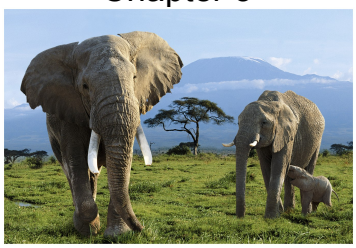
Chapter 3



The Big Picture: Systems of Change

Chapter 3

- Make a Cause and Effect thinking map interactions, causes and effects described in the case study about Amboseli Park.

Systems and Feedback

- System:
  - A set of components or parts that function together to act as a whole.
- Open System:
  - Not generally contained within boundaries
  - Some energy or material moves into or out of the system
- Closed System:
  - No energy movement into or out of the system

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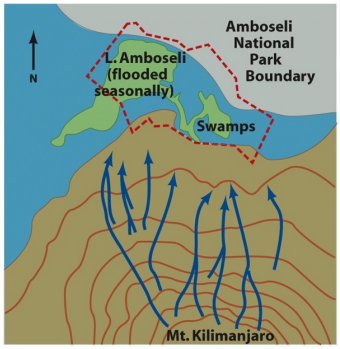
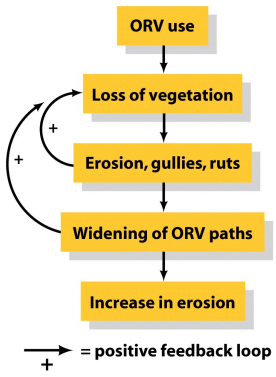


Systems and Feedback

- Negative Feedback
  - Occurs when the system's response is in the opposite direction of the output
  - Self-regulating - tends to be stabilizing
- Positive Feedback
  - Occurs when an increase in output leads to a further increase in output



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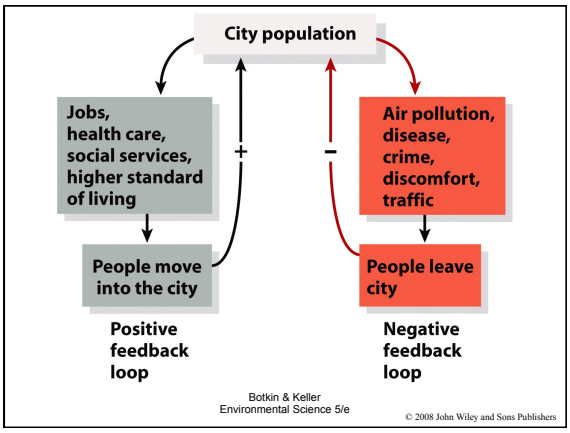
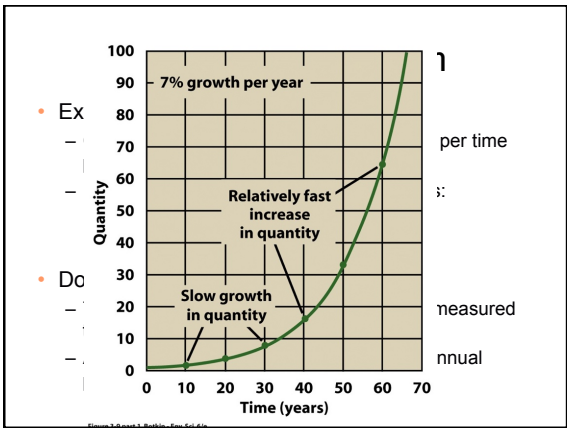




Environmental Unity

- Environmental unity:
  - It is impossible to change only one thing; everything affects everything else.
  - You can't do "just" one thing.
  - Examples: p. 45

Botkin & Keller
Environmental Science 5/e

Uniformitarianism

- Uniformitarianism:
  - The principle that processes that operate today operated in the past.
  - Observations of processes today can explain events that occurred in the past and leave evidence

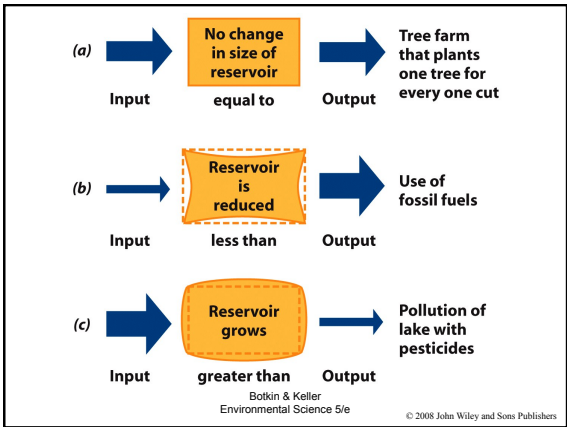
"The present is the key to the past."

Botkin & Keller
Environmental Science 5/e

Changes and Equilibrium in Systems

- Steady state:
  - A dynamic equilibrium
  - Material or energy is entering and leaving the system in equal amounts
  - Opposing processes occur at equal rates

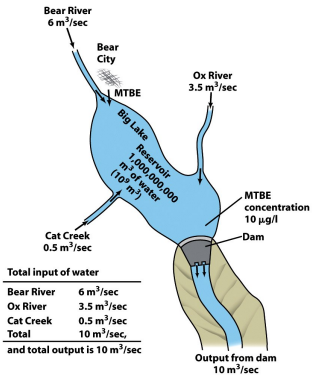
Botkin & Keller
Environmental Science 5/e



Changes and Equilibrium in Systems

- Average residence time:
  - The time it takes for a given part of the total reservoir of a particular material to be cycled through the sytem
  - The equation for average residence time is:

ART = S/F



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Earth as a Living System

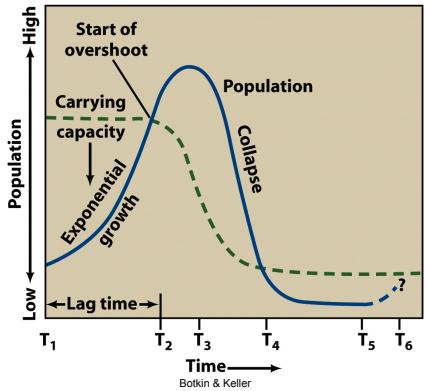
- Biota:
  - All the organisms of all species living in an area or region up to and including the biosphere
- Biosphere:
  1. That part of a planet where life exists
  2. The planetary system that includes and sustains life

Ecosystem

- Ecosystem:
  - A community of organisms and its local nonliving environment in which matter (chemical elements) cycles and energy flows.
  - Sustained life on Earth is a characteristic of ecosystems
  - Can be natural or artificial

Why Solving Environmental Problems Is Often Difficult

1. Exponential growth
   - The consequences of exponential growth and its accompanying positive feedback can be dramatic
2. Lag time
   - The time between a stimulus and the response of a system
   - If there is a long delay between stimulus and response, then the resulting changes are much more difficult to recognize.
3. Irreversible consequences
   - Consequences that may not be easily rectified on a human scale of decades or a few hundred years.



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