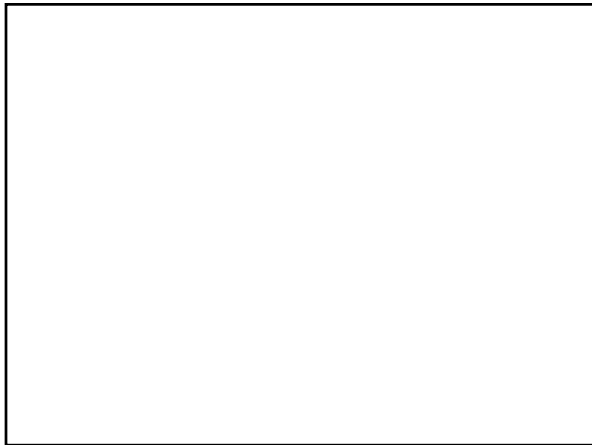


## Community Change: disturbance and succession

Reading: Chap. 20

- |                       |                                     |
|-----------------------|-------------------------------------|
| I. Disturbance        | II. Succession                      |
| A. Disturbance:       | A. Primary and secondary succession |
| Frequency             | B. Changes in species composition   |
| Intensity             | - Pioneers, climax species          |
| Scale                 | C. Changes in species richness      |
| B. Stability:         | D. Changes in physical factors      |
| Resistance/resilience | E. Changes in ecosystem properties  |
|                       | F. Mechanisms of succession         |



- I. Disturbance
- A. Disturbance:

Any physical force that results in mortality of organisms or loss of biomass.

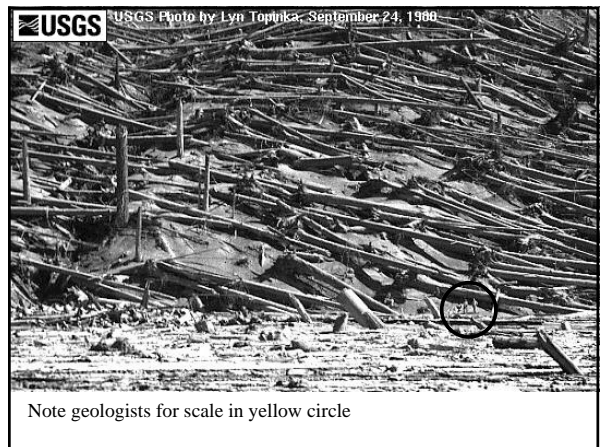
Any physical force?  
What qualifies as “disturbance”?

[http://vulcan.wr.usgs.gov/Photo/SlideSet/ljt\\_slideset.html](http://vulcan.wr.usgs.gov/Photo/SlideSet/ljt_slideset.html)



USGS

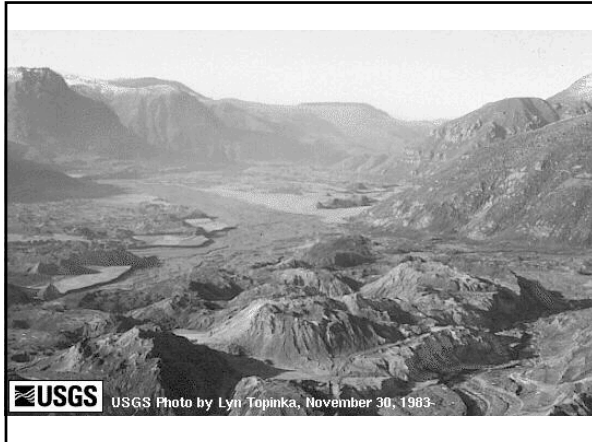
USGS Photo by D.A. Swanson, May 18, 1980



USGS

USGS Photo by Lyn Topinka, September 24, 1980

Note geologists for scale in yellow circle



## What about?

- A single tree fall?
  - A log rolling against rocks in the intertidal zone?
  - A gopher mound?
  - An outbreak of gypsy moths?

### I. Disturbance

#### A. Disturbance:

Any physical force that results in mortality of organisms or loss of biomass.

Frequency - how often a disturbance event occurs

Intensity - how strong that event is (how much mortality is caused).

Scale - how large an area it covers

## How do biotic communities respond to disturbance?

### B. Stability: resistance, resilience

- Resistance: the ability of a community or ecosystem to maintain structure and/or function in the face of potential disturbance
- Resilience: the ability of a community or ecosystem to return to its original conditions following disturbance

Draw it



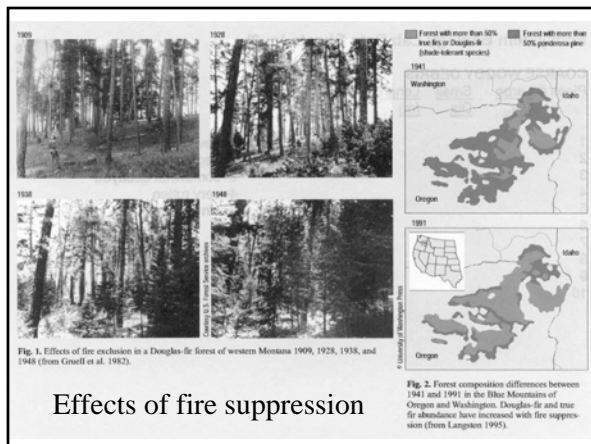
## What affects resistance and resilience?

- Frequency
- Intensity
- Scale
- and ...?

## Grasslands, California

Tropical dry forest, Palo Verde, Costa Rica

- The extent of resistance or resilience to a given disturbance will depend on the adaptations of the organisms affected.
- This depends on their historic exposure to that disturbance over evolutionary time.
- Humans are greatly altering disturbance cycles – both increasing and decreasing.



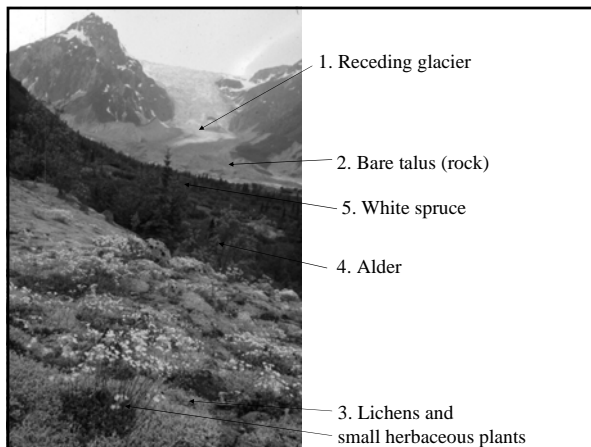
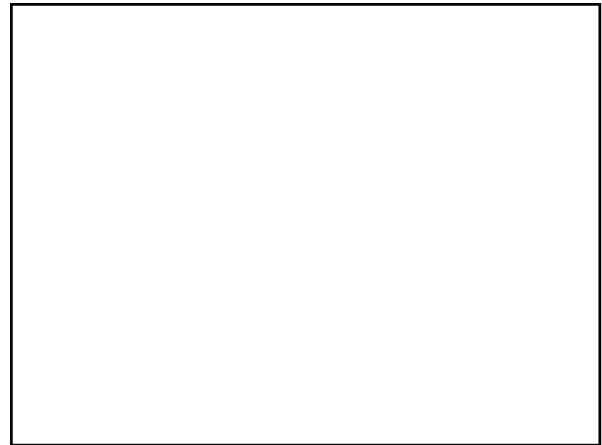
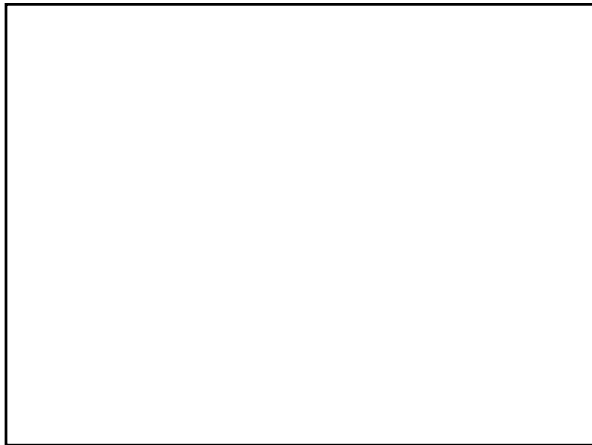
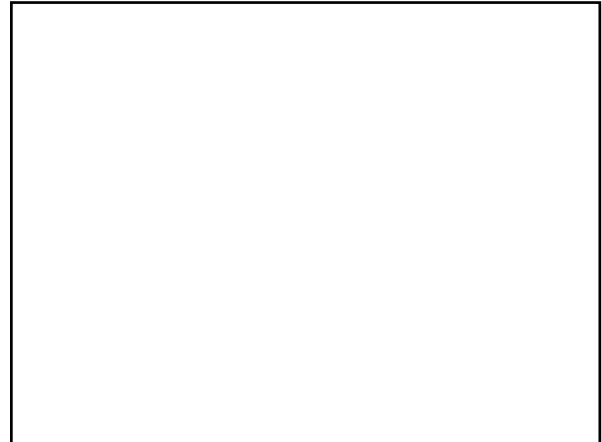
## II. Succession

Change in species composition of a community over time following disturbance

## A. There are two types of succession

### 1. Primary succession - growth on a new mineral substrate

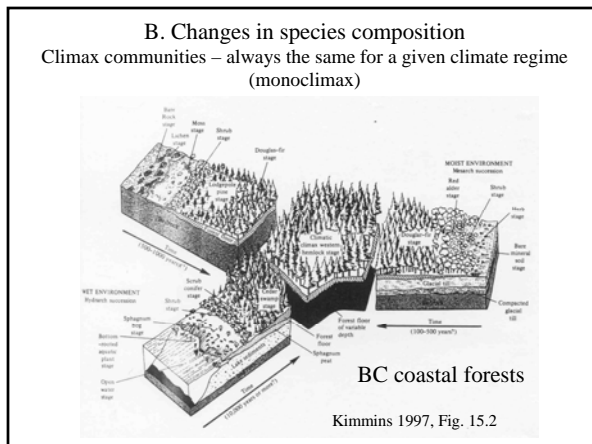
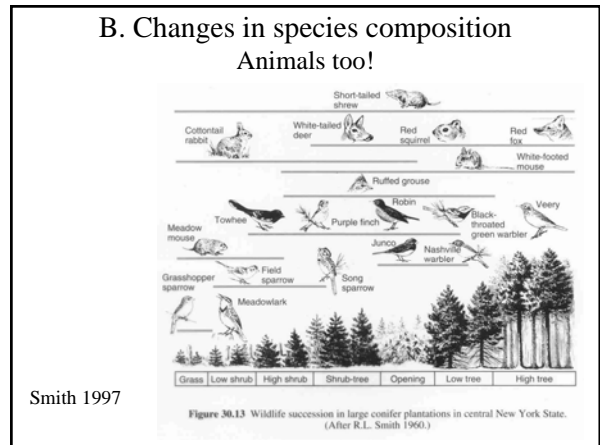
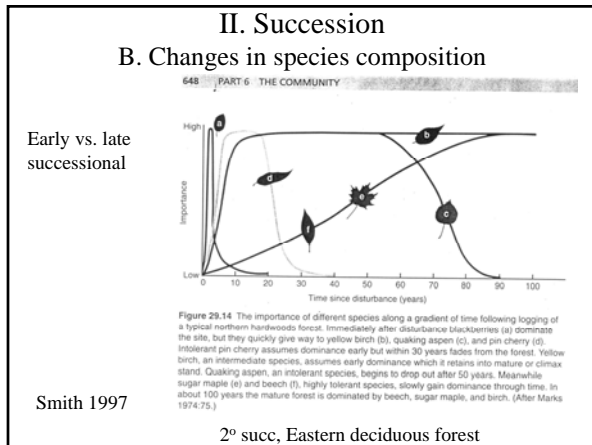
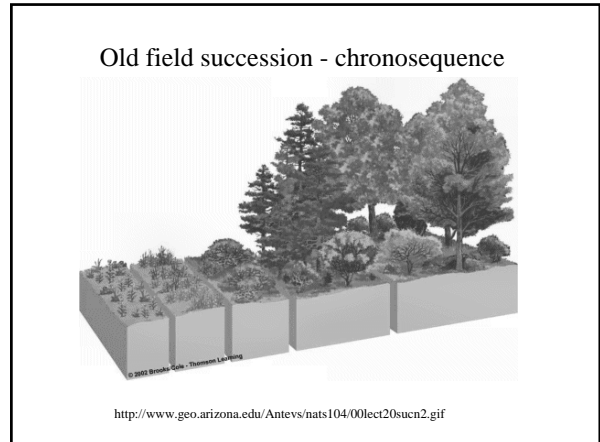
- Volcanic deposition
- Glaciation
- Landslide
- Sand dunes
- River bars



## Types of succession

### 2. Secondary succession - new organisms but soil remains intact from previous community.

- Fire
- Clearcut
- Insect outbreak
- Hurricane/storm damage
- Agriculture - old fields



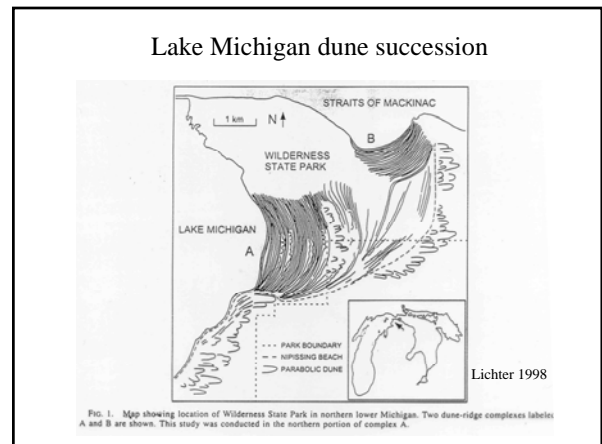
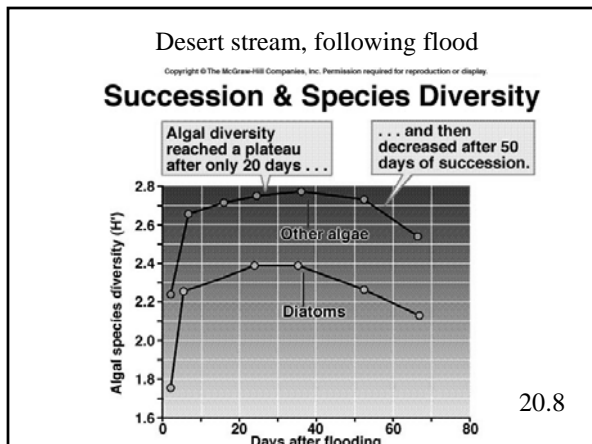
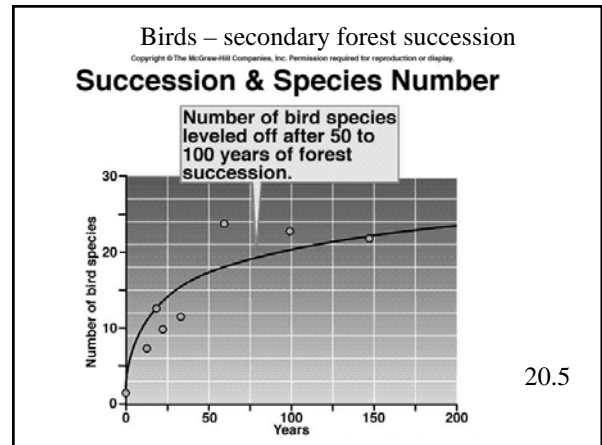
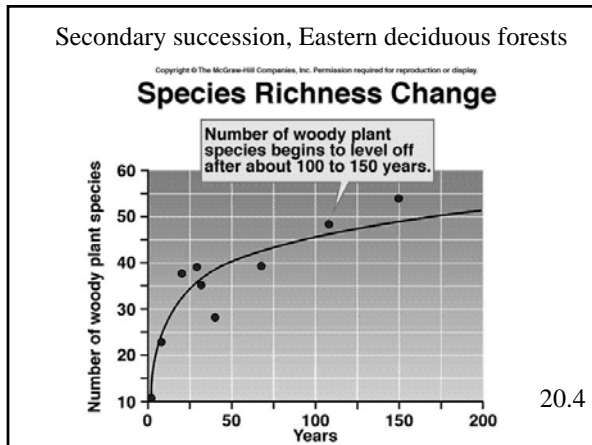
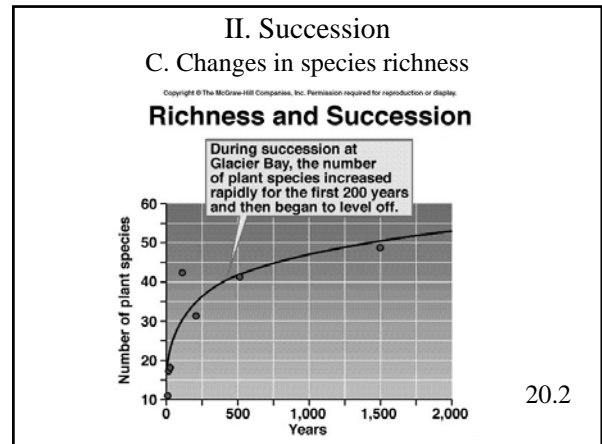
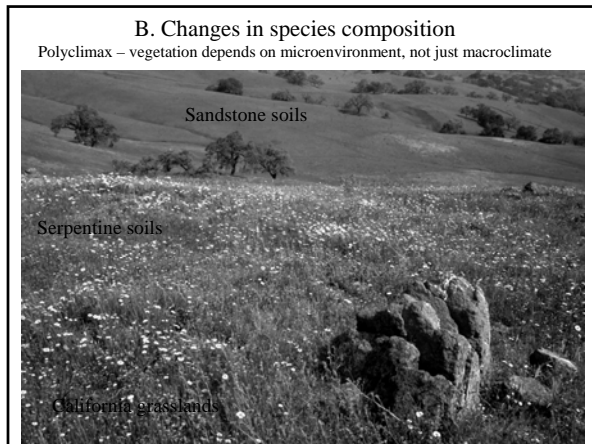
## B. Changes in species composition

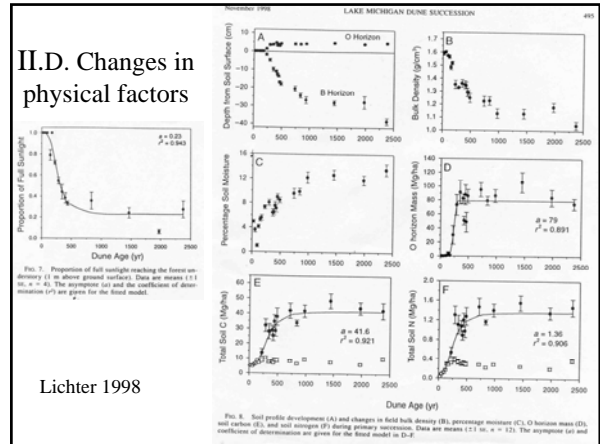
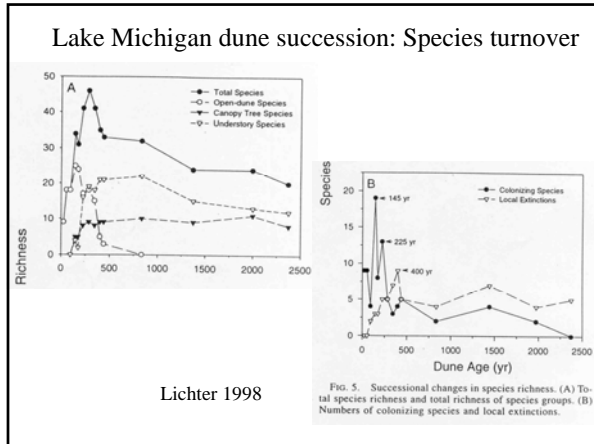
- Species characteristics (life history traits)

Smith 1997

Characteristic	Early Succession	Late Succession
Photosynthesis		
Light saturation intensity	high	low
Light compensation point	high	low
Efficiency at low light	low	high
Photosynthetic rate	high	low
Respiration rate	high	low
Water-use efficiency		
Transpiration rate	high	low
Mesophyll resistance	low	high
Seeds		
Number	many	few
Size	small	large
Dispersal distance	large	small
Dispersal mechanism	wind, birds, bats	gravity, mammals
Viability	long	short
Induced dormancy	common	uncommon?
Resource acquisition rate	high	low?
Recovery from nutrient stress	fast	slow
Root-to-shoot ratio	low	high
Mature size	small	large
Structural strength	low	high
Growth rate	rapid	slow
Maximum life span	short	long

Sources: Huston and Smith 1987.

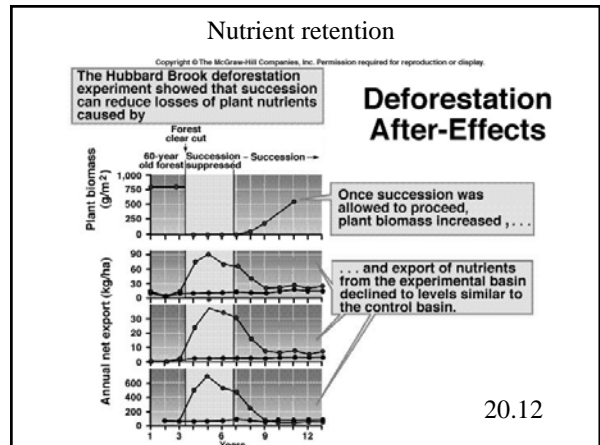




### II. Succession

#### E. Changes in ecosystem properties

GPP  
Biomass  
Total Respiration  
NEP

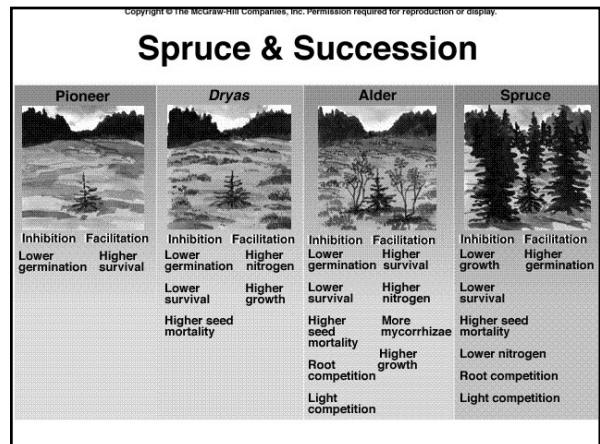


### II. Succession

#### F. Mechanisms of succession

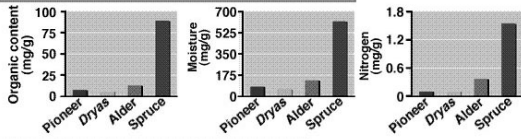
Facilitation  
Inhibition

20.17

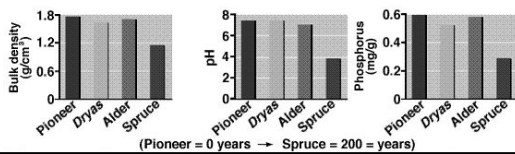


## Soil Properties & Succession

During succession, nitrogen, moisture, and organic matter content increased, . . .



. . . while phosphorus content, pH, and bulk density decreased.



(Pioneer = 0 years → Spruce = 200 years)