

Ecological Succession

Community (Ecosystem) Development

Temporal Change in Community

Driven by Biotic and Abiotic Processes

*Community Development: Species Diversity,
Life Histories of Species, Patterns in Abundance*

Ecosystem Development: Productivity, Biomass

Succession

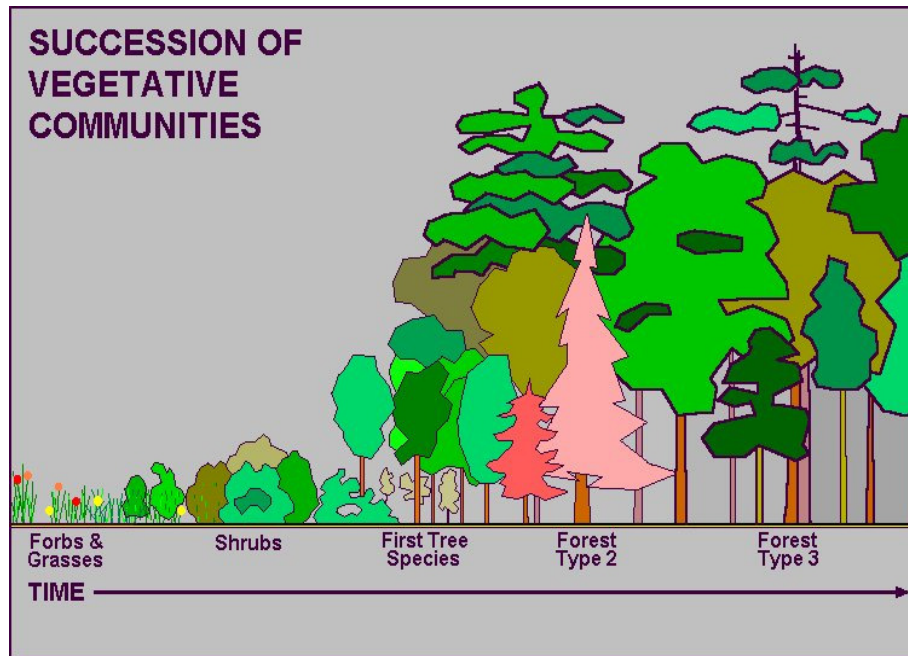
Primary: Newly Opened Location

Secondary: Disturbance of Previous Ecosystem

Successional Equilibrium: Mature Community

Cyclic Succession: Frequent Disturbance

Michigan Forests Forever:



Secondary Succession → *Equilibrium*

Abandoned Agricultural Fields:

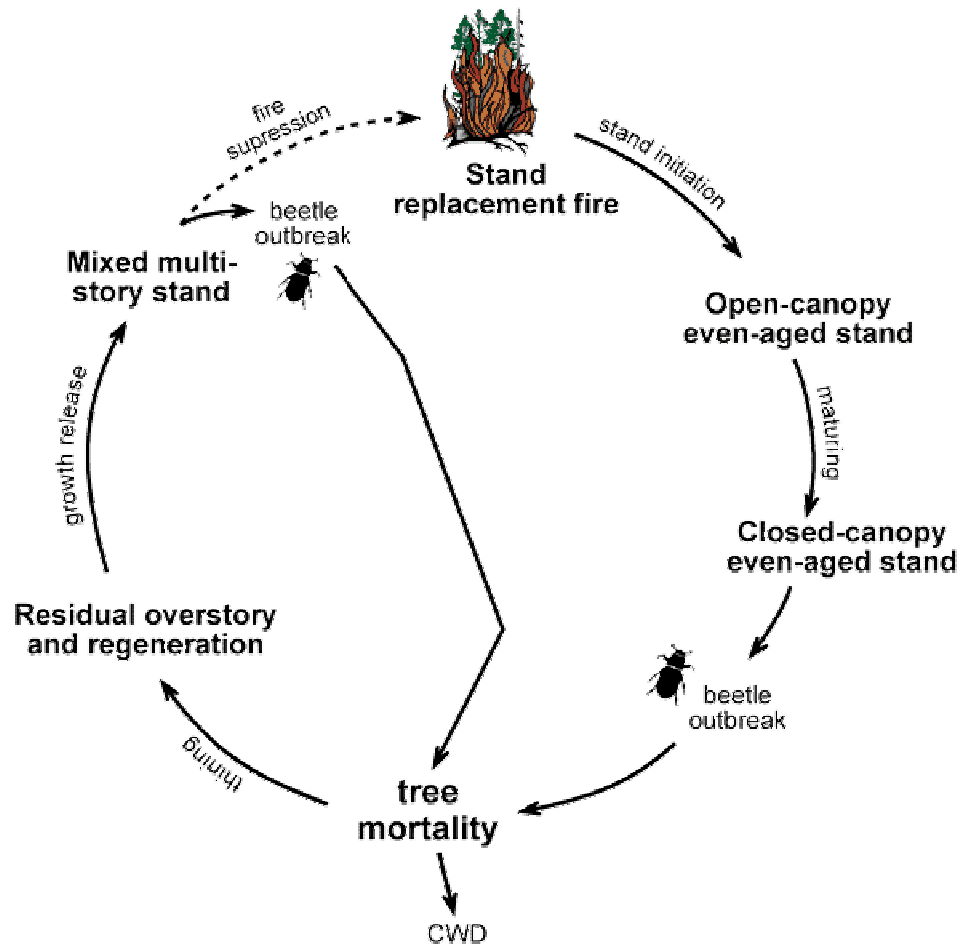
Grassland → Shrubs → Trees

Pine Forest → Mature Deciduous Forest

Species Change; Size, Longevity of Individuals

Animals Follow Plants (Ecosystem Engineers)

Natural Resources Canada:



Fire Disturbs Community → *Early Stage of Succession*

Lodgepole Pine Forest Recovers

Susceptible to Parasite Attack → Dead Trees

Some Re-growth of Community → Fire

Biotic Process (*Parasitism*) Increases Chance of

Abiotic Process (*Fire*) Inducing New Cycle

Ecosystem: Succession (Combine Species)

Productivity: Rate of Energy Flow

$$P_G = P_N + R$$

P_G: Gross Productivity, *Total Energy into System*

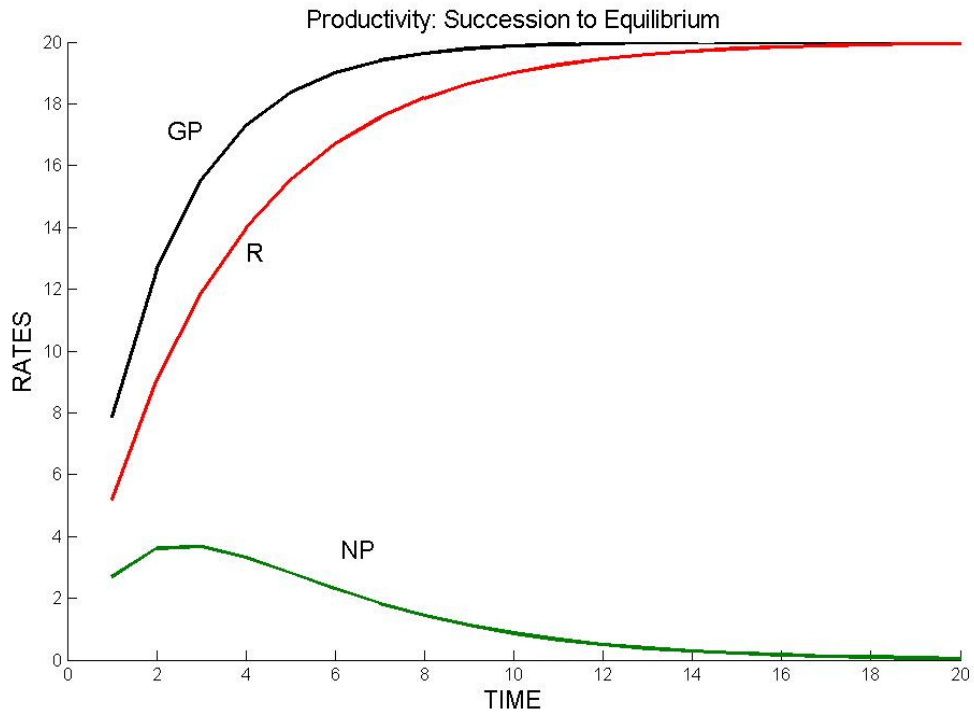
P_N: Net Productivity, *Growth + Reproduction*

Rate of Change in Energy Stored in Organisms

R: Respiration, *Biological Work*

$P_G > R \Rightarrow P_N > 0$, *Biomass Increases*

$P_G = R \Rightarrow P_N = 0$, *Biomass (Stored Energy) Equilibrium*



Equilibrium Succession

Biomass Increases to Maximum

Biomass Constant when Net Productivity = 0

Energy Turnover Maximal at Equilibrium

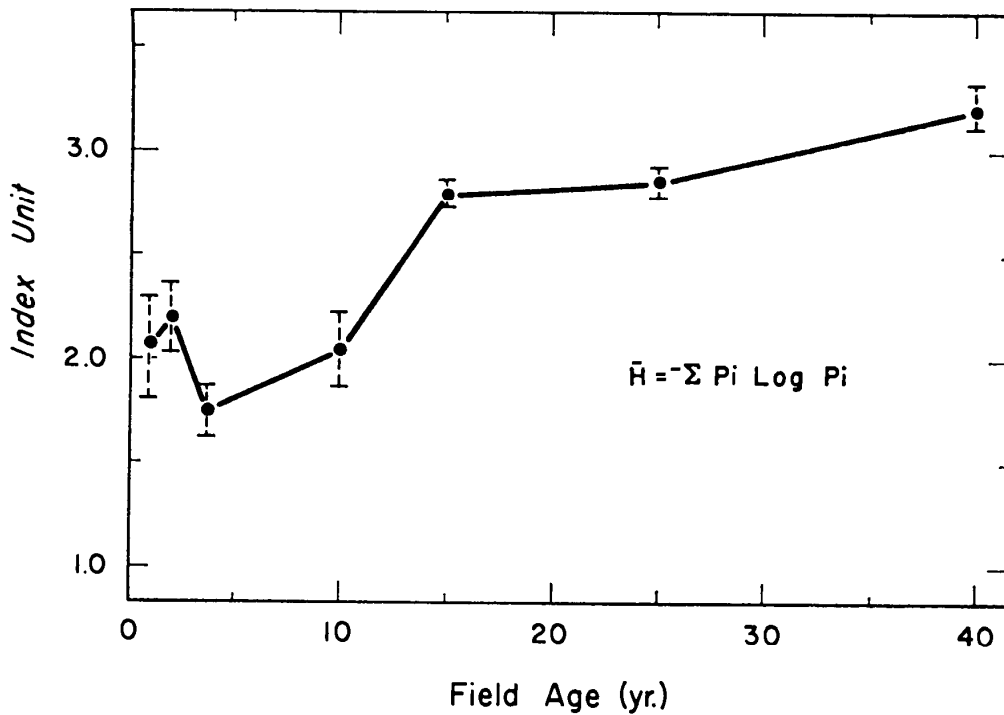


FIG. 1. Relationship between plant species diversity (\bar{H}) and succession on old fields in southern Illinois.

Secondary Succession

Species Diversity Increases

More Species

Abundances More Even

Rapid Increase Early in Succession

Equilibrates

Mechanisms of Succession

Facilitation: *Pioneer Species Modify Environment*

Permits/Enhances Entry of Persistent Species

Inhibition: *Pioneer Species Monopolize Resources*

Competitively Resist Entry of Mature Species

Independence: *Null Hypothesis*

Species Interaction Unimportant

Species Sequence Reflects Life Histories

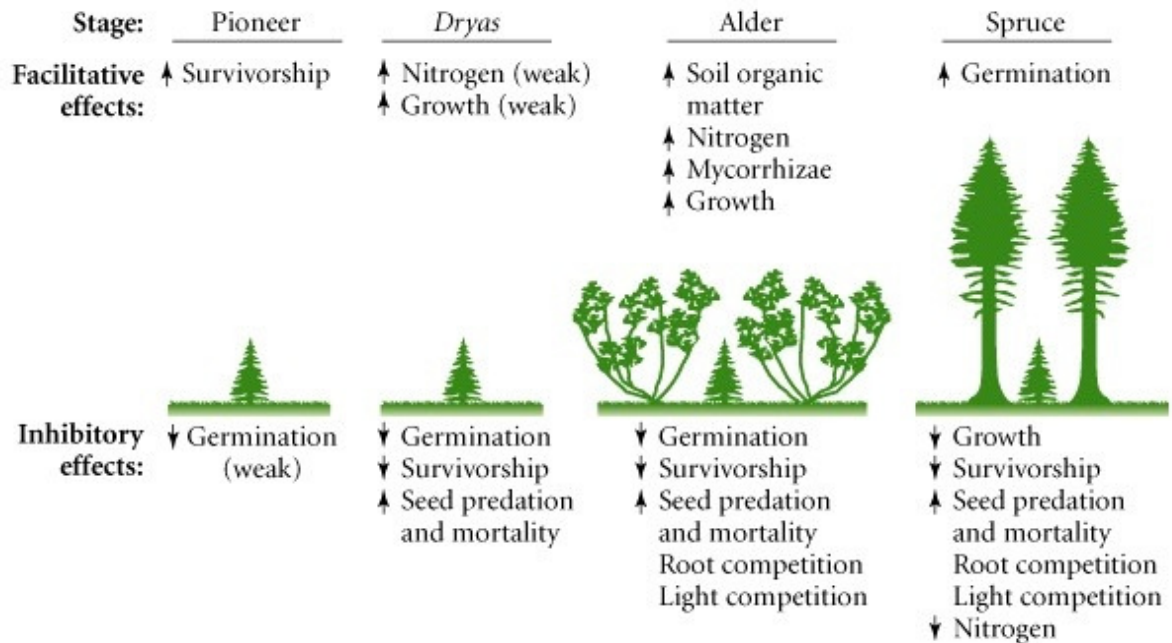
Presence/Absence & Quality: *Lateral Interaction*

General Mechanisms

Importance of Soil Microorganisms

Mutualism & Parasitism of Terrestrial Plants

Ricklefs and Miller 2001:



Actual Succession:

Facilitative and Inhibitory Effects

Difficult to Predict When/Where +/- Dominate

Need Model for Succession: *General Biotic Effects*

Markov Model