Ecosystem ecology
A more complete picture

Community + Abiotic
- Ecosystems are interacting biotic-abiotic systems somewhat arbitrarily bounded
- Focus is on energy flow and nutrient cycling

Ecosystem dynamics
- Energy (carbon) flow
- Nutrient cycling (esp. N & P)

The importance of decomposition

Why is an ecosystem approach so effective?
- Ecosystem dynamics follows the laws of physics
- First law (conservation of energy) means you can trace energy flow throughout an ecosystem and calculate energy budgets
- Second law (entropy) means energy is ‘lost’ as heat and less energy is available to higher trophic levels; efficiency is important!

Primary production
- The base of the food web
- **GPP** = all the light energy converted into chemical energy by photosynthesis per unit time
- **NPP** = **GPP** – plant respiration (R)
  - The amount of energy available to consumers

Productivity vs. biomass
- **Biomass**: mass in a given area at a given time
  - **Standing crop**: plant biomass
  - g/m²
- **Productivity**: mass produced in a given area over time
  - g/m²/yr
NPP by ecosystem
- NPP varies considerably across the globe

What limits NPP?
- Any guesses?

What is limiting production?

Limitation in action
- Eutrophication: an experiment to determine causes

Secondary production
- Animal productivity
- Energy stored in biomass—growth and reproduction
Energy flow
Where does the food go?

50% to Feces
33% to Cellular respiration
17% to Growth

Pyramid of production
How efficient?

Humans at two trophic levels

Nutrients Cycle through Ecosystems
Unlikely energy, nutrients can be recycled through an ecosystem
Nutrients move between both biotic and abiotic portions of ecosystems
- Biogeochemical cycles

The carbon cycle

CO$_2$ increase and Global Temperature
The nitrogen cycle

Global NPP visualized
- Hot spots and cold spots

Nutrients and disturbances

The phosphorus cycle

Nutrient cycling model
- Where do organisms fit in to these ‘black boxes’?