Disturbances & Succession

- Objectives
  - Overview of:
    - Disturbances (natural and anthropogenic)
    - Ecological succession
  - Implications for forest management

  - **First:** take-home points, things you learned, etc. from reading assignments

Disturbances & Succession

- Disturbance
  - Mix of large infrequent & small frequent events
  - A given disturbance is tyically the result of numerous, interconnected factors
  - Natural disturbances are not “bad”
  - Disturbances characterized by type, size, severity, intensity, frequency, timing, etc.
    - Disturbance Regime

Disturbances & Succession

- Disturbance Regime
  - Spatial Component
    - Disturbances are patchy by nature → patchwork of stand ages, types, etc. across the landscape

Disturbances & Succession

- Disturbance Regime
  - Temporal Component
    - Mean return interval

100 year flood

30 year fire

Disturbances & Succession

- Disturbance - Fire

Disturbances & Succession

- Disturbance - Fire

Crown Fire

Surface Fire

Disturbances & Succession

- Disturbance - Wind

Disturbances & Succession

- Disturbance – Diseases, Insects, & Pathogens

Koa Moth

Rapid Ohi‘a Death

Disturbances & Succession

- Other important natural disturbances

Flooding

Earthquakes

Volcanoes

Disturbances & Succession

- Natural disturbances are not “bad”
  - Renew ecosystems and diversify landscapes
    - Diverse habitat → high biodiversity
  - Pop./comm./eco. adapted to natural disturbance
    - In many cases, would not exist without them
  - Integral part of ecosystem structure and function that initiates ecological succession
- Humans have modified both disturbance regimes & the actual disturbances
  - Anthropogenic disturbances often threaten ecological integrity

Disturbances & Succession

- Disturbance – Invasive Species

Feral Cattle

Quadrastichus erythrinae

Pennisetum setaceum

Feral Pigs

Psidium cattleianum

Disturbances & Succession

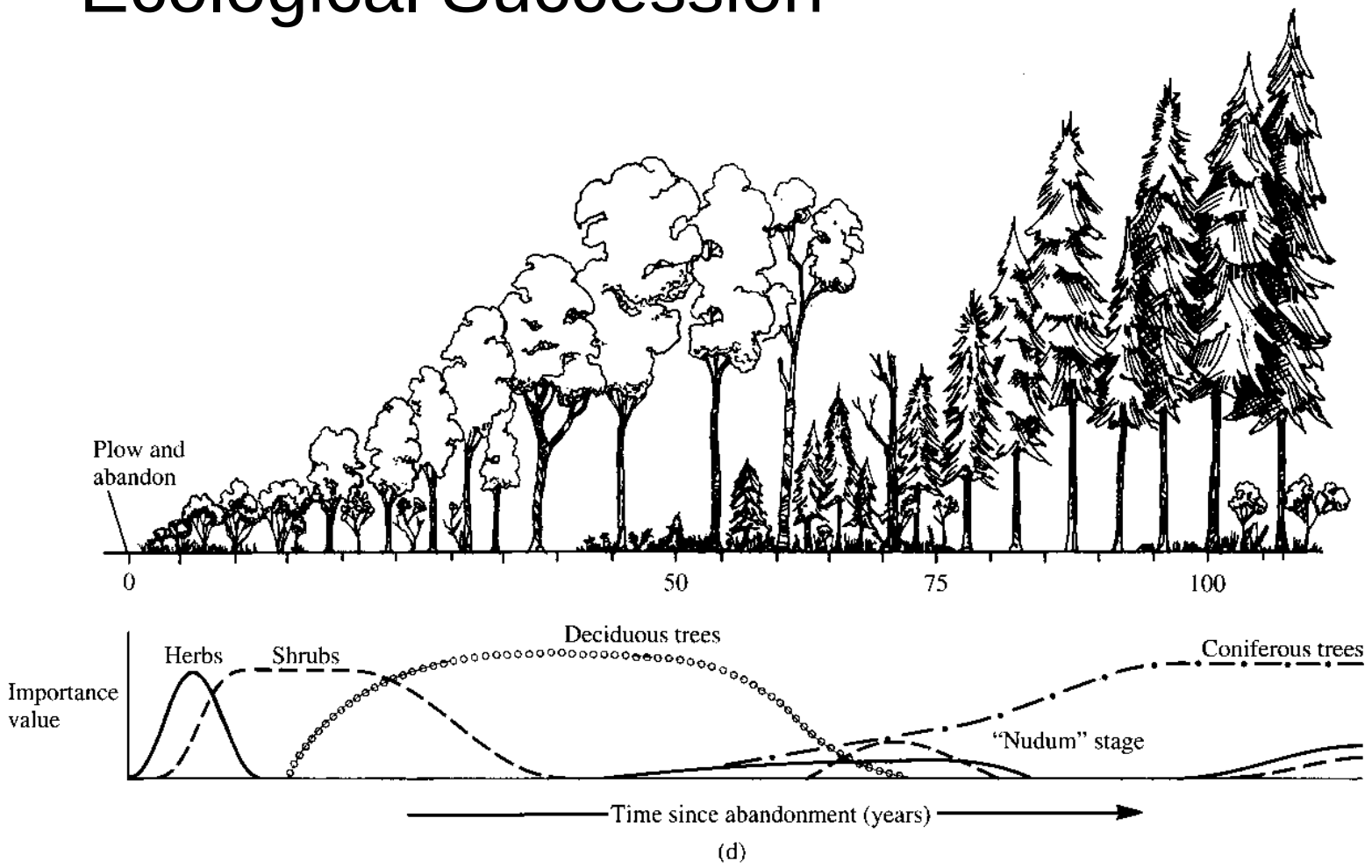
- Disturbance – LULCC






Disturbances & Succession

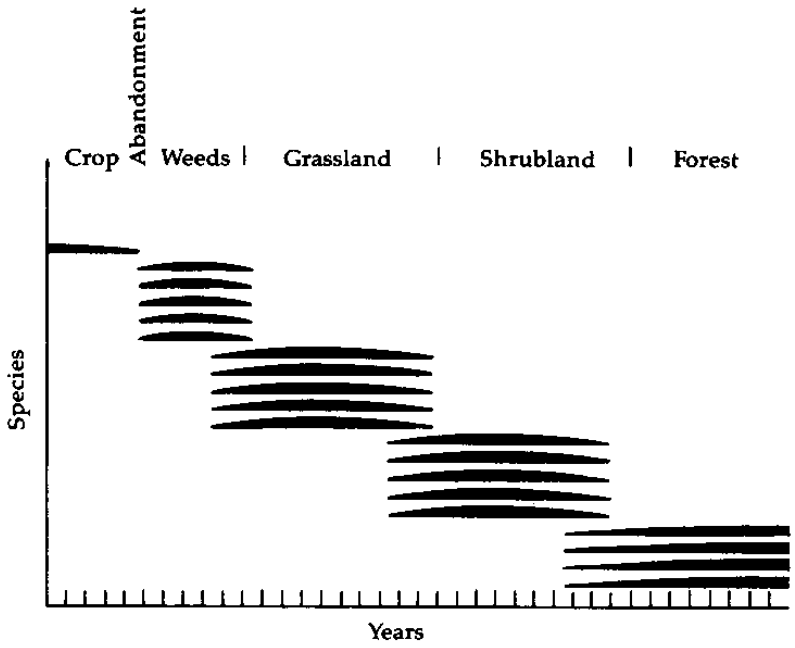
- Ecological Succession

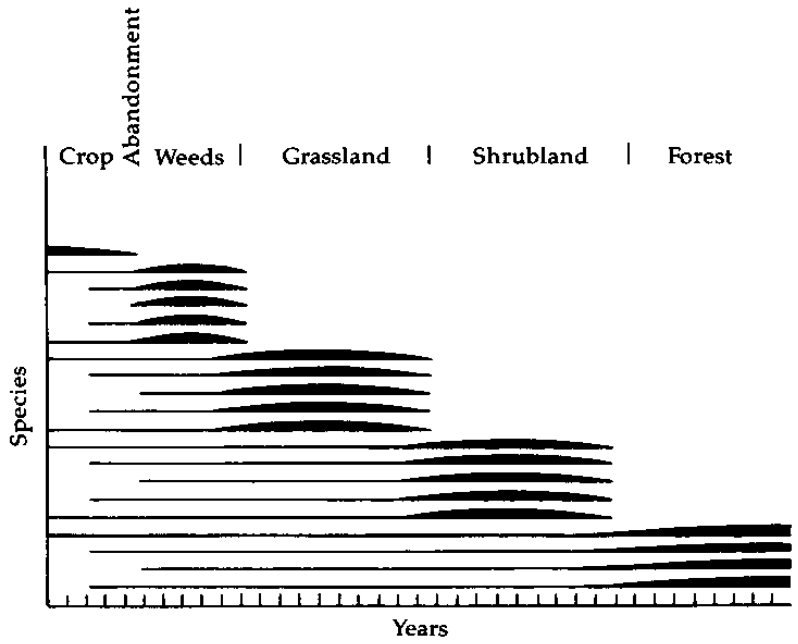


Disturbances & Succession

- Succession - Models

Relay Floristics Model vs. Initial Floristic Composition Model





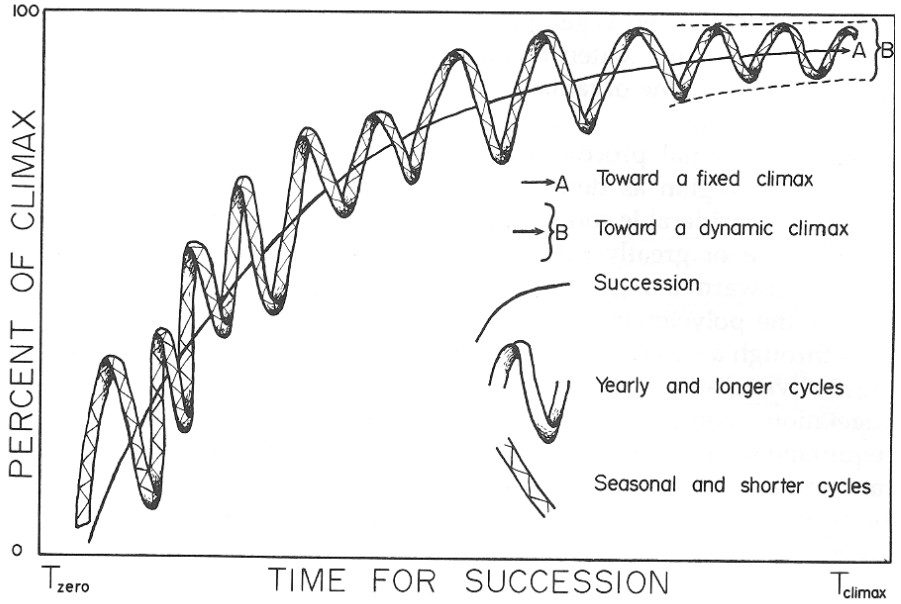
Disturbances & Succession

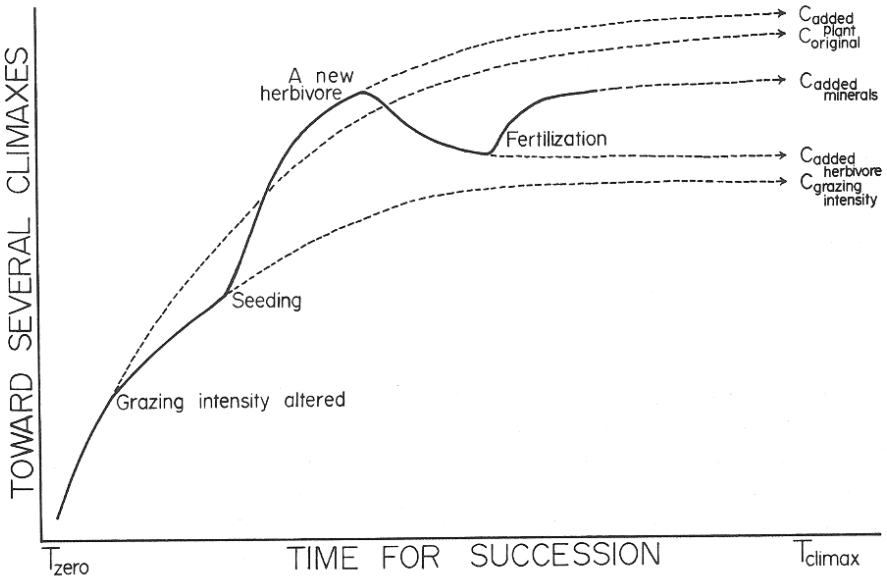
- Species occurrence during succession:
  - Largely in response to changes in the physical environment & biotic interactions:
    - Who can get there and establish?
      - Dispersal and colonization
    - Who can survive and reproduce?
      - Competition and other biotic interactions



Disturbances & Succession

- Succession – Stable vs. Alternative Steady States





Disturbances & Succession

- Succession – Primary vs. Secondary

Primary Succession

Secondary Succession

Disturbances & Succession

- Succession – Primary

Disturbances & Succession

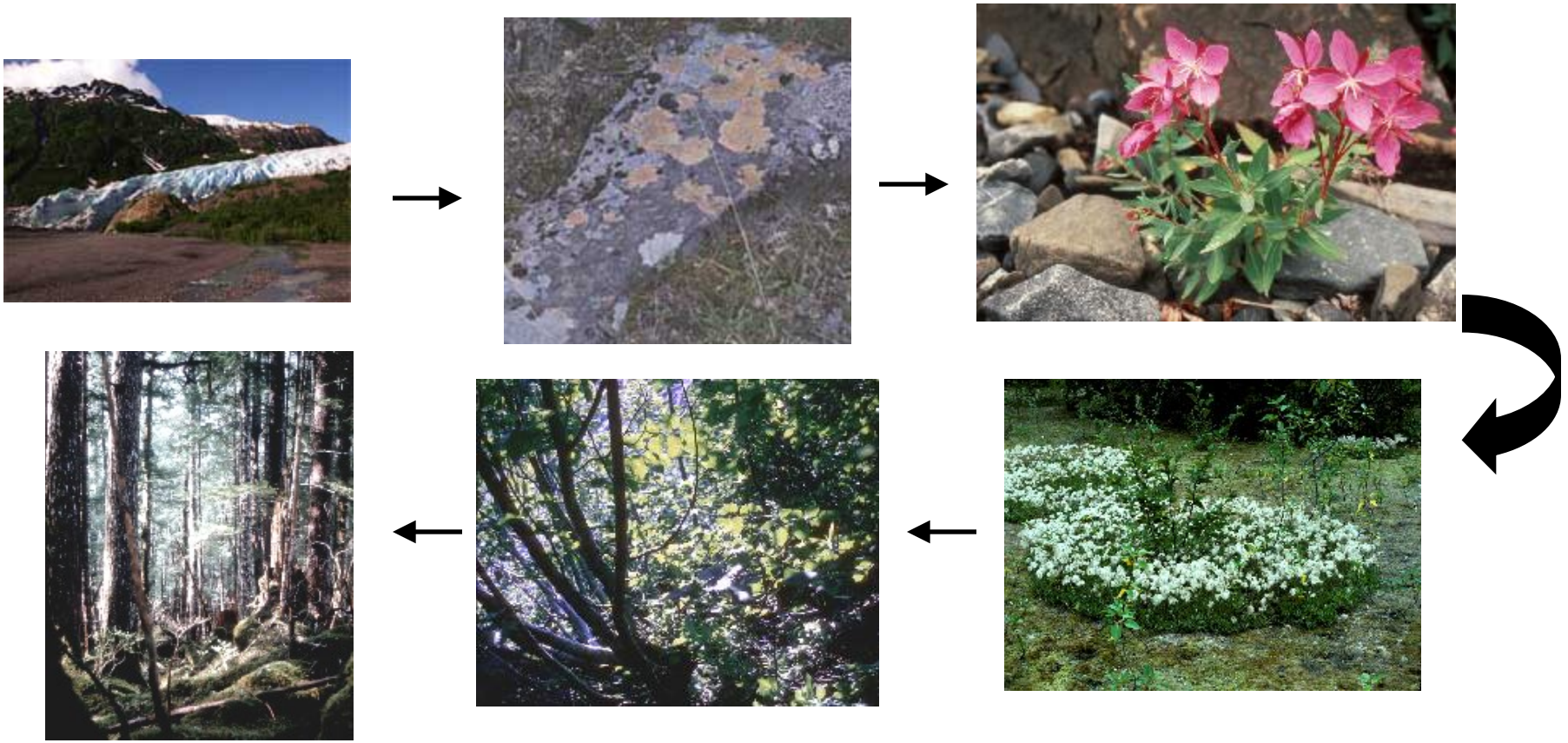
- Succession – Secondary

Disturbances & Succession

- Succession – Gap Phase Dynamics

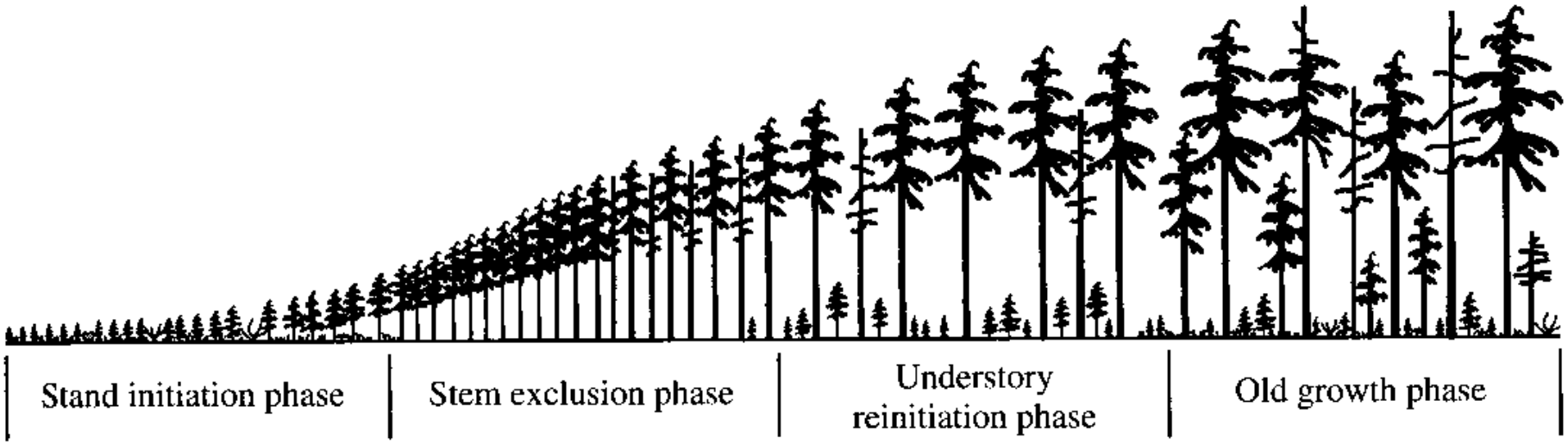
Disturbances & Succession

- Succession – Facilitation



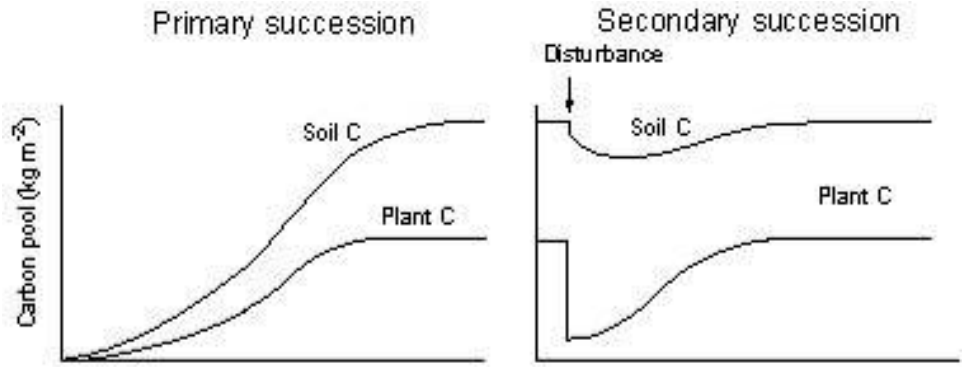
Disturbances & Succession

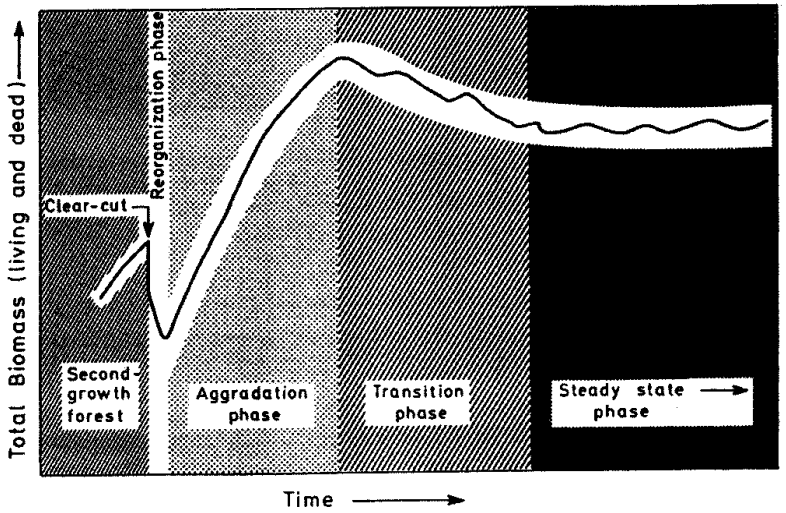
- Succession – Structure



Disturbances & Succession

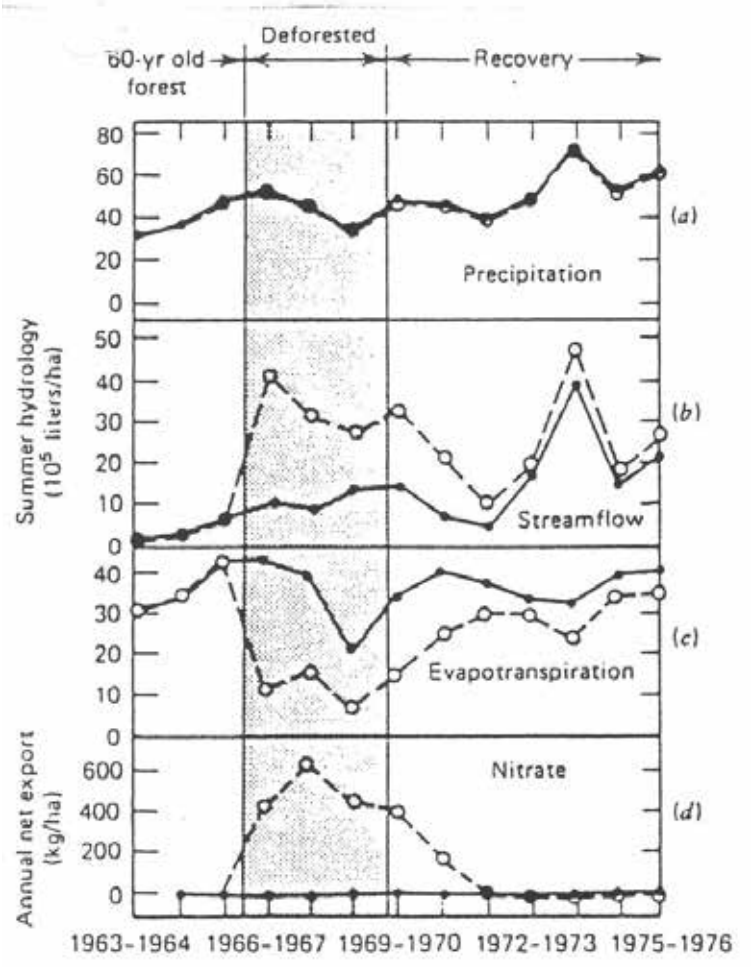
- Succession – Ecosystem Processes

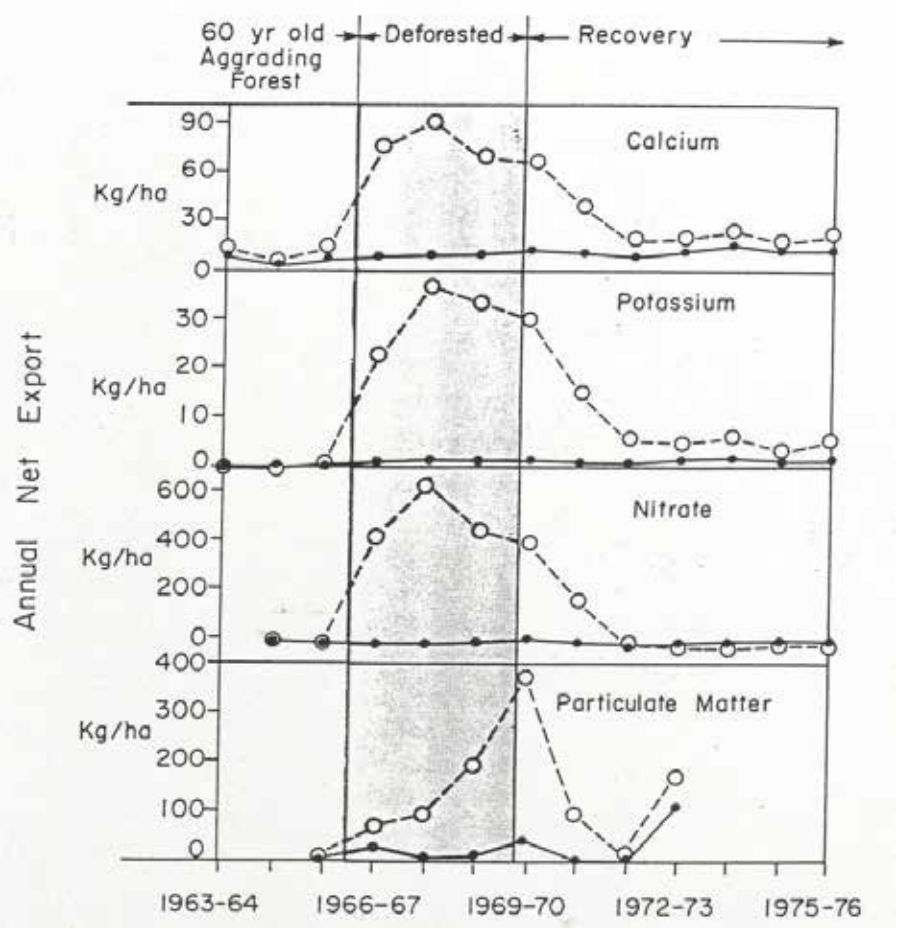




Disturbances & Succession

- Succession – Ecosystem Processes





Disturbances & Succession

- Implications of disturbances for management
  - **Natural, often desirable, and inevitable**
    - **Historical frequency, severity, and scale modified**
    - **Large disturbances largely beyond control**
    - **Small disturbances easier to control, but often not a good idea to do such, at least over long time periods**
  - **To manage and conserve forests, we must:**
    - **Understand ecological role of natural disturbances**

      ≫Anticipate their occurrence

      ≫*Emulate them, where possible, in management**

Disturbances & Succession

- Implications of succession for management
  - **Ecosystems are characterized by change**
    - **Physical, chemical and biological**
  - **Succession does not always follow same pattern**
    - **Alternative stable states; variability in rate & duration**
  - **Change in structure → change in function**
    - **Beneficial or detrimental; manage for beneficial**
  - **Foresters constantly manipulate succession to optimize growth of desired species (ENFD)**
    - **Requires an understanding of the ecology of the system**