

# The Ecosystem Concept

What is ecosystem ecology?

# Ecology: definition

The study of the relationships between organisms and:

1. Each other
2. The environment

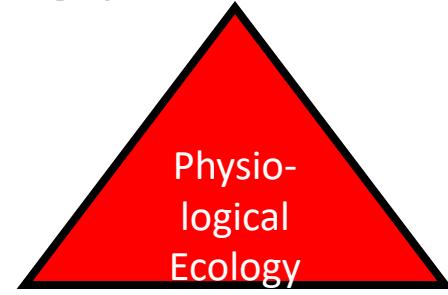
# Ecology: definition

The study of the relationships between organisms and:

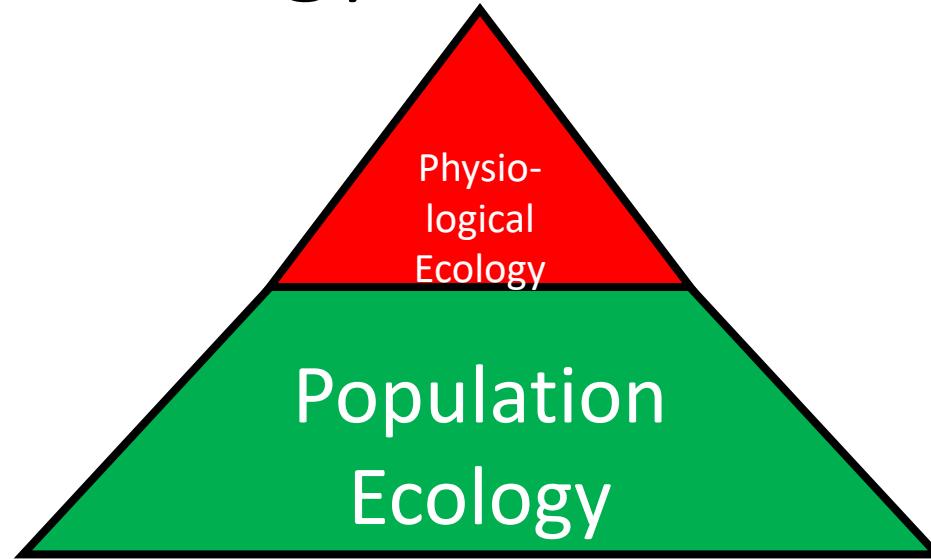
1. Abiotic environment
2. Biotic environment

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

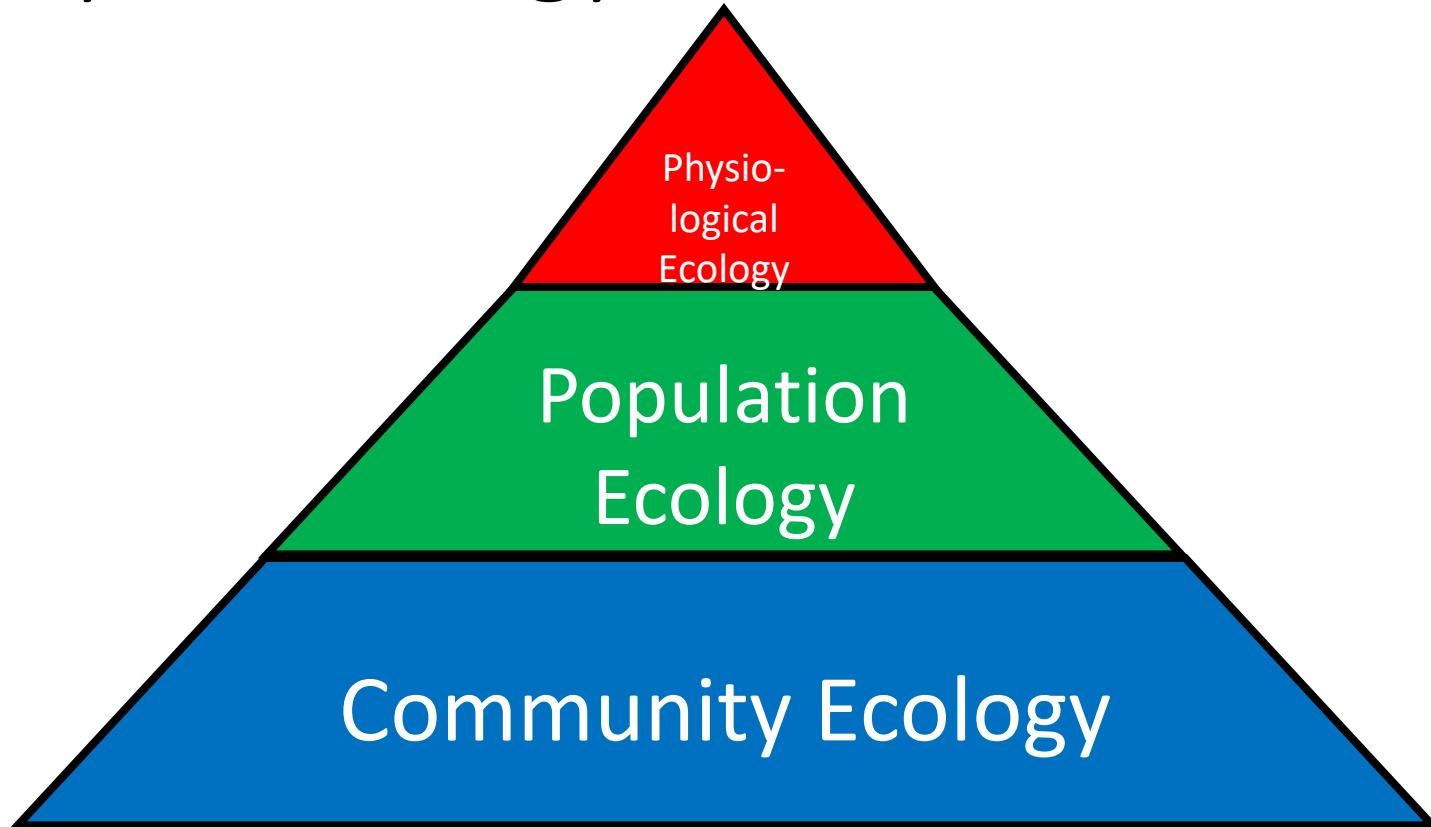
# Hierarchy of Ecology



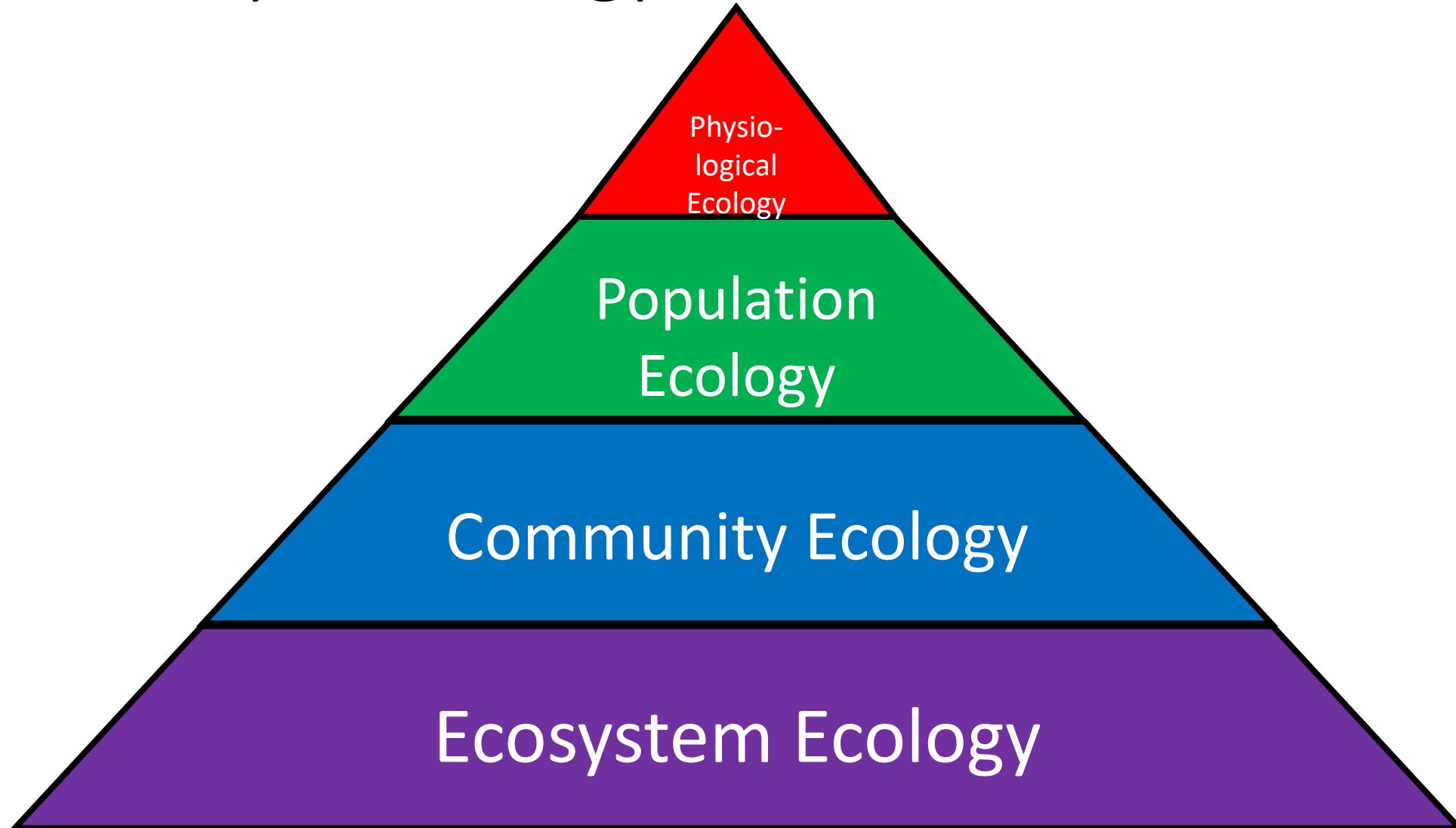
# Hierarchy of Ecology



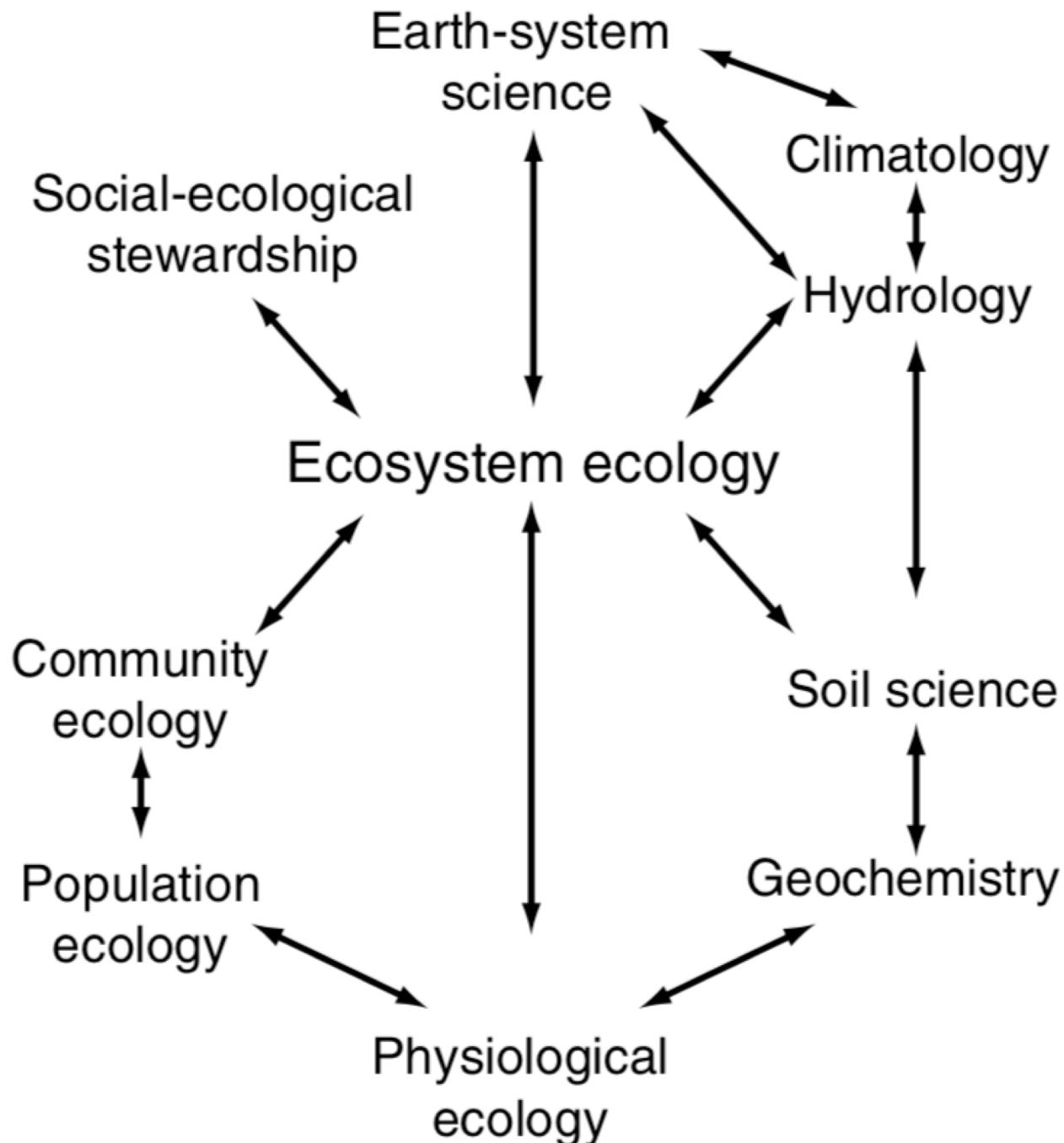
# Hierarchy of Ecology



# Hierarchy of Ecology



Ecosystem ecology is the study of the interactions between organisms and their environment as an integrated system



What is an ecosystem? Example?

How big is an ecosystem?

**a**  
Global ecosystem



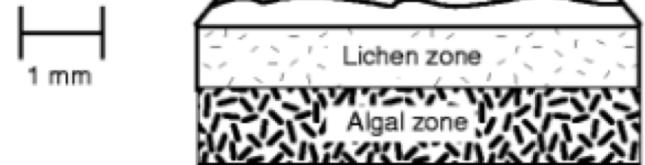
**b**  
Drainage basin



**c**  
Forest ecosystem



**d**  
Endolithic ecosystem



Ecosystems can vary in size!

**a**  
Global ecosystem



**b**  
Drainage basin



**c**  
Forest ecosystem



**d**  
Endolithic ecosystem



## Ecosystems can vary in size!

(but must include multiple organisms interacting with their abiotic and biotic environments)

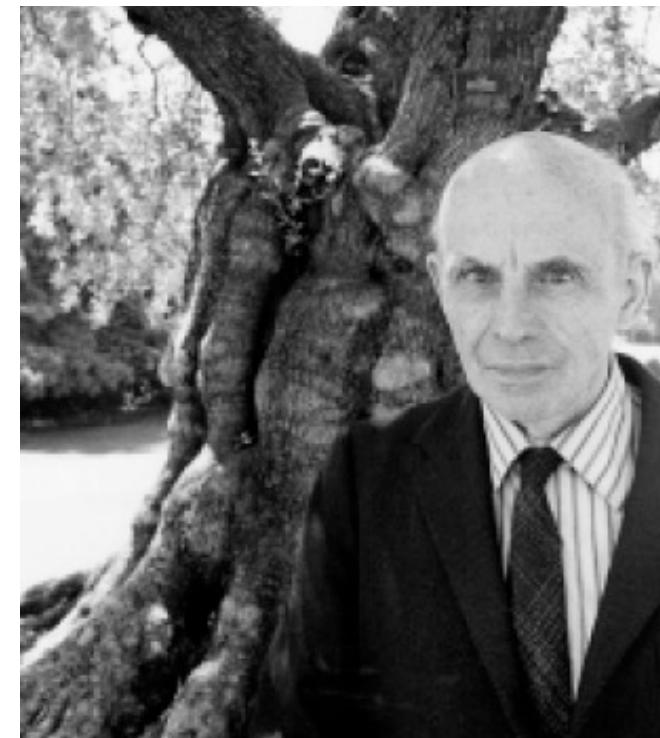
Ecosystem Processes: “things an ecosystem does”

What are some examples of  
ecosystem processes?

# Controls Over Ecosystem Processes

Hans Jenny (US soil scientist) in 1941 first to formalize a quantitative model of soil formation as well as the “state factors” that set the bounds for characteristics of an ecosystem:

**S = f (climate,  
organisms,  
relief/topography,  
parent material, time)**



Example: succession is the result  
of state factor changes

# CLIMATE

## Climate

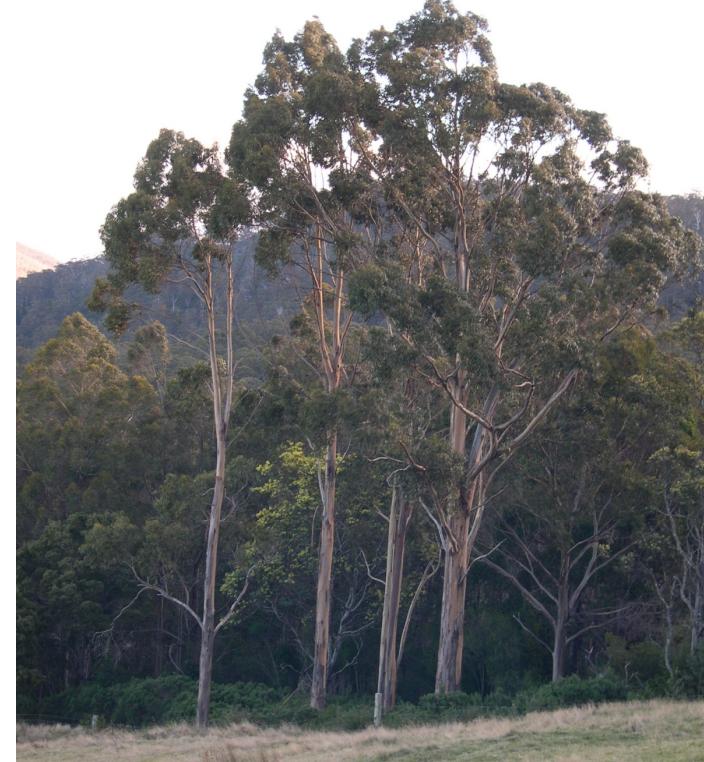


- \* Precipitation
- \* Temperature

C  
I  
O  
R  
P  
T



## Organisms



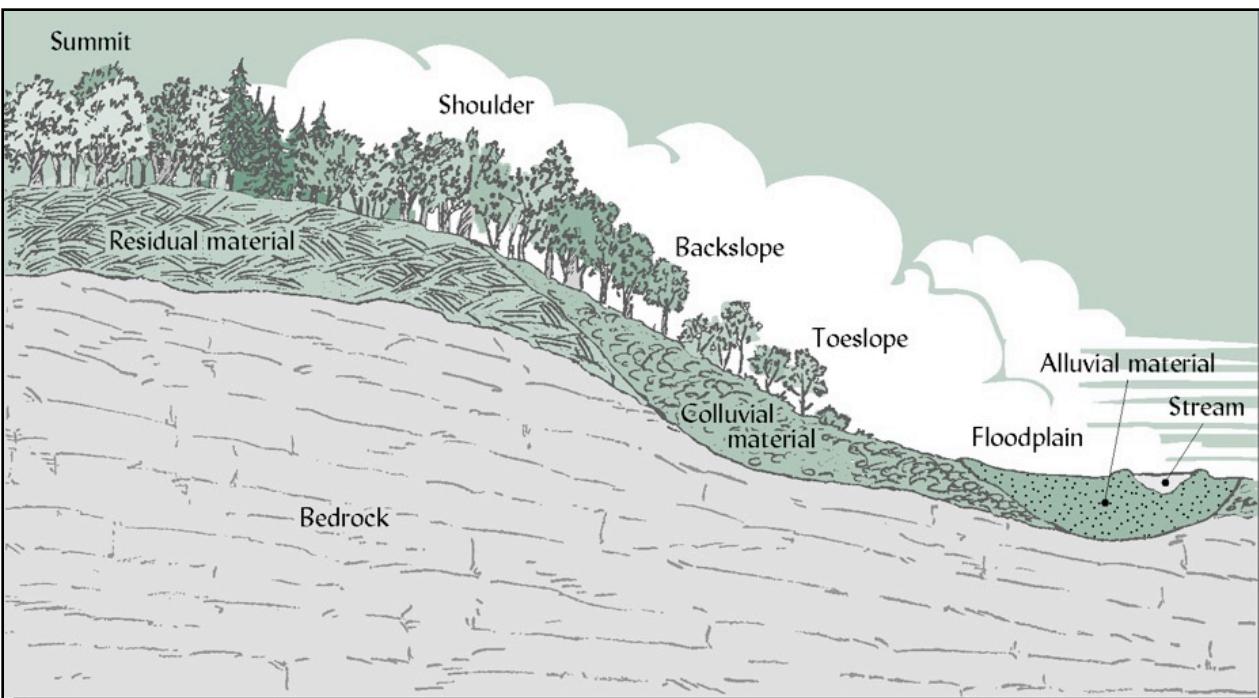
C

O

# R Relief/Topography

P

T



# P Parent Material

C  
O  
R  
T



**Igneous** (basalt)



**Metamorphic** (schist)

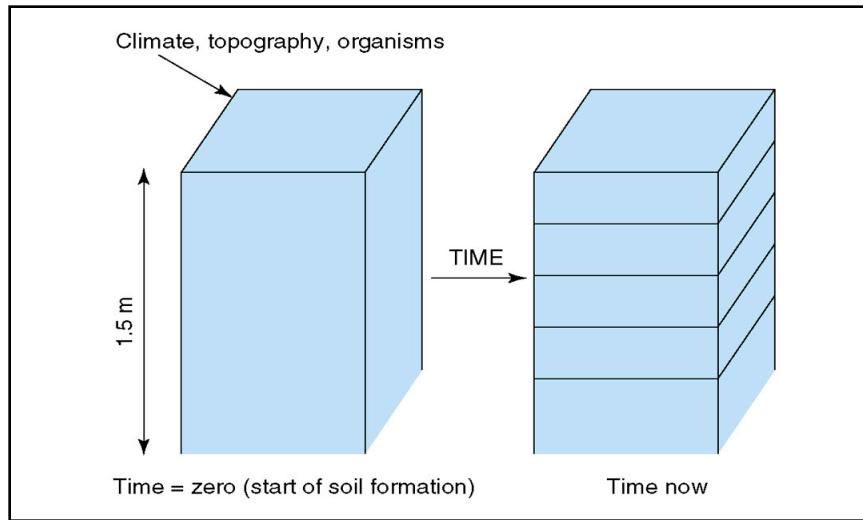
**Sedimentary**  
(sandstone)



C  
O  
R  
P  
T

Time

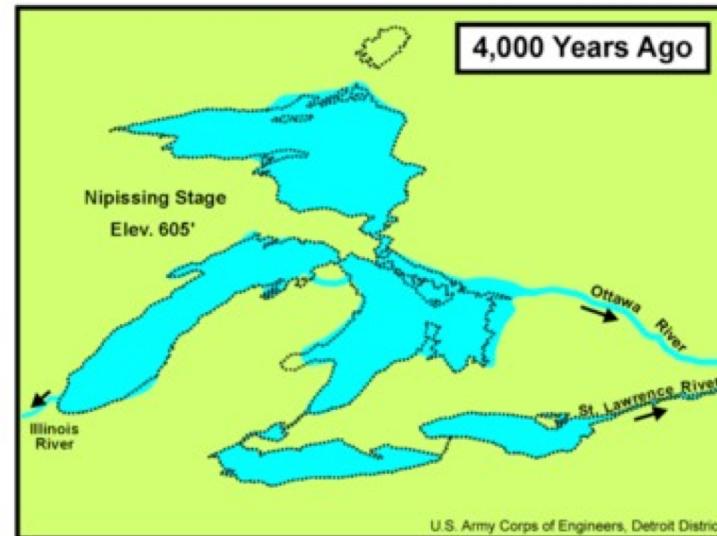
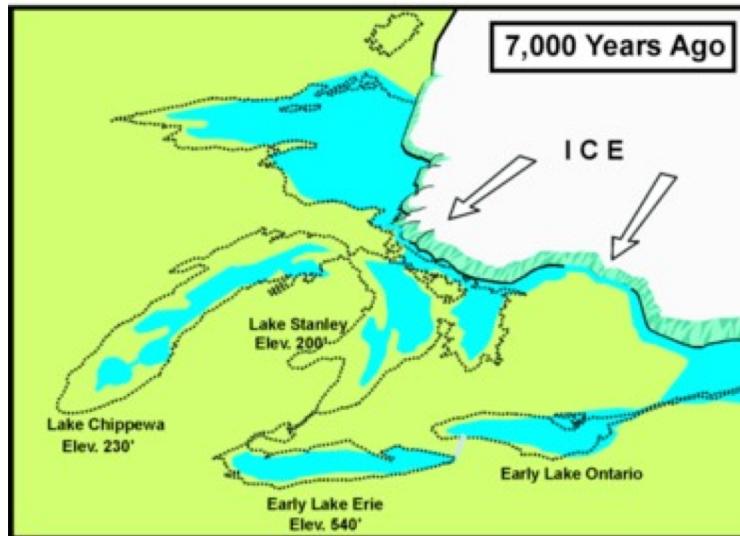
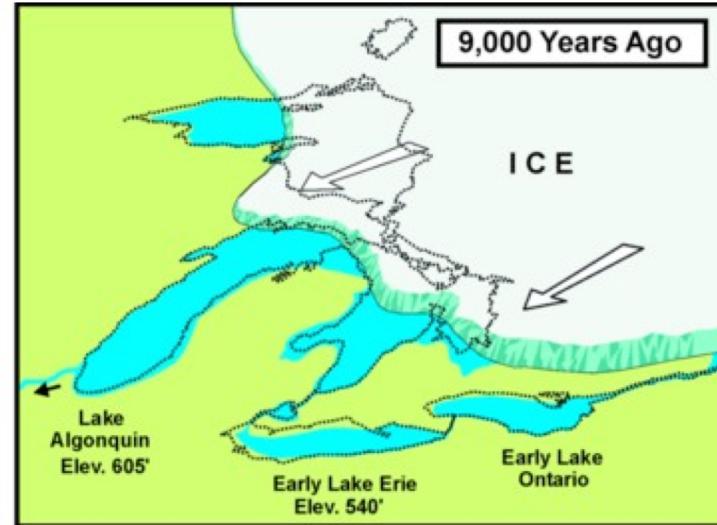
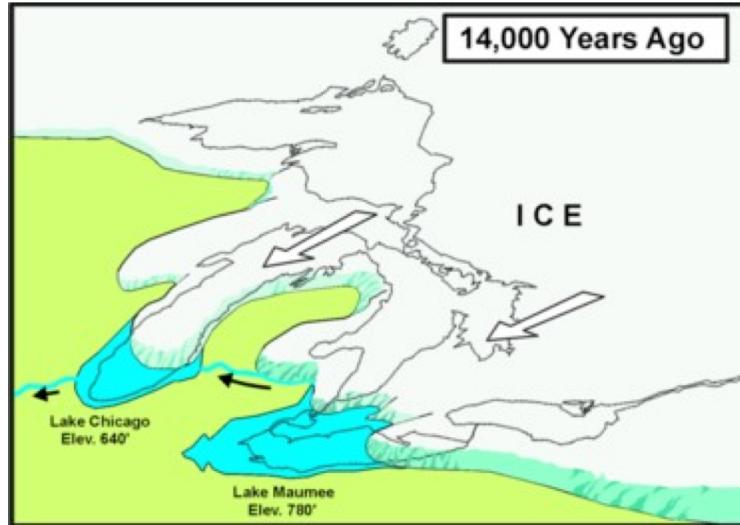
## Development of Soil



## Evolution



# Lake Michigan dunes



U.S. Army Corps of Engineers, Detroit District

# Lake Michigan dunes

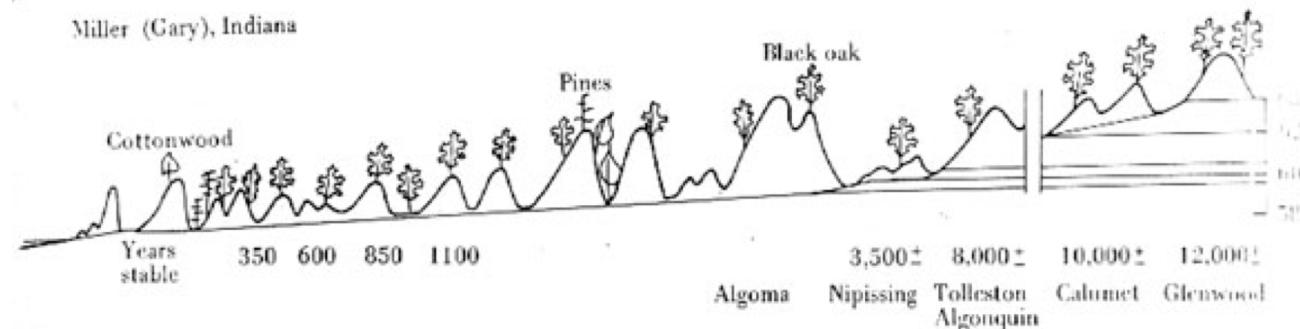
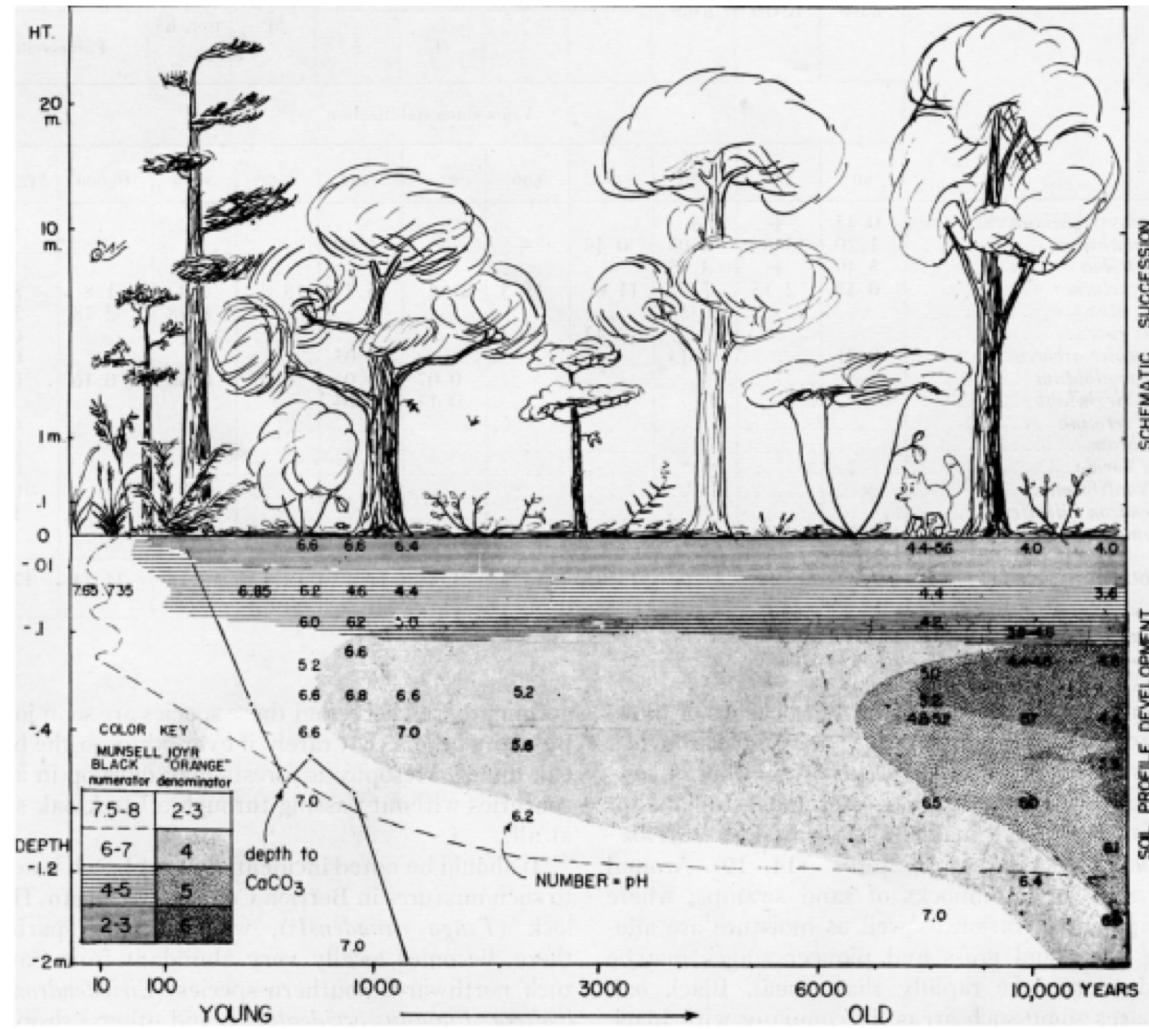


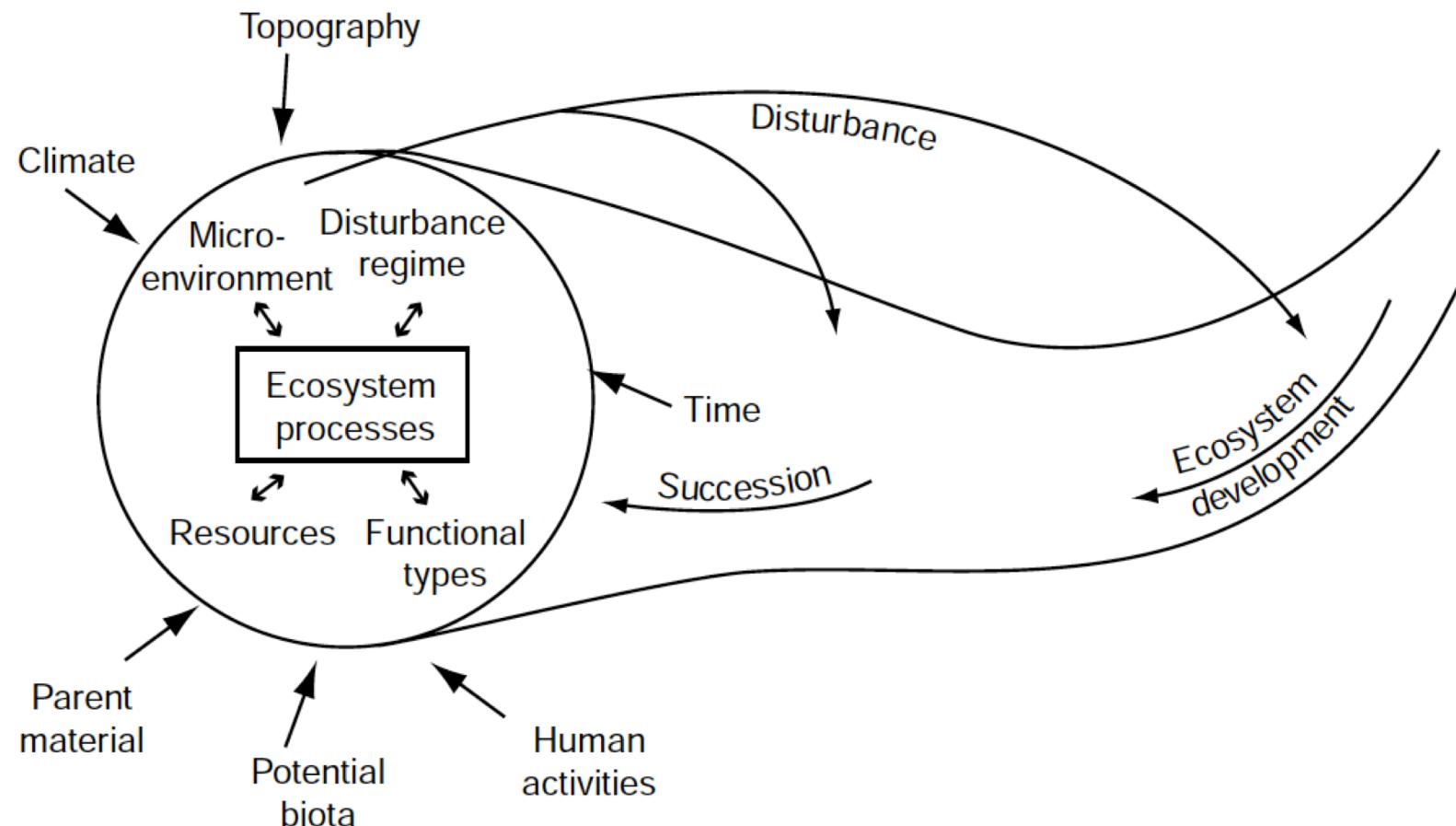
Figure 22.4. Diagrammatic profiles across Indiana sand dunes at the southern end of Lake Michigan. Successively older dune systems originated along earlier and higher beaches. (After Olson 1958.)

# Lake Michigan dunes

- Beaches
  - Low nutrient environments
  - Unstable soils
  - Few plants (sea rocket)
- Foredunes
  - Soil stabilized by grasses
  - Low nutrient soils
  - Grasses and wildflowers
- Dune forests
  - Better soils
  - Competition is for light (tall plants)



Olson (1958)



In your book, but modified from Chapin et al. (2006)



# Climate



Wet ----- Dry

# Organisms



Diverse ----- Depauperate

# Topography



Steep ----- Flat

# Parent Material

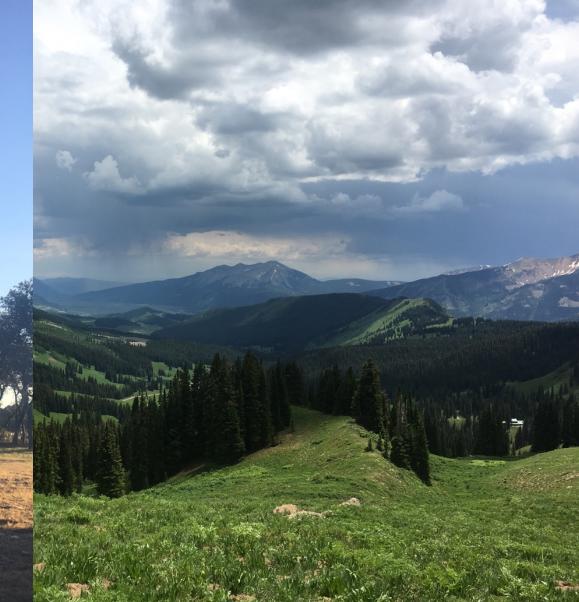


Igneous

Sedimentary

Basalt

# Time

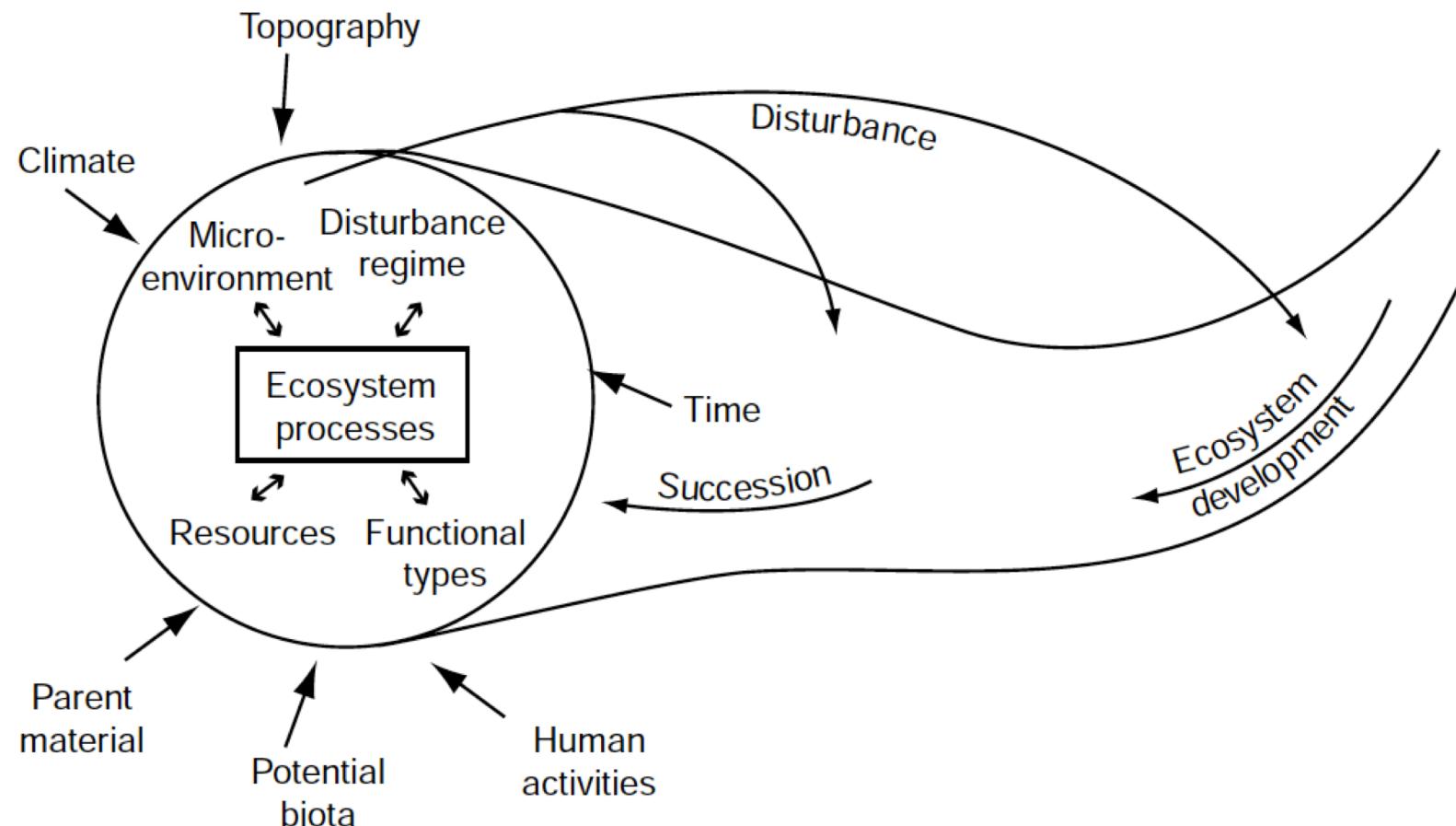


Old

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Recent





In your book, but modified from Chapin et al. (2006)

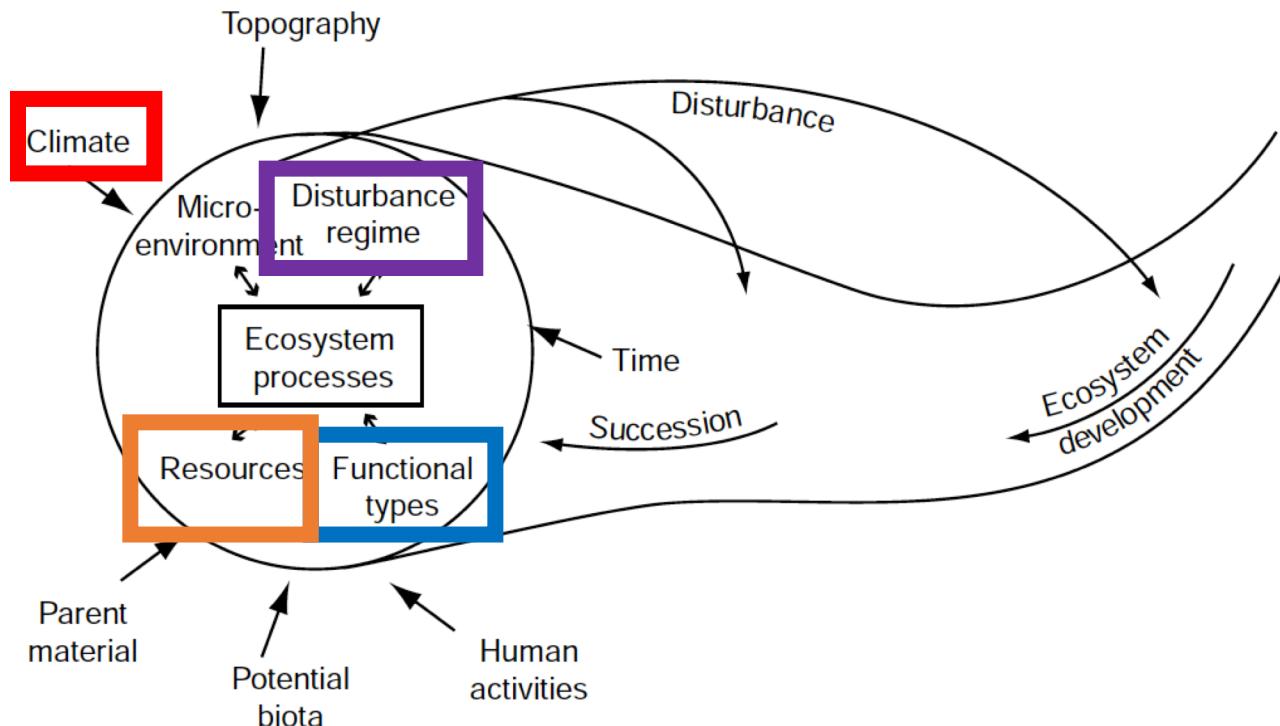
Ecosystem Services: “things an ecosystem provides”

What do humans get from  
ecosystems?



# Systems Thinking Exercise

# Humans are altering things! What does this mean for an ecosystem?



## Climate

Elevated CO<sub>2</sub>

Elevated Temperatures

More variable precipitation

## Functional types

Invasive species

Woody encroachment

## Disturbance regime

Fire frequency

Land clearing

## Resources

Nutrient addition

# Assignment (groups of 2-4)

- Pick an ecosystem
- Pick an anthropogenic disturbance
- Use a box (pool) and arrow (flux) diagram to explain the effect on ecosystem processes and services

Climate

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