

What is plant  
ecophysiology?

Ecophysiology = Ecology +  
Physiology

## Ecology: definition

The study of the relationships between organisms and:

1. Each other
2. The environment

# Ecology: definition

The study of the relationships between organisms and:

1. Abiotic environment

2. Biotic environment

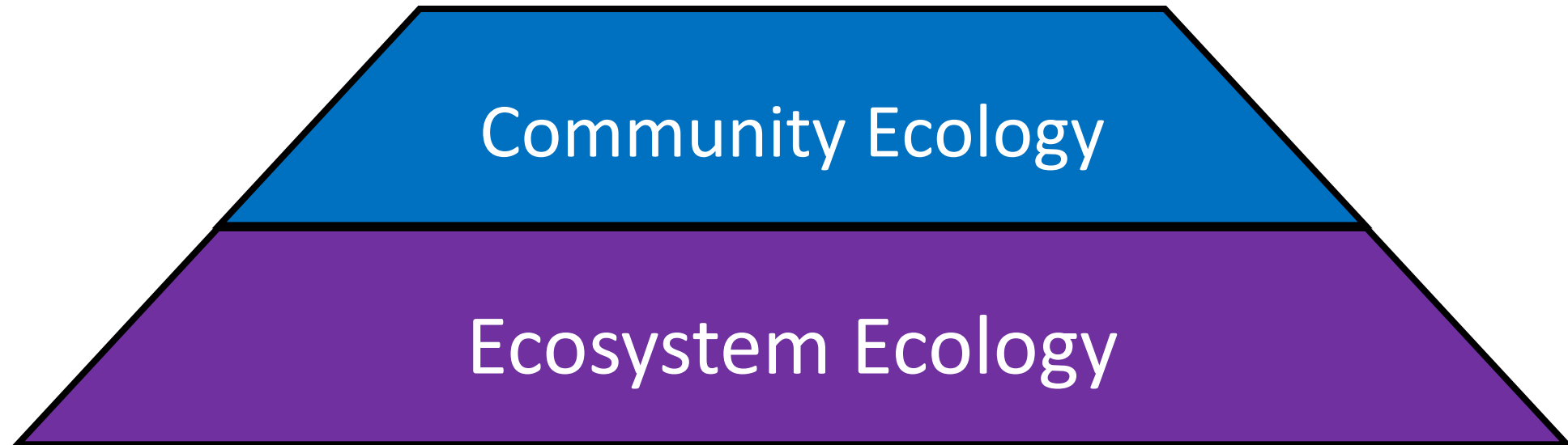
What aspects of the abiotic and biotic environment influence plant functioning?

# Hierarchy of Ecology

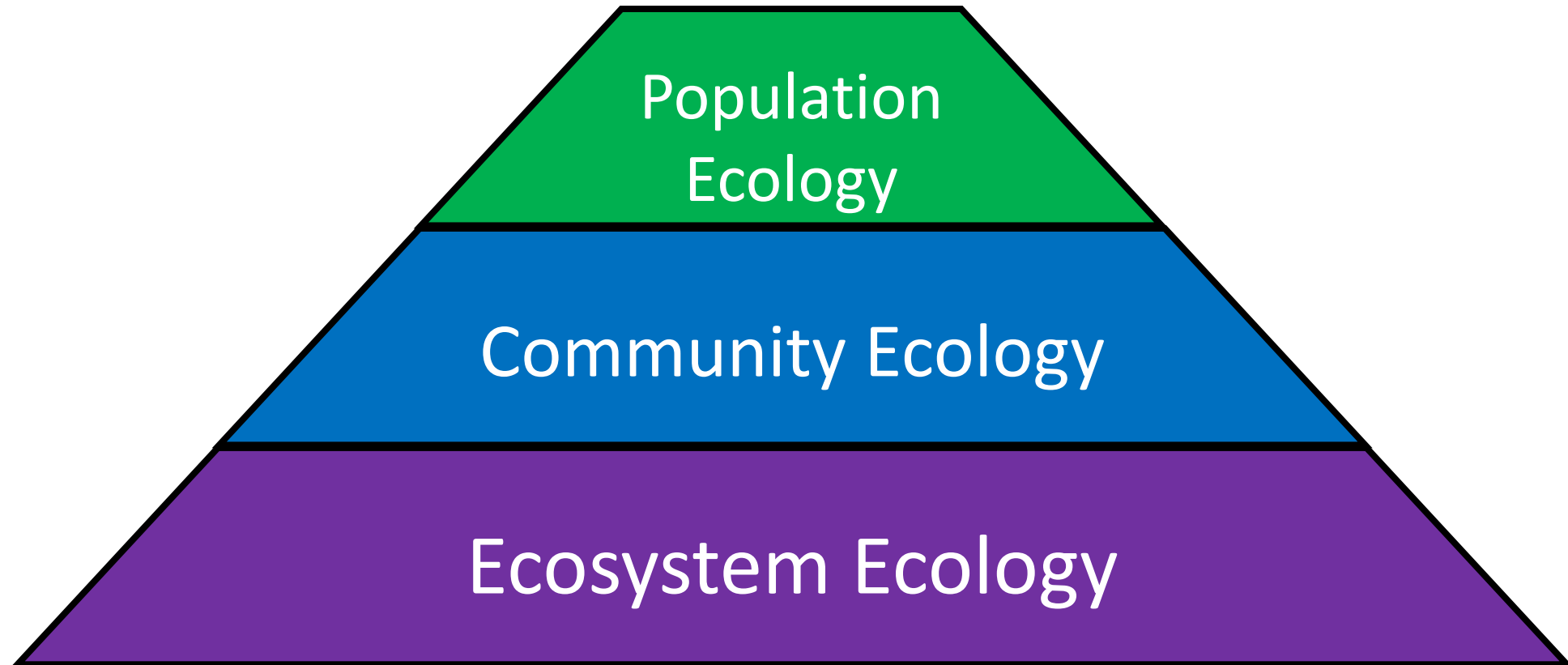


Ecosystem Ecology

# Hierarchy of Ecology

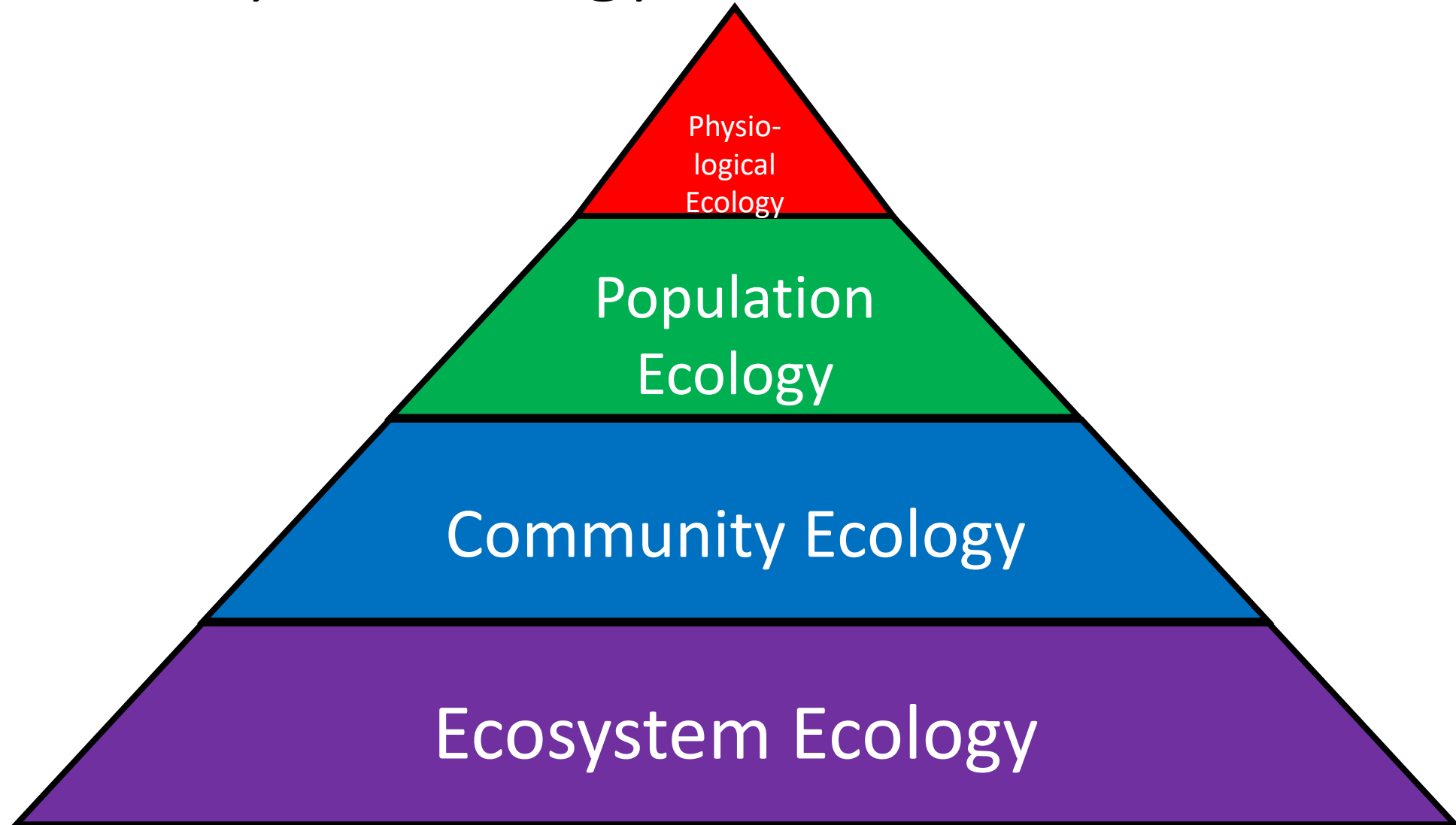


# Hierarchy of Ecology





# Hierarchy of Ecology



Physiology: a definition

The functioning of an organism that allows it to survive, grow, and reproduce

# Ecophysiology: a definition

Responses to environmental conditions  
observable at the *individual* level



Ecophys discussion: traits

# Discussion

- What is a plant trait?
- How do plants get their traits?

Functional traits are “morpho-physio-phenological traits which impact fitness indirectly via their effects on growth, reproduction, and survival, the three components of individual performance.”

# Let's talk about some traits...

Organ	Abbreviation	Definition	Units
Leaf	SLA	Specific leaf area	$\text{m}^2 \text{g}^{-1}$
	LMA	Leaf mass per area (1/SLA)	$\text{g m}^{-2}$
	$A_{\text{area}}$ or $A_{\text{mass}}$	Photosynthetic rate on a mass or area basis	$\mu\text{mol m}^{-2} \text{s}^{-1}$ or $\text{nmol g}^{-1} \text{s}^{-1}$
	$\Psi$	Leaf water potential	MPa
Stem	$k_{\text{stem}}$	Stem hydraulic conductivity	$\text{mmol m}^{-1} \text{s}^{-1} \text{MPa}^{-1}$
	[no symbol]	Wood density	$\text{g m}^{-3}$
Root	SRL	Specific root length	$\text{m g}^{-1}$
All	$R_{\text{area}}$ or $R_{\text{mass}}$	Respiration rate on a mass or area basis	$\mu\text{mol m}^{-2} \text{s}^{-1}$ or $\text{nmol g}^{-1} \text{s}^{-1}$
Whole-plant	RGR	Relative growth rate	$\text{g g}^{-1} \text{day}^{-1}$

...but characteristics can also be traits

- Photosynthetic pathway (C3 or C4)
- Growth form (tree, shrub, forb, grass)
- Lifespan (annual, perennial)
- Mycorrhizal association (AM, ECM)
- Etc.



# Discussion

- What is the difference between acclimation and adaptation?
- How would you know?

Why do we care about plants and their traits? Discussion of Chapin (2003)

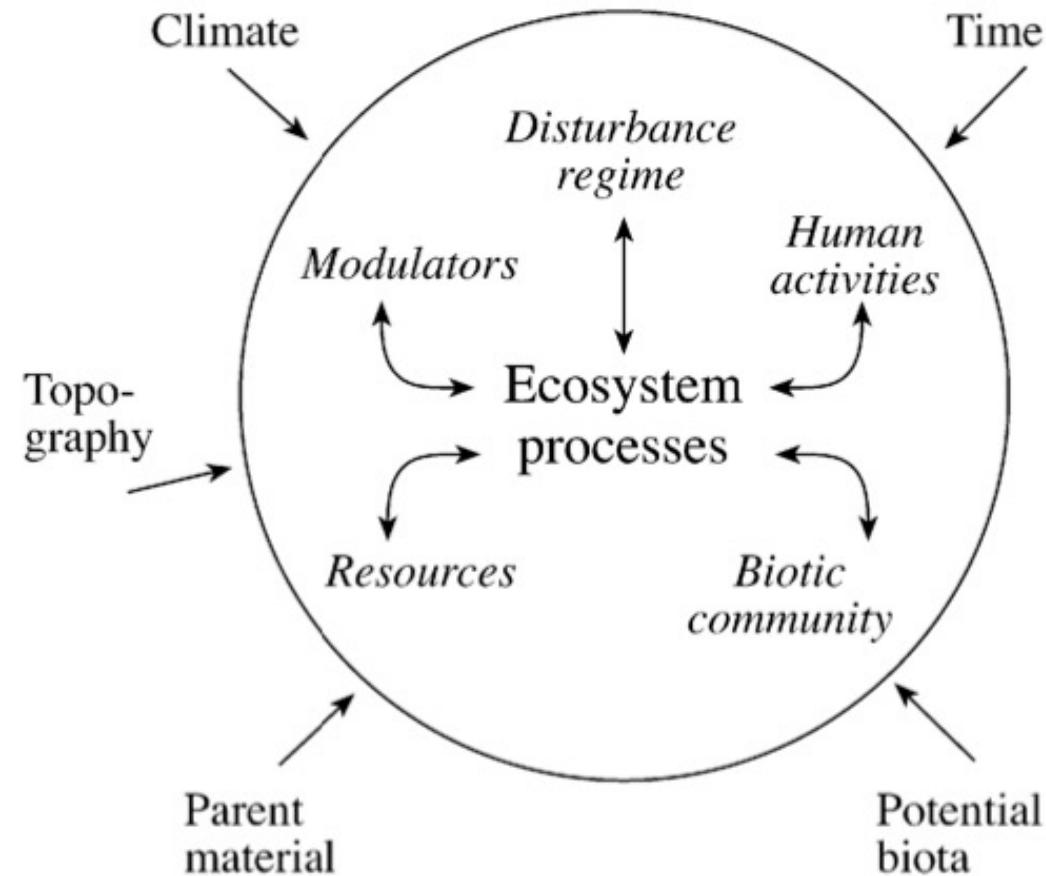


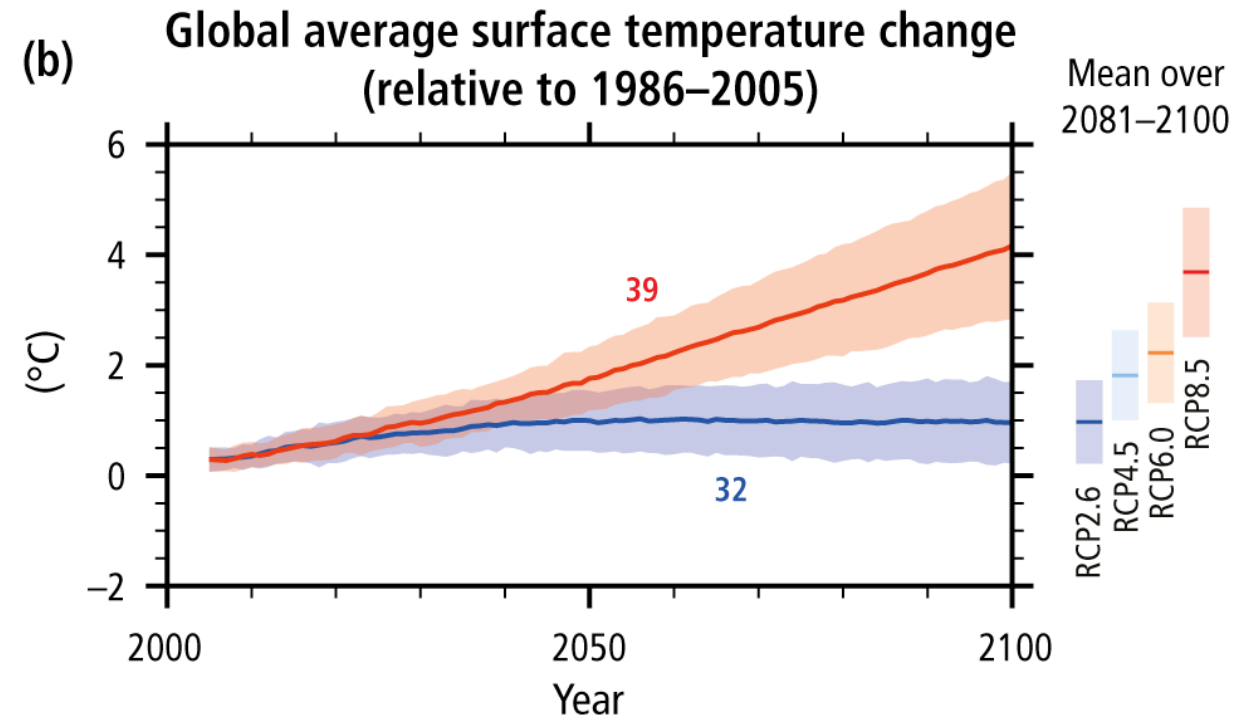
FIG. 1. The relationship between state factors (outside the circle), interactive controls (inside the circle) and ecosystem processes. The circle represents the boundary of the ecosystem. Reprinted from Chapin *et al.* (2002), with the permission of Springer-Verlag.

# Ecosystem Service



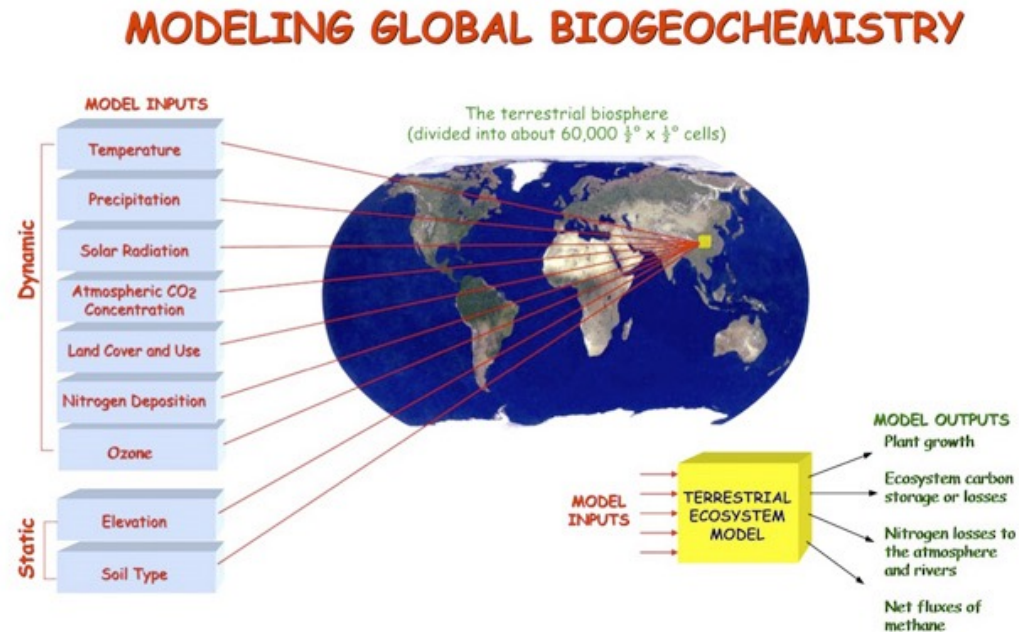
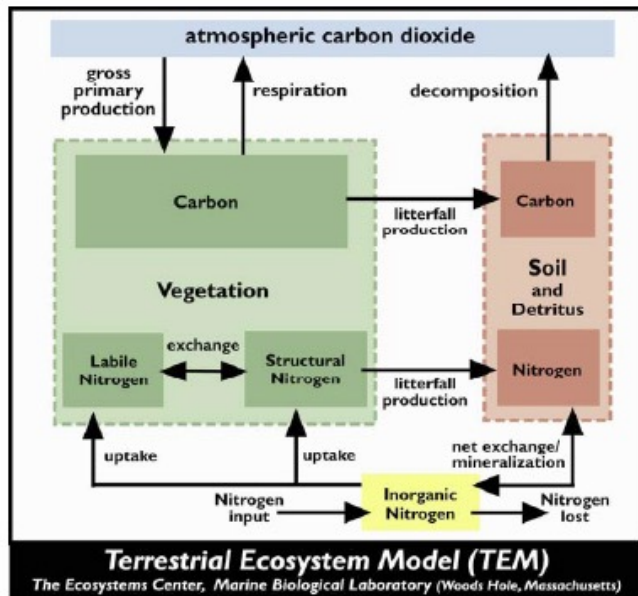
# Global changes to state factors

- Changes in atmospheric gas concentration (e.g., elevated CO<sub>2</sub>)
- Warming temperatures
- Altered precipitation patterns
- Nutrient deposition



# Plants as interactive controls

- Biodiversity
- Disturbance regulators (e.g., fire)
- Movers of resources
- Modulators (e.g., albedo, microclimate)
- Interaction with humans (e.g., agriculture)



To understand how ecosystem services will change in the future, we need to understand plants

Questions/thoughts about  
Chapin (2003)?