

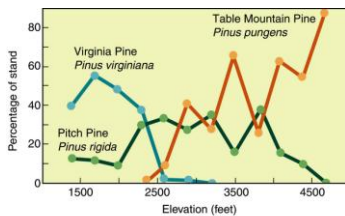
Community Dynamics

- Community structure is not static!
- As environmental conditions change in time and space, the structure of the community (physical & biological) also changes
- Results in a dynamic mosaic

Zonation

- Spatial variation in community structure
 - As we move across the landscape, the physical and biological structure of the community changes
 - Boundaries?
 - Common to all environments (aquatic & terrestrial)
 - Physical changes = Biological changes

Distribution of tree species along an elevation gradient in the Smoky Mountains, TN. No distinct boundaries between tree communities.



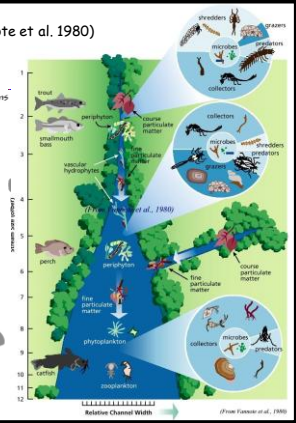
Copyright © Benjamin Cummings, an imprint of Addison Wesley Longman

(Whitaker 1956)

The River Continuum Concept (Vannote et al. 1980)

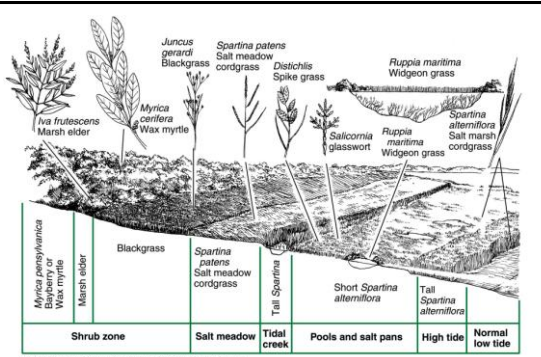
Some of the River Continuum Concept's generalizations

- Small Streams: shaded, cool, low nitrogen, high connectivity to local riparian community; Shredders and others...
- Mid-sized Streams: Some shading, some connectivity to riparian, moderate nitrogen, highly diverse, All functional feeding groups!
- Large Rivers: Little shading, upstream dependence of food webs, high nitrogen, low diversity, high production, dominance by collectors



www.thebugguy.org/

(From Fausch et al., 1980)



Copyright © Benjamin Cummings, an imprint of Addison Wesley Longman

Patterns of zonation in a New England salt marsh. Note: Relationship of plant distribution to microtopography and tidal submergence.

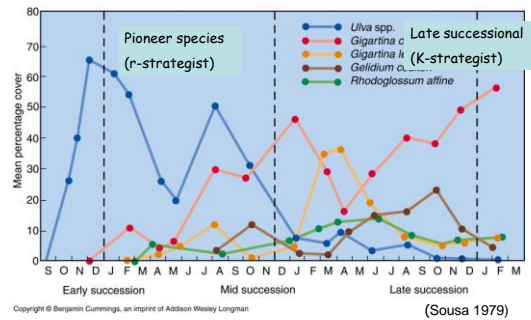
Succession

- Temporal variation in community structure
 - Succession → the gradual (directional) change in the structure of a community through time from field to forest
 - Temporal change referring to a single location
 - Seral stage → each sequence (change) in a time continuum of vegetation
 - Example: grass → shrub → ... → forest

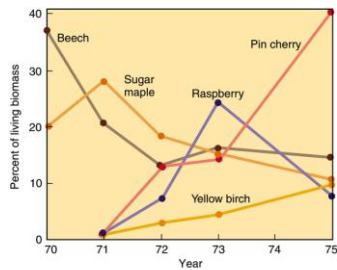
Succession

- Early successional species (initial)
 - Early colonizers (1st ones to get there)
 - Pioneer species → high growth rates, smaller size, high degree of dispersal (typical r-strategist)
- Late successional species
 - Lower rates of dispersal and colonization, slower growth rates, larger and longer lived (typical k-strategist)

Changes in the cover of five algal species colonizing blocks introduced to the intertidal zone in southern California (Note community shift through time)



Changes in the relative abundance of woody species in the Hubbard Brook experimental forest after a clear-cut experiment (Bormann and Likens 1979)



Succession

- Primary succession
 - Occurs in sites previously unoccupied by a community
 - Typical in very inhospitable sites (i.e., sand dunes, glacier retreats, near volcanoes)
- Secondary succession
 - Occurs on previously occupied (vegetated) sites following disturbance
 - Abandoned crop fields, forested sites turned to agriculture, clear-cut forest (HBF example)



← Example primary succession: Vegetation in sand dunes

Example secondary succession → Forest plots from clear cut experiment at Hubbard Brook



Time and Duration in Succession

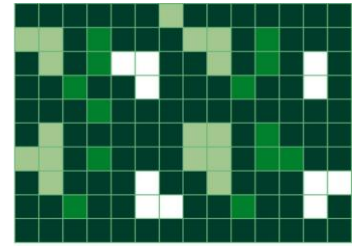
- Climax
 - Concept championed by F.E. Clements (1916)
 - If community left undisturbed → climax community (determined by climate)
 - Clements viewed the community as a super organism
- Cyclic replacement
 - As canopy individuals die out they create openings in the forest (light gap concept)
 - Small-scale dynamic of the community
 - Heterogeneity of habitat approach to succession

Time and Duration in Succession

- **Shifting mosaic**
 - Community composed of a mosaic of patches where succession is constantly occurs at different stages
 - Shifting mosaic steady state (Bormann and Likens 1979)
 - Not static, each patch continuously changing
- **Autosuccession**
 - Typical in extreme environments (only specialist can occupy)
 - Self-replacing nature of vegetation after disturbance
- **Fluctuations: Nonsuccessional dynamics**
 - Short-term reversible changes
 - Changes in relative abundance, but community composition remains unchanged

Representation of a forested landscape as a mosaic of patches in various stages of successional development. Each patch is continuously changing.

Succession concept shifts from unidirect. series of stages to a variety of patches undergoing different stages of change → cyclic replacement



As trees die out (fall) they create open gaps of light availability that will allow for diff communities to arise

Different successional stages within the landscape

Legend: Early succession (light green), Mid succession (medium green), Late succession (dark green), Gap (white)

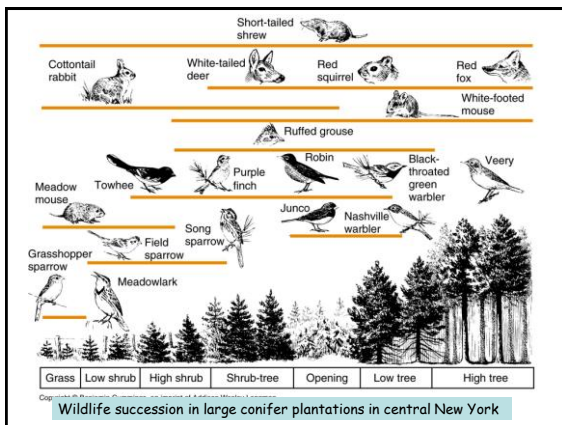
Copyright © Benjamin Cummings, an imprint of Addison Wesley Longman

Degradative Succession

- Earlier examples discussed in plant (autotrophic) communities
- What about animal communities?
- We have discussed succession in animal communities before
 - Decomposition → successional stages
 - Examples: fungi → bacteria → inverts...

Degradative Succession

- Decomposition (stages) → good example of heterotrophic (degradative) succession
 - A leaf (or fruit) falls from a tree...
- Animal succession
 - As vegetation (habitat) changes, the animal communities it will support will also change
 - Different life stages may depend on different habitats (structure, resources, strategies, etc.)



Paleosuccession

- Succession as experienced by humans takes place over a very short period of time
- The study of the relationships of ancient flora and fauna to their environment → paleoecology
 - The key to the distribution of animals and plants today may be found in the past (fossils, bones, plant parts, pollen grains, etc.)
 - The Pleistocene Epoch of particular interest to paleoecologists. Why?
 - Climatic and vegetation changes that followed the advance and retreat of glaciers