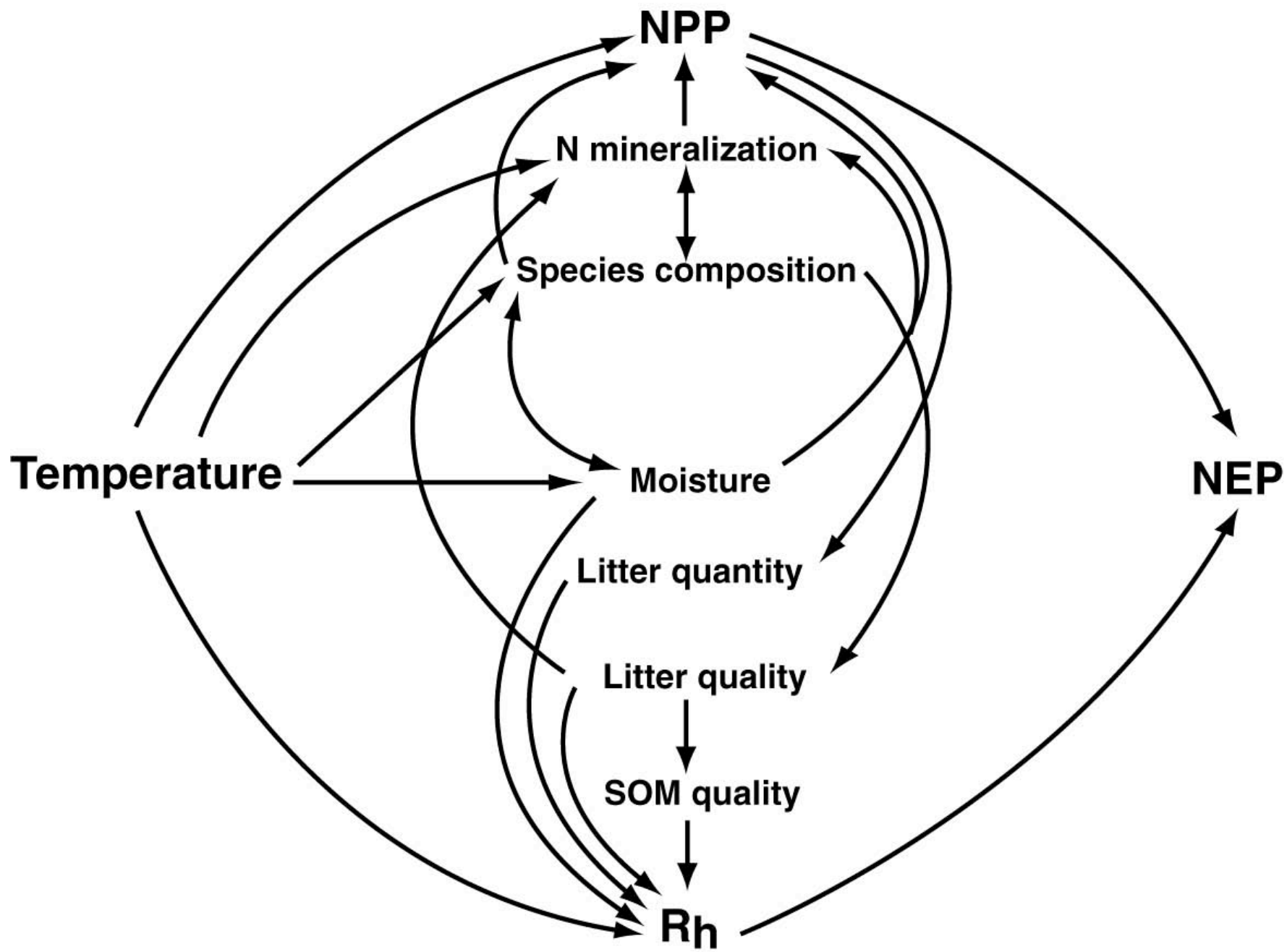
# Connections and Key Scientific Issues: A Terrestrial Perspective

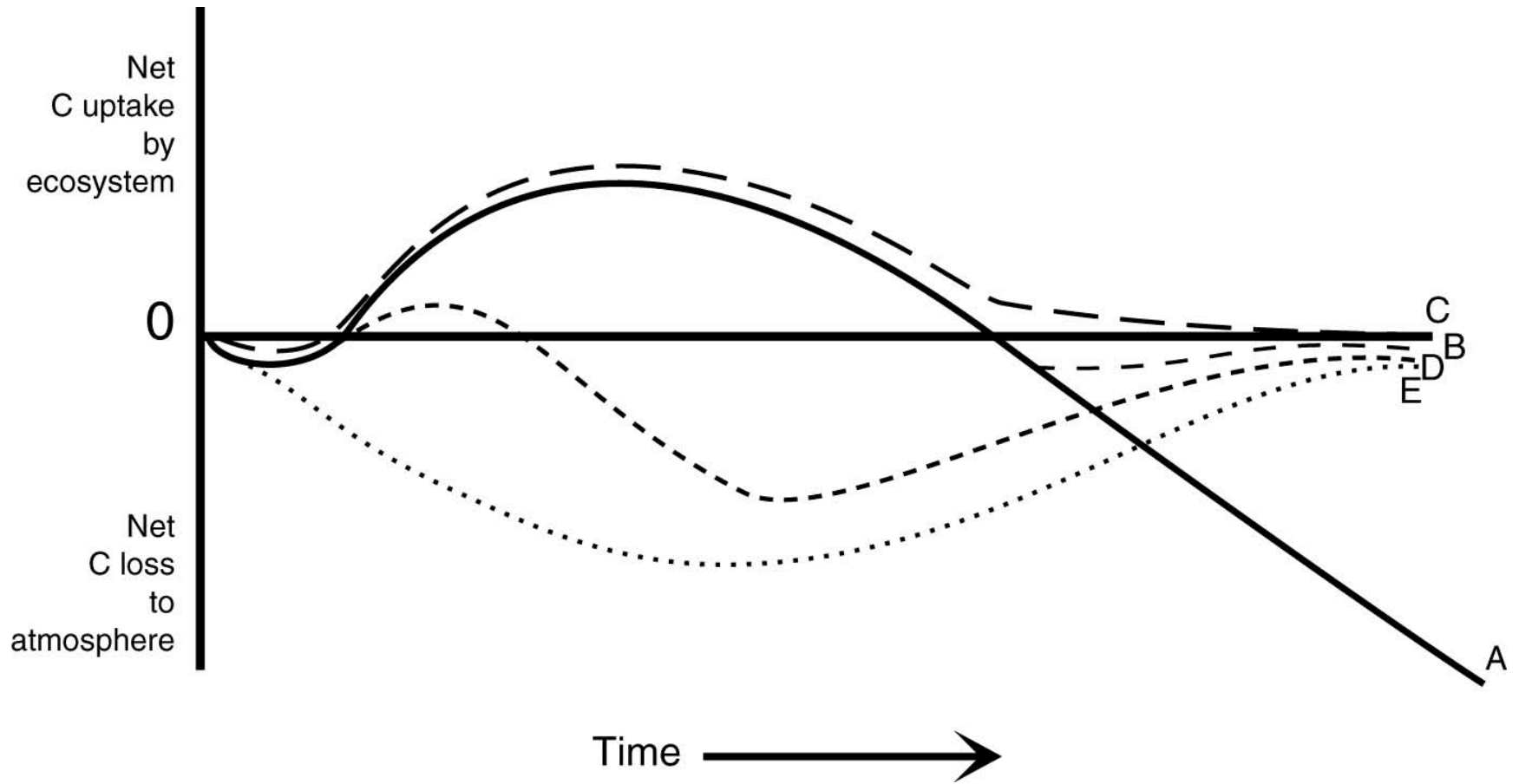


How do we get from Point A to Point B ?









# Timing is everything

- Trajectories of change
- Sequence and linkages

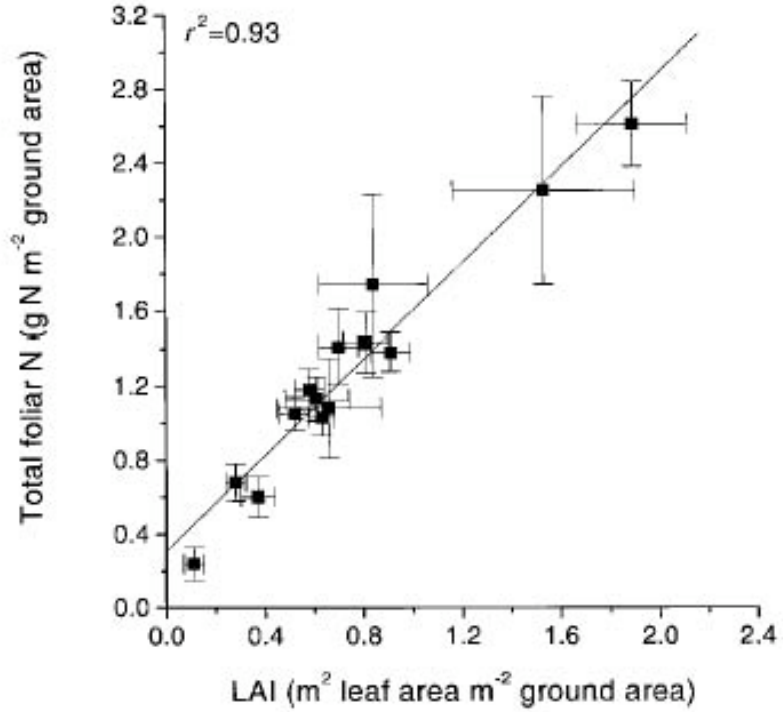
**Timescale of change in terrestrial biogeochemistry and energy balance is longer than timescale of major climatic oscillations.**

**Spatial scales are generally finer.**

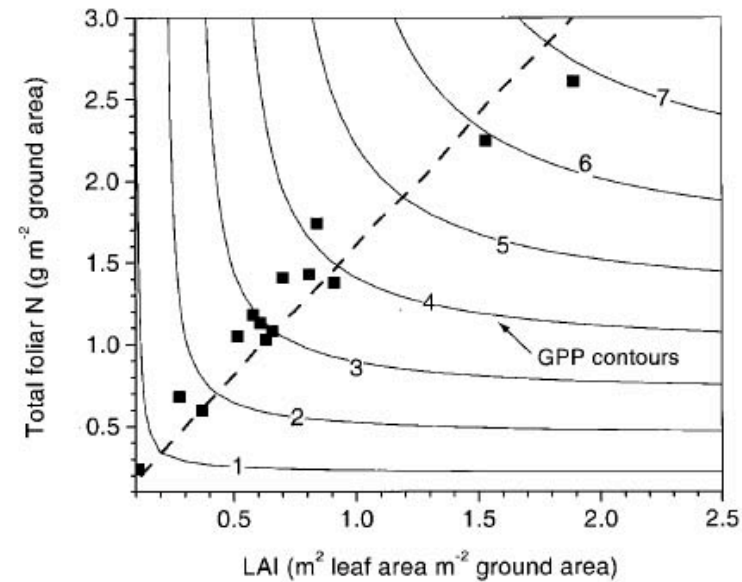
**Major need: Study systems  
that are clearly changing,  
focus on linkages not single  
processes**

**Scaling up: How can we make broad regional predictions from fine-scale measurements?**





**Fig. 5** The relationship between mean total vascular plant foliar N ( $\pm 1$  SE) and mean leaf area index ( $\pm 1$  SE) for sites along the transect. Also plotted is the linear regression ( $r^2 = 0.93$ ,  $y = 0.31 + 1.29x$ ).

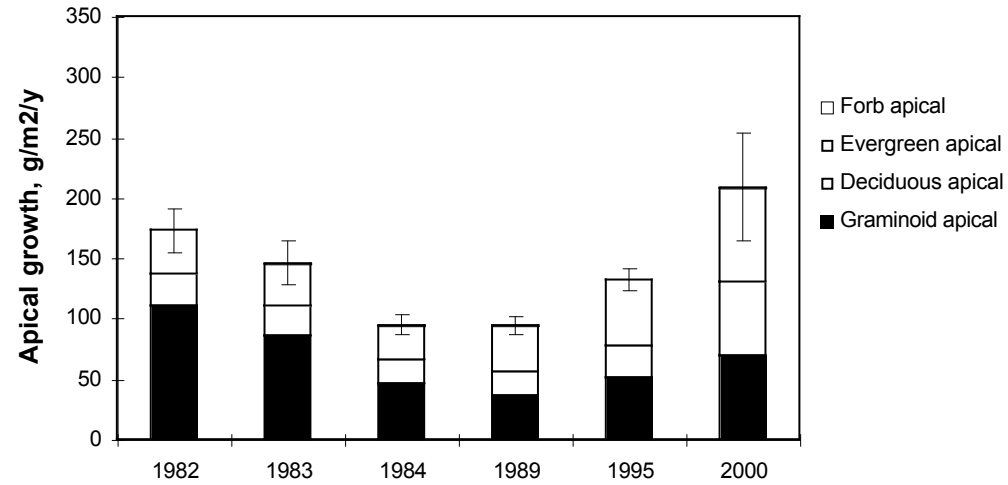


**Fig. 6** The modelled response surface of GPP of vascular plants (contour lines,  $\text{g C m}^{-2} \text{ day}^{-1}$ ) to combined variations in LAI ( $L$ ;  $\text{m}^2 \text{ leaf area m}^{-2} \text{ ground area}$ ) and total foliar N ( $N$ ;  $\text{g N m}^{-2} \text{ ground area}$ ). Also shown (symbols) are the LAI-N relationships for the sites along the transect, and the line that connects points on the surface where  $\partial P/\partial L = 1.48 \partial P/\partial N$ , where  $P = \text{GPP}$ .

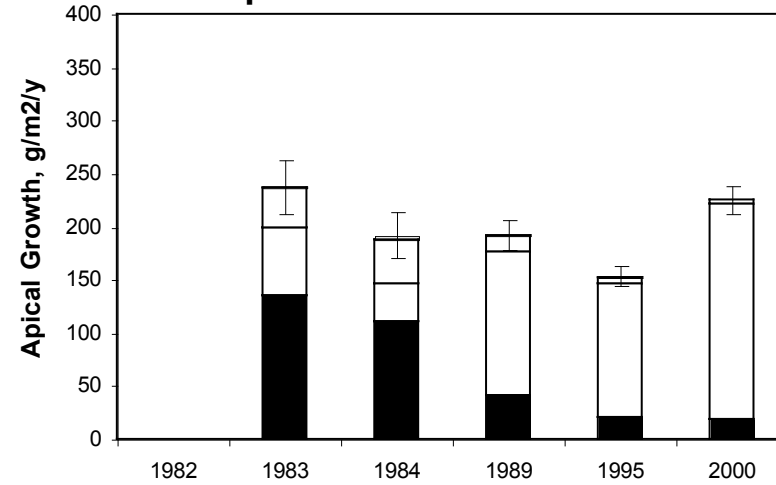


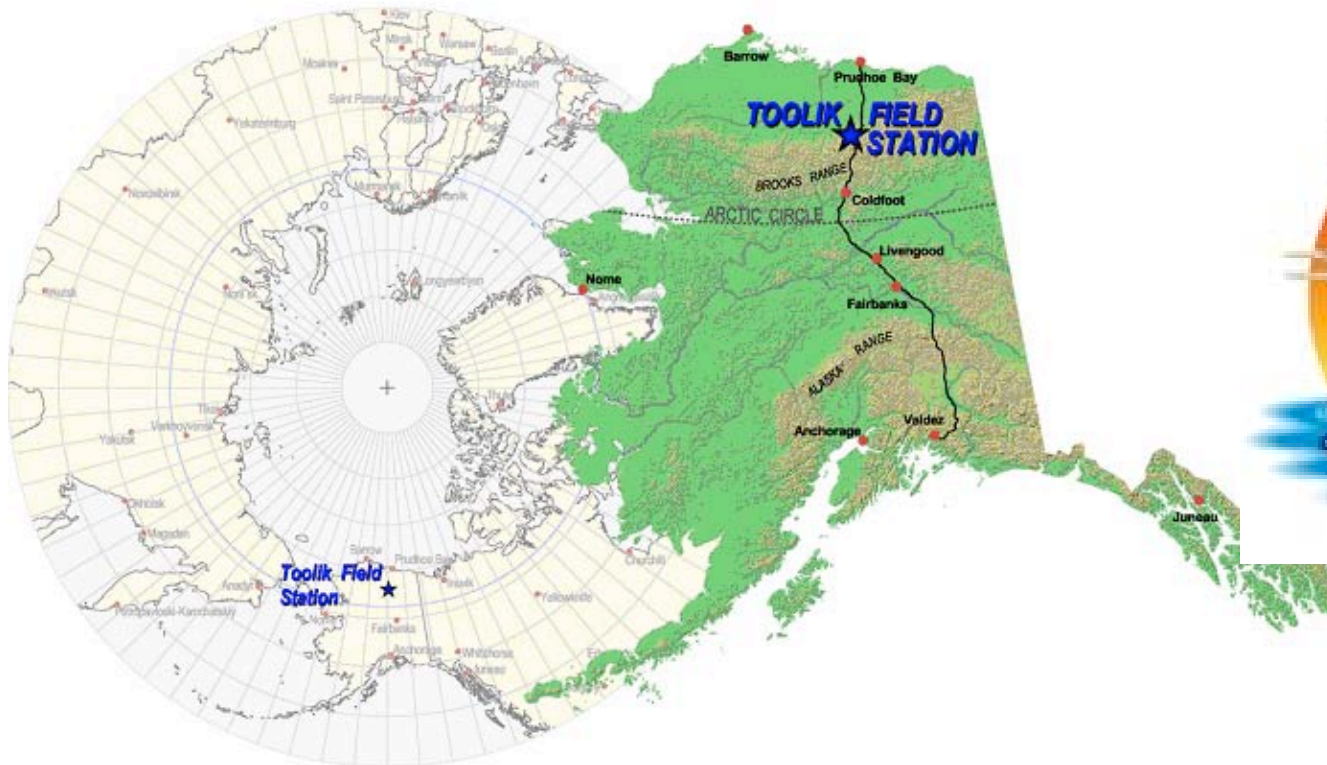


### A. Control plots



### B. Fertilized plots





**New elements: e.g., Winter C turnover**

**“Development” of prev. observed changes: e.g.,  
Shrub abundance**

**Identification of feedbacks:**

**Surface Energy balance  
C cycling/GH gases**

**Water**

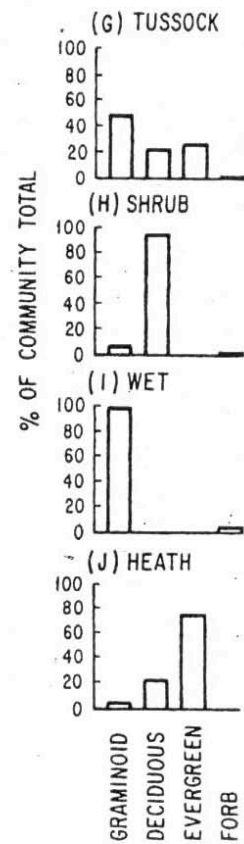
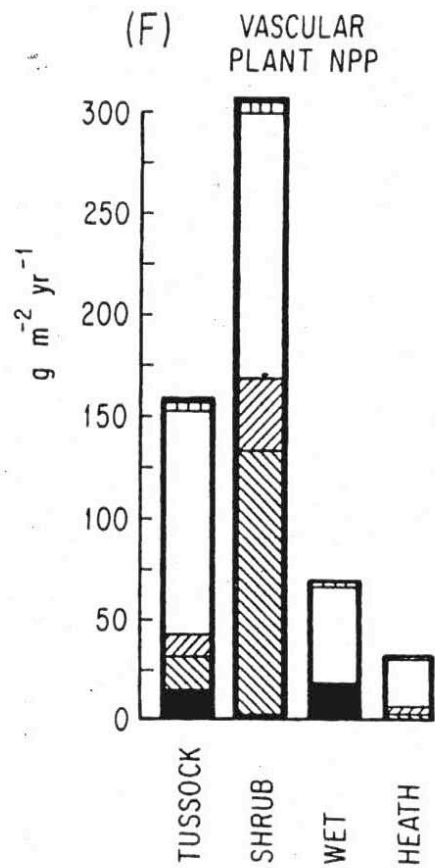
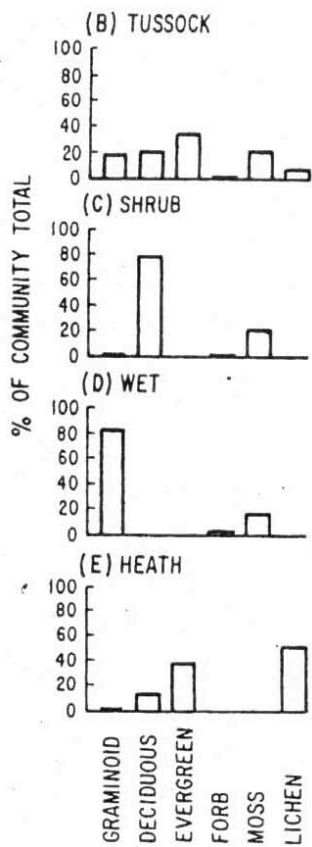
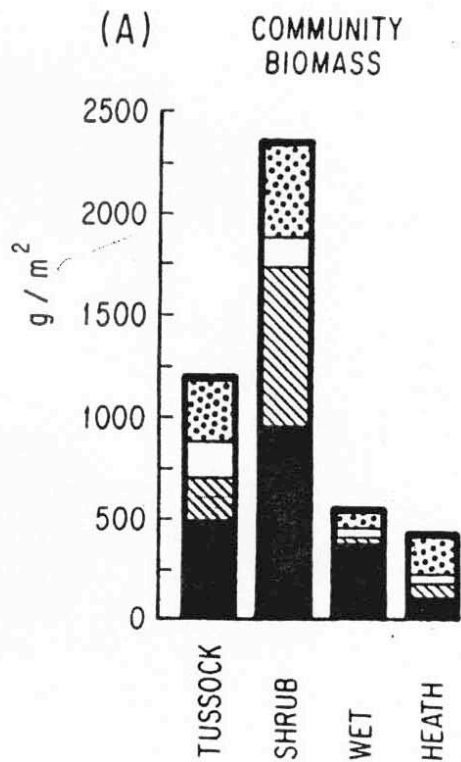
**Nutrients**

**Scales of change: longer time scale, coarser space  
scale than climate oscillations.**

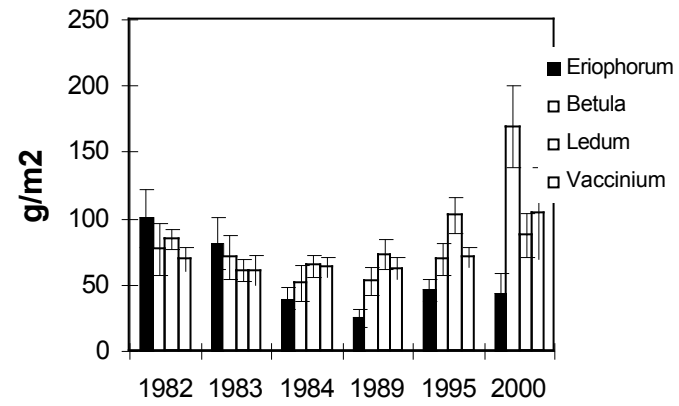




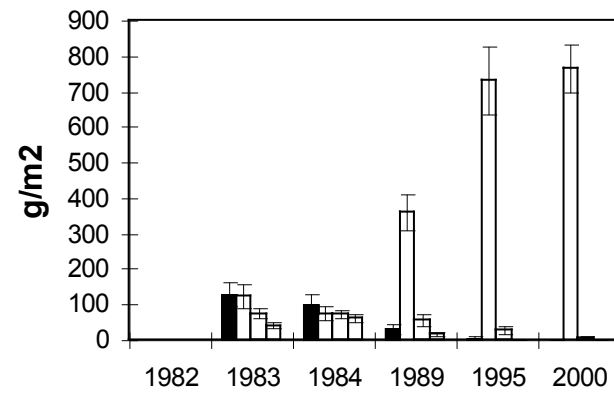




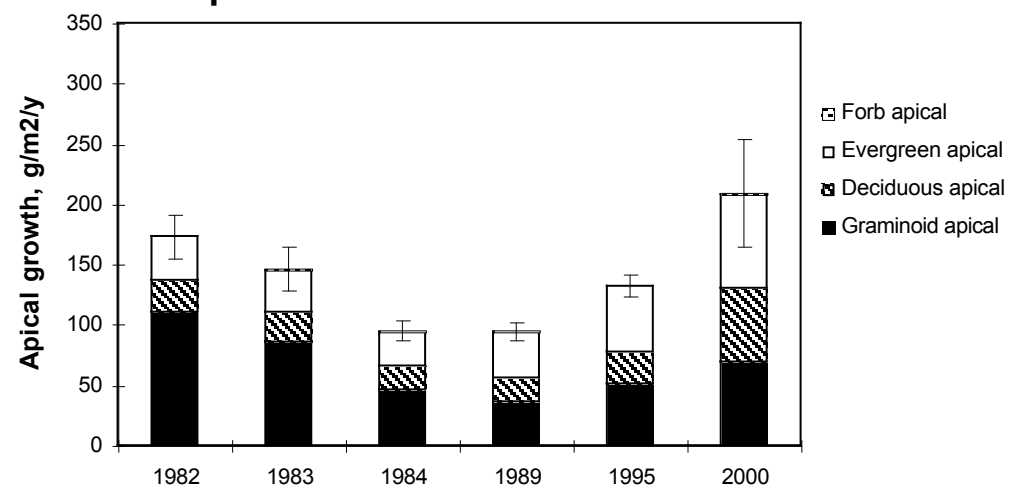
## A. Control Plots



## B. Fertilized plots



### A. Control plots



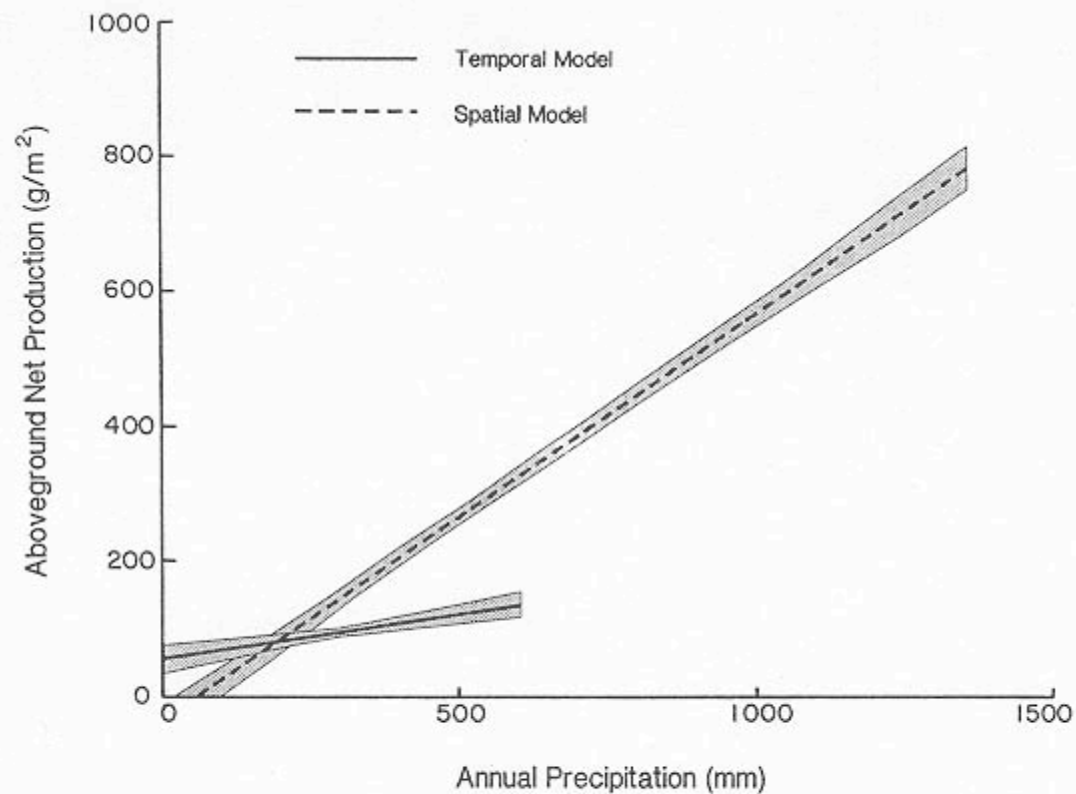
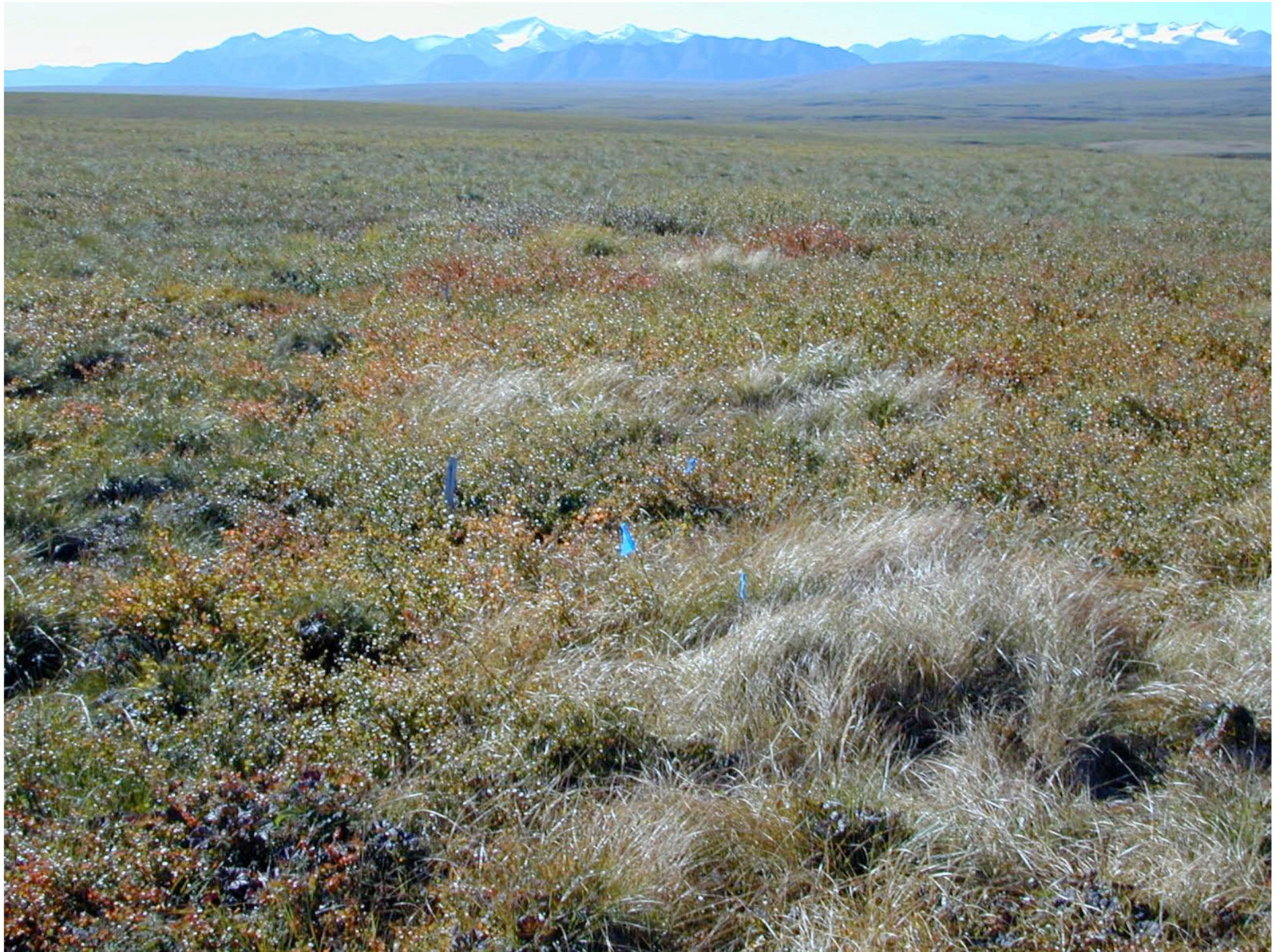
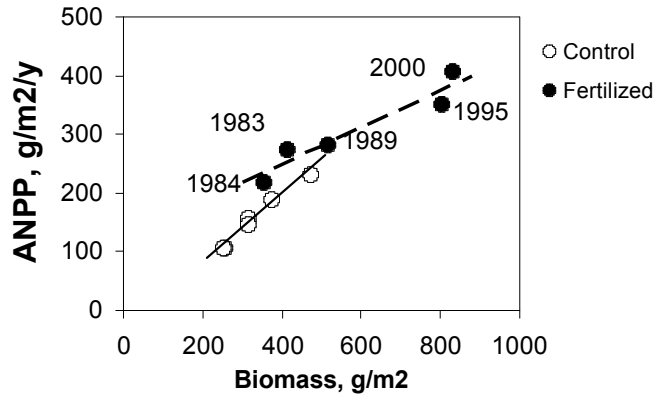


FIG. 2. Relationships between aboveground net primary production ( $\text{g/m}^2$ ) and annual precipitation (mm) for a regional model (Sala et al. 1988) for the Central Grassland Region of the U.S. and for the long-term model from this work for the Central Plains Experimental Range. Shaded areas represent 95% confidence intervals. Regional model  $\text{ANPP} = -34 + 0.60(\text{Ann. Precipitation})$ . Long-term model  $\text{ANPP} = 56 + 0.13(\text{Ann. Precipitation})$ .

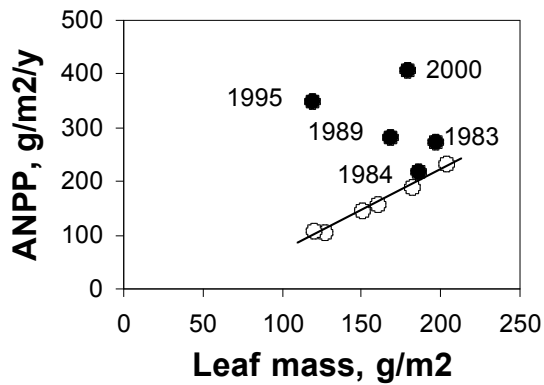




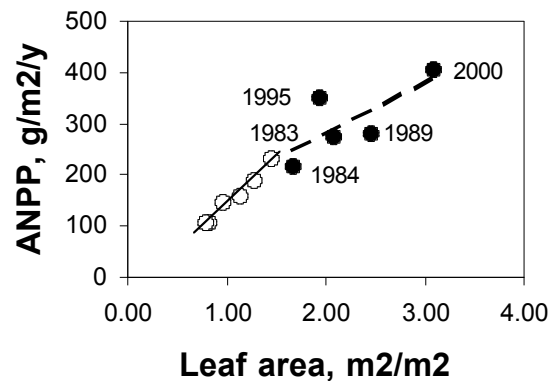
### A. ANPP vs biomass



### B. ANPP vs leaf mass

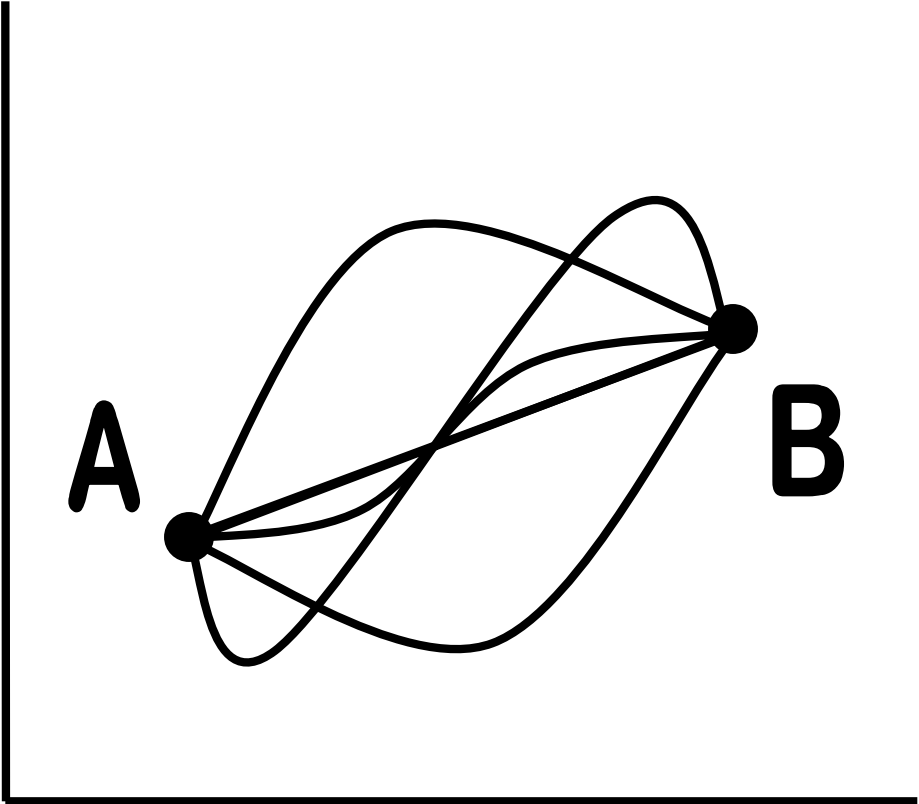


### C. ANPP vs. estimated leaf area



**Figure 4.** Aboveground net primary production versus biomass, leaf mass, and leaf area in the long-term fertilizer experiment at Toolik Lake, Alaska. Open symbols represent data from control plots; filled symbols represent fertilized plots. For the fertilized plots, the year of harvest is indicated for each data point. Data from 1983-1995 are from Shaver et al. 2001; data from 2000 are unpublished.

**SYSTEM  
PROCESS**



**SYSTEM STATE**