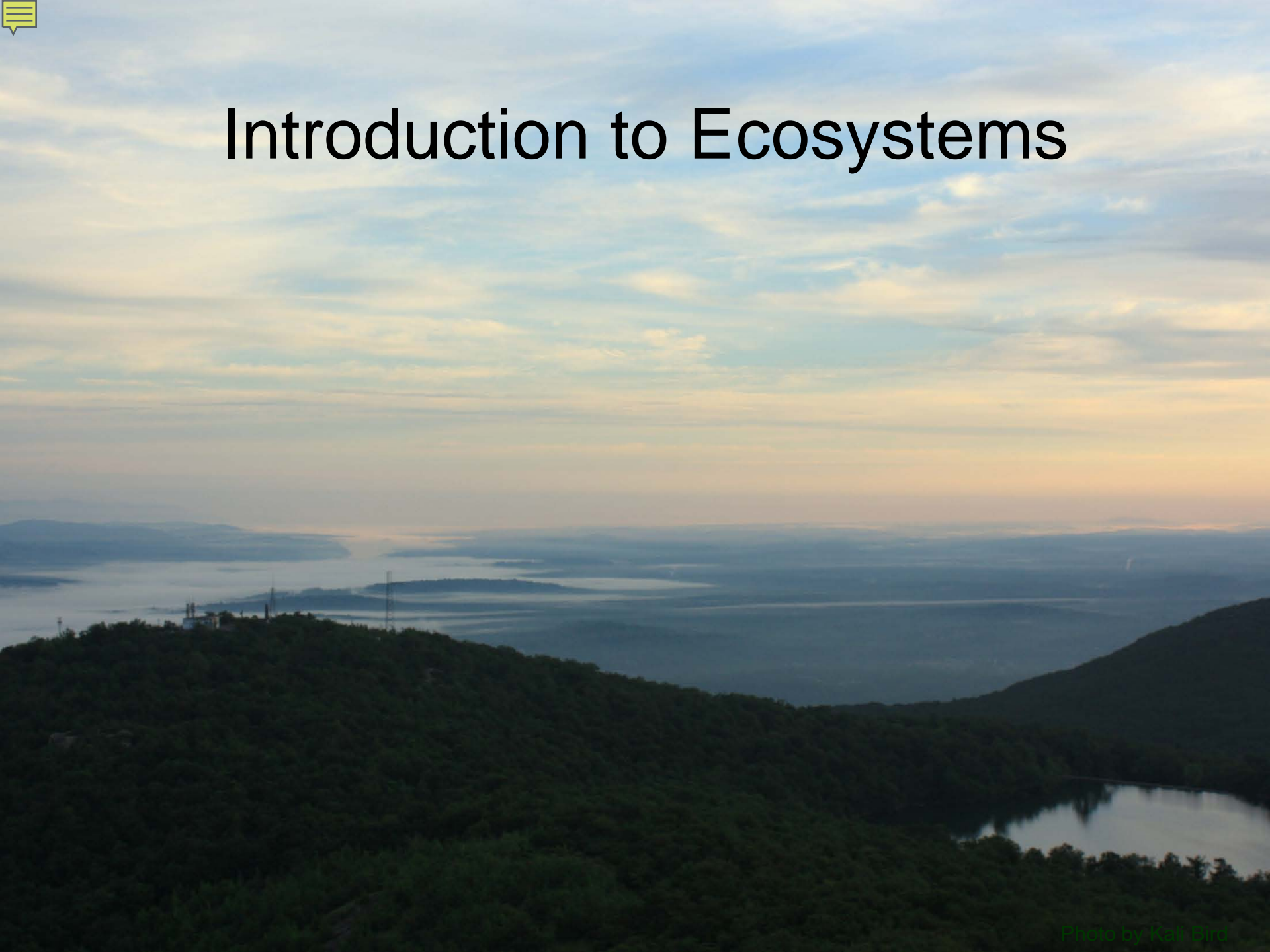
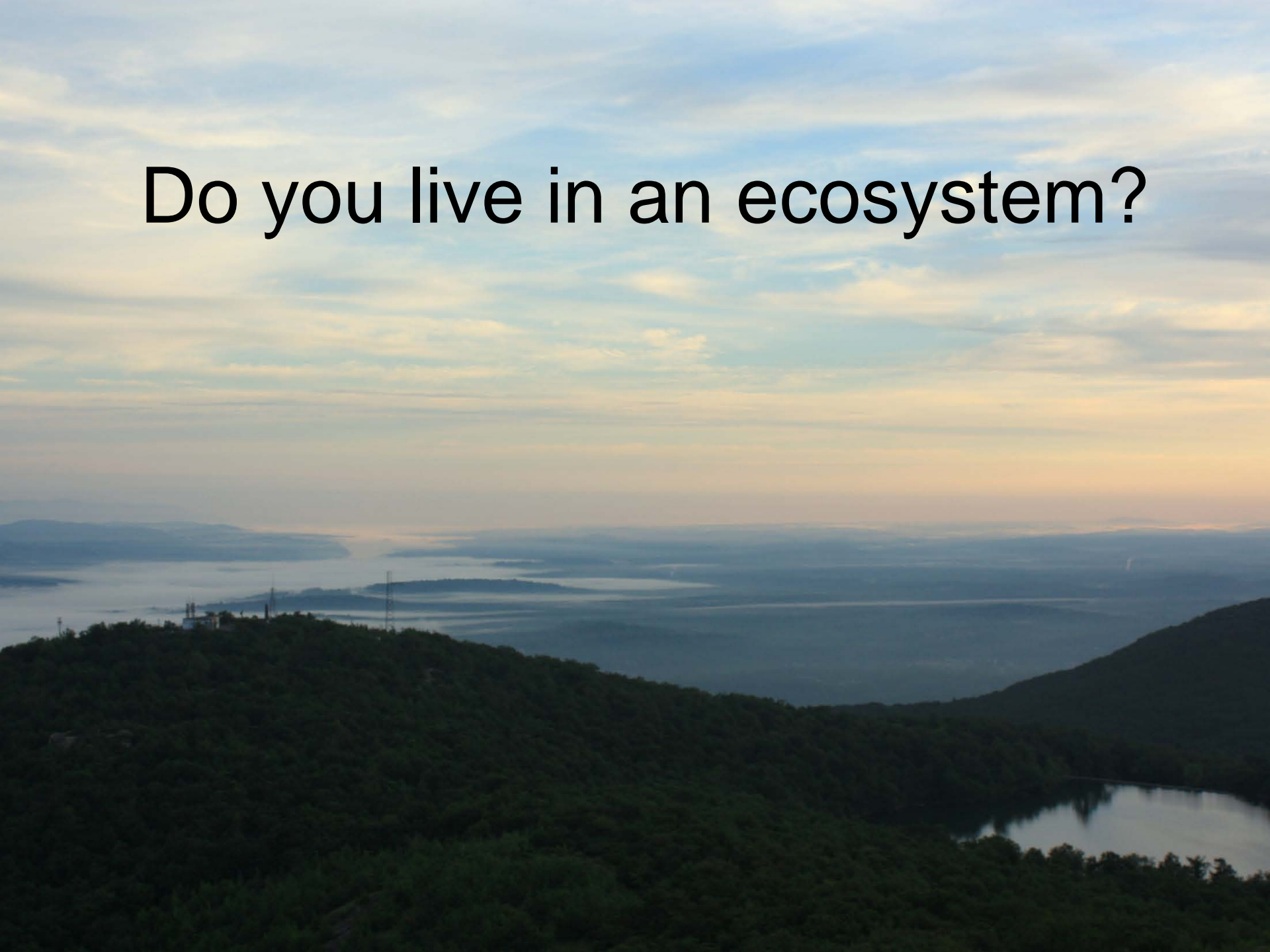




Introduction to Ecosystems



Do you live in an ecosystem?





What is an Ecosystem?

- Biological community (biotic)
- Physical environment (abiotic)
- The ecosystem concept:
 - all the organisms (a community of species) & all the abiotic components interacting together as a system, within spatial boundaries



How big is an ecosystem?

a) Global ecosystem

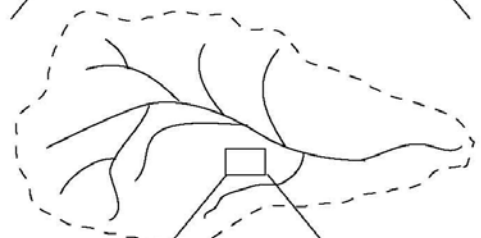
5,000 km



How does carbon loss from plowed soils influence global climate?

b) Watershed

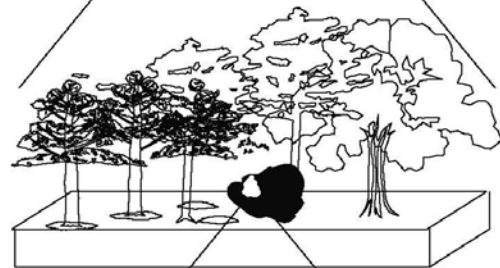
10 km



How does deforestation influence the water supply to neighboring towns?

c) Forest ecosystem

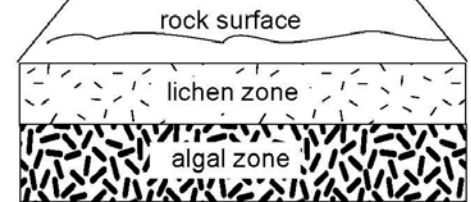
1 km



How does acid rain influence forest productivity?

d) Endolithic ecosystem

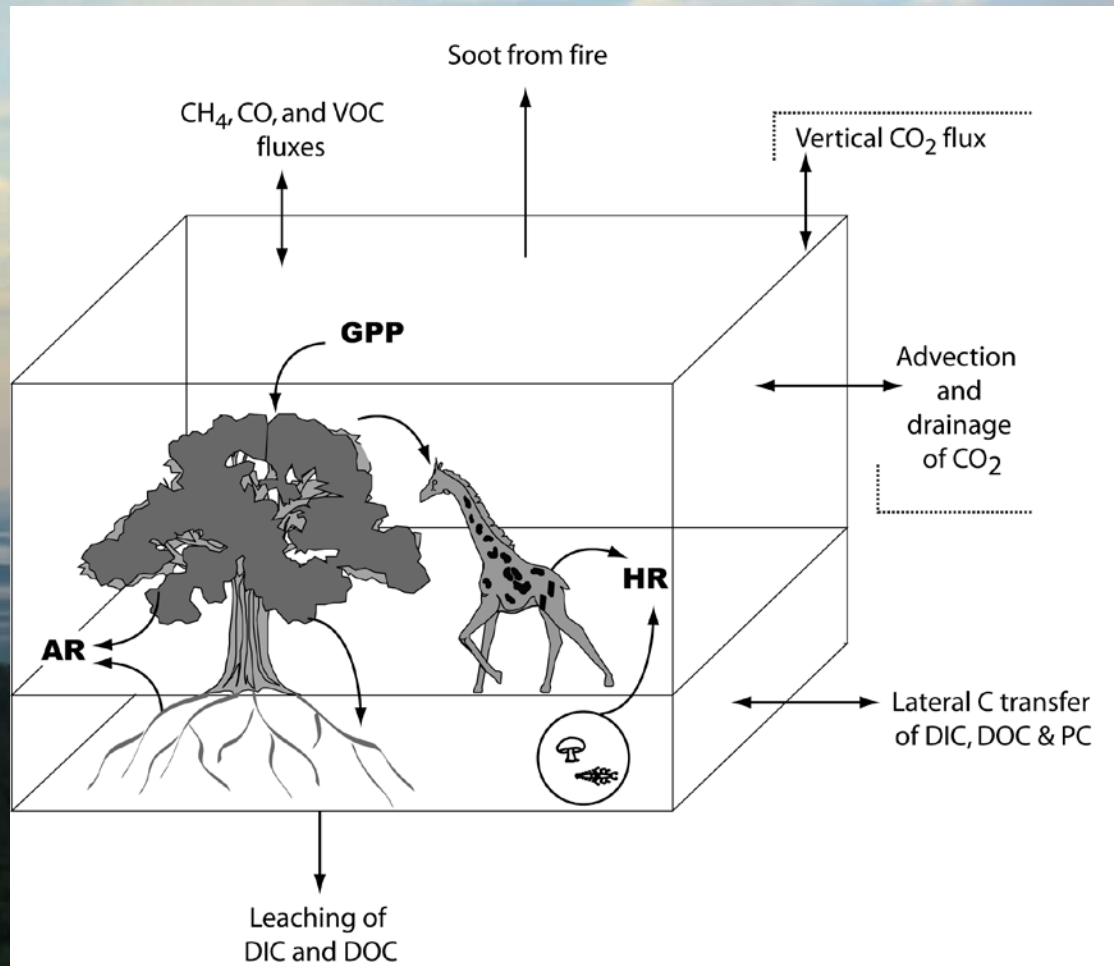
1 mm



What are the biological controls over rock weathering?

It can get very complicated, very quickly!

Must define the size before you can measure inputs, outputs, rates of cycling, & fluxes



How does an ecosystem work (function)?

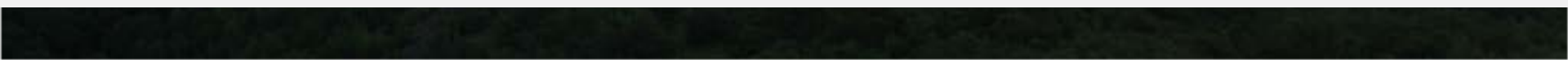
Things to think about:

- Biotic and abiotic components & interactions
- Boundaries (scale)
- Flux / cycling of nutrients & energy
- Change over time & history of a place
- Ecosystem inputs /outputs are connections to adjacent ecosystems, and to larger, global cycles

What questions could we ask to understand the Hudson River ecosystem?



Consider:

- Biotic and abiotic components & interactions
 - Boundaries (scale)
 - Flux / cycling of nutrients & energy
 - Change over time & history of a place
 - Ecosystem inputs /outputs are connections to adjacent ecosystems, and to larger, global cycles
- 

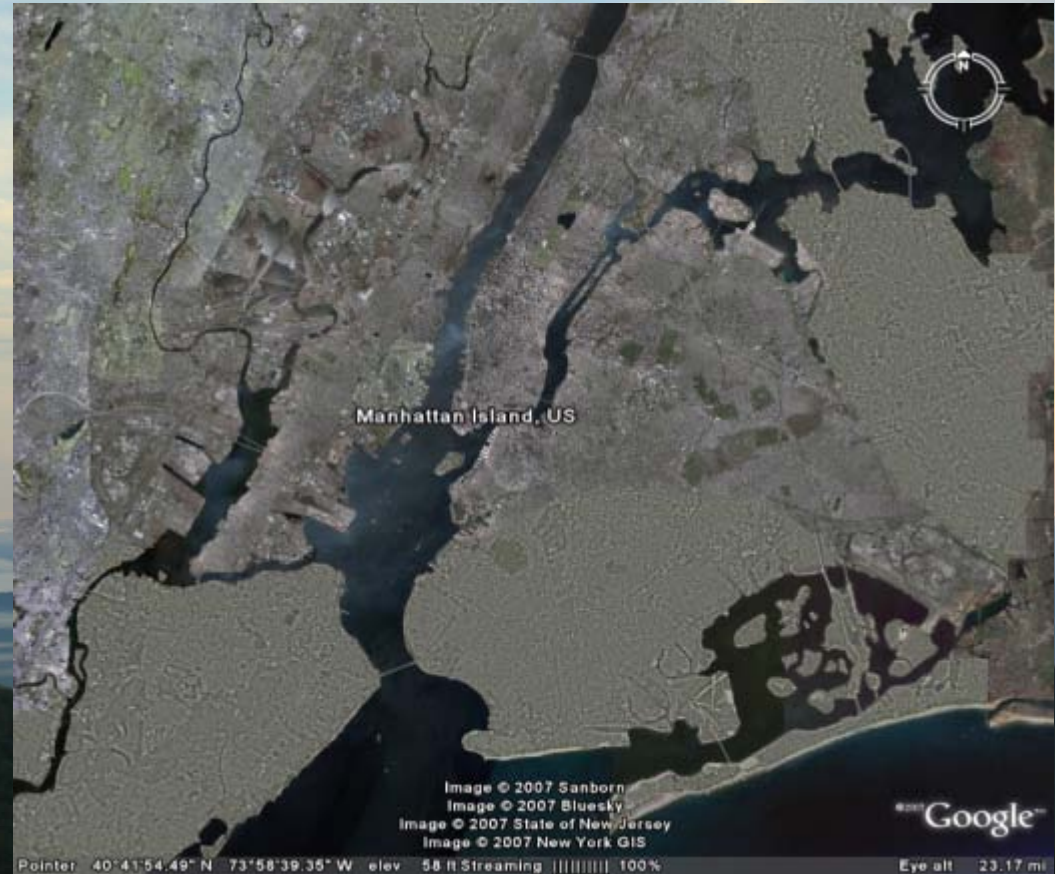
The Hudson as an Ecosystem

- What abiotic factors are important?
- What lives in the river?
- How do nutrients & energy move in the system?
- How has the river changed over time?



Abiotic: What's special about it?

- Its an estuary
 - Tidal
 - Fresh & salt water
 - Very productive



The Hudson River
is tidal all the way
to the Troy dam.

Some are fresh
water tides, like
those at Tivoli Bay.

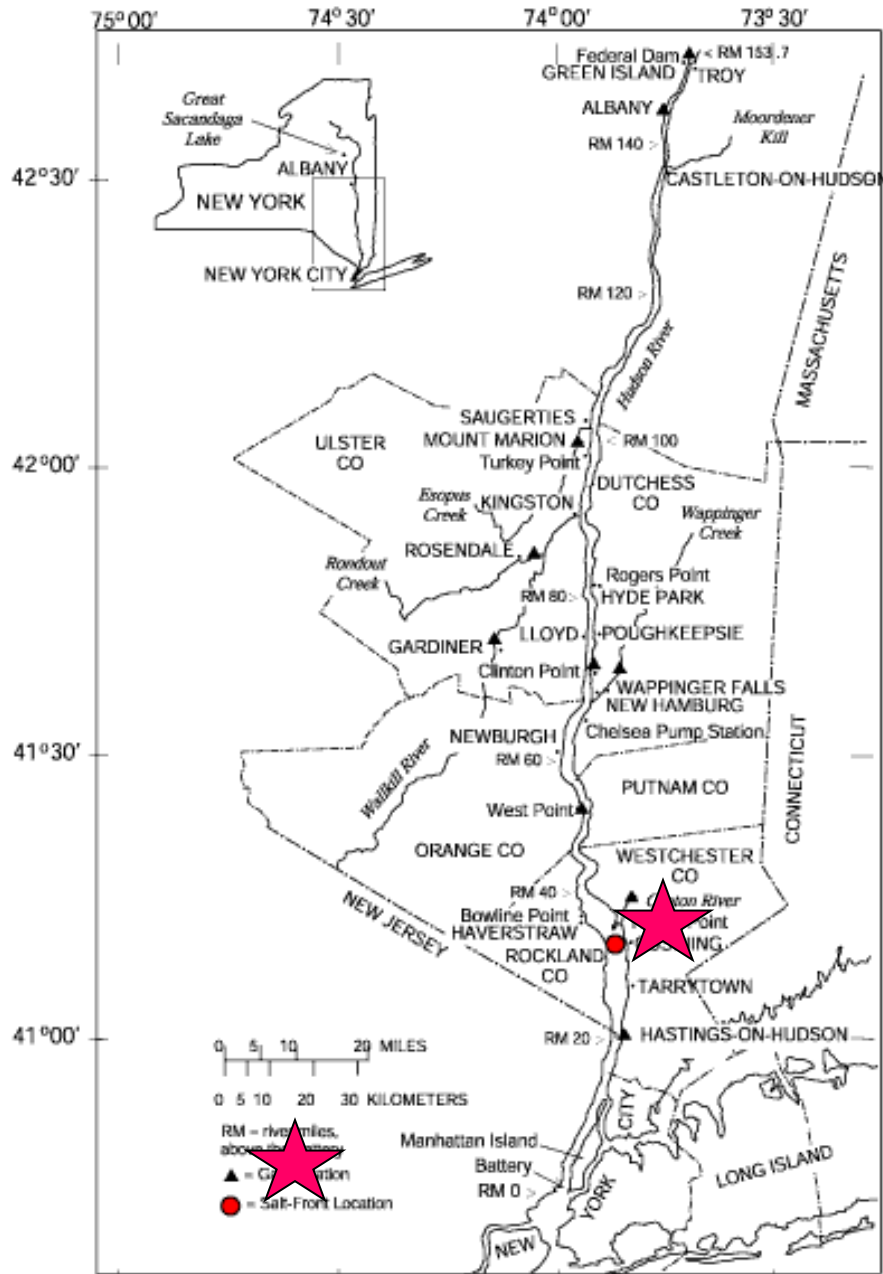




Upper Hudson in the Adirondacks



Federal dam at Troy, NY



Base from U.S. Army Corps of Engineers, 1952

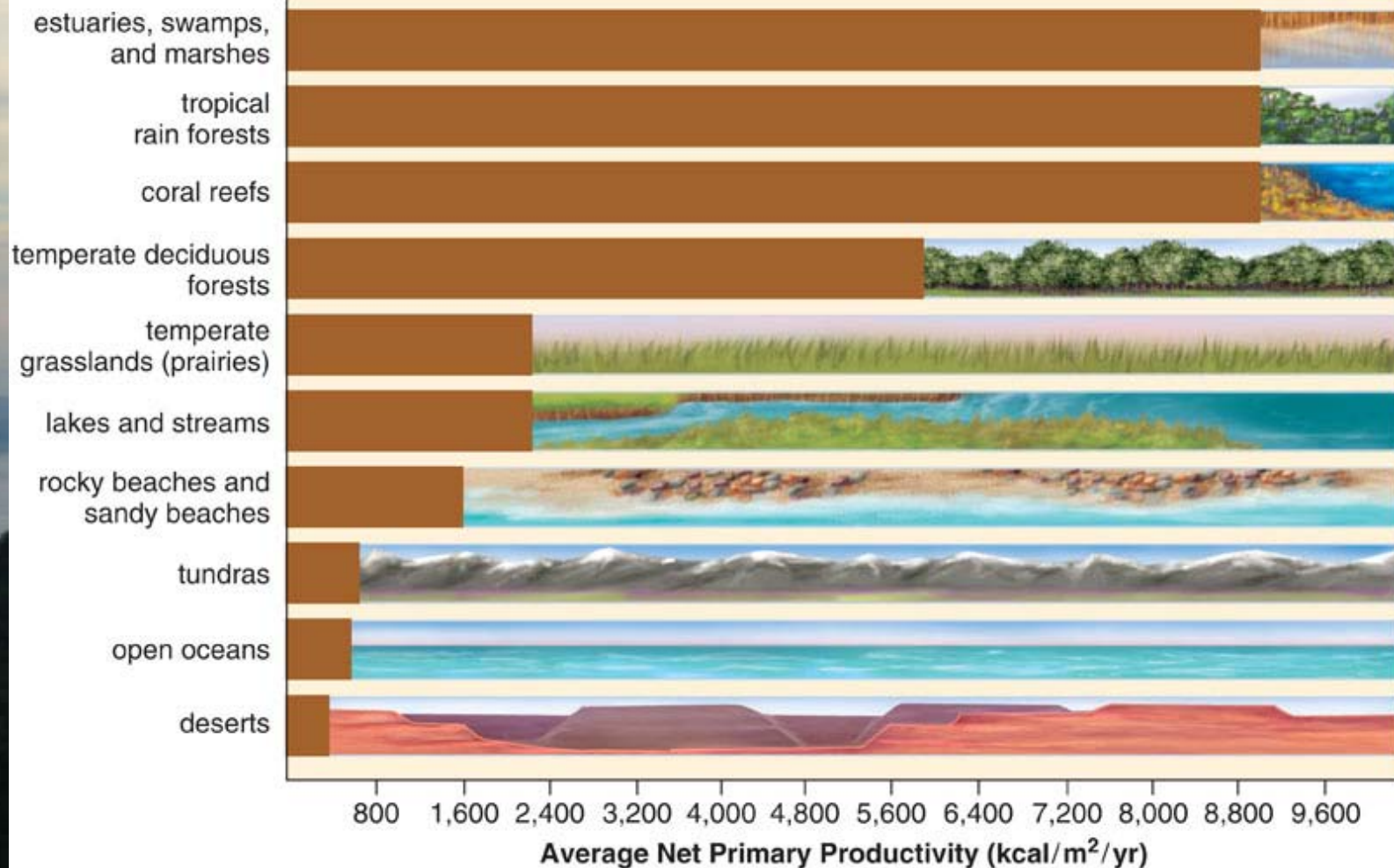
U.S. Geological Survey Hudson River salt-front data--
 Yesterdays salt-front location at high-slack tide was
 32 river miles above the Battery at New York City.

River Mile: 32 on 01/25/2008

Why does the salt front change?

The Hudson, as an estuary, is very productive...what does this mean?

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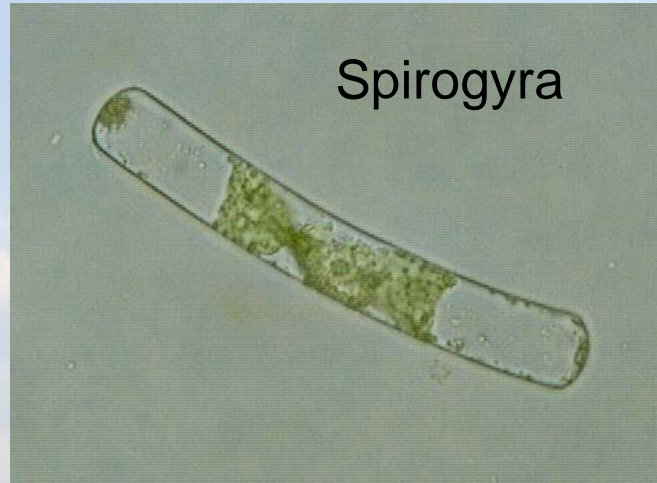
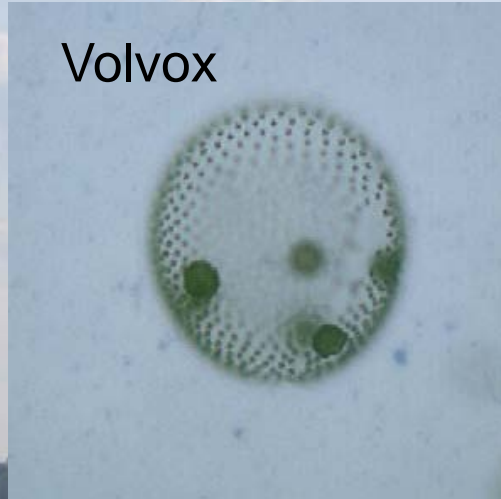


What is productivity?

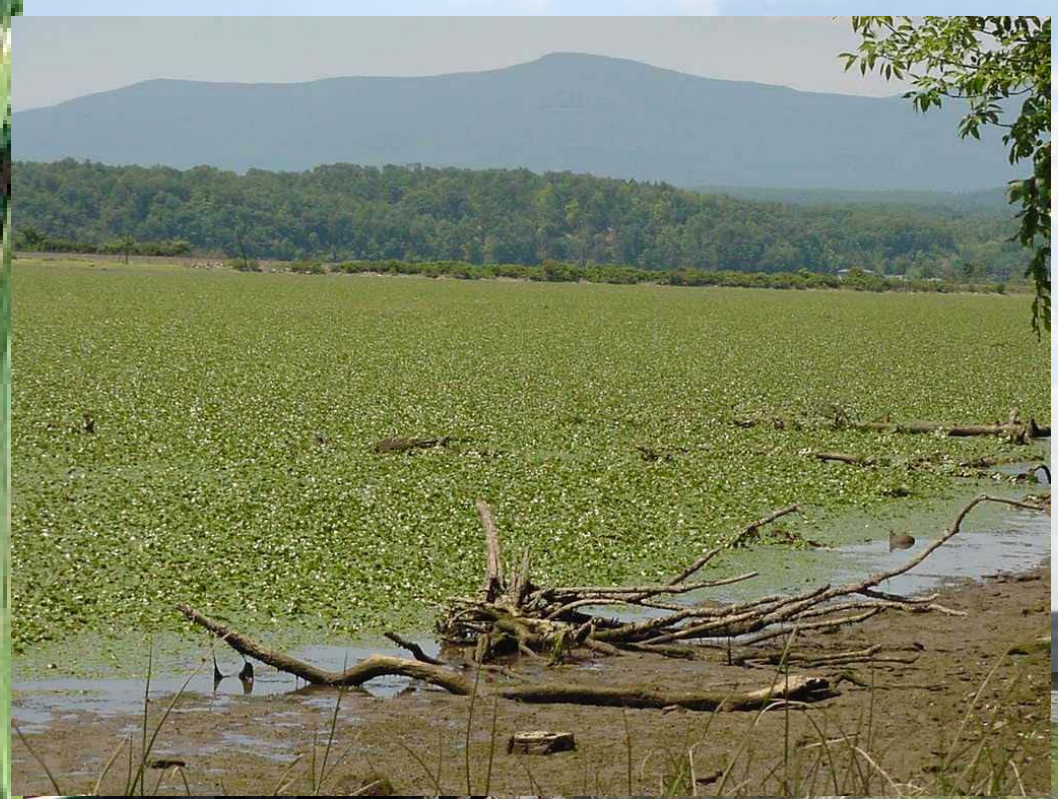
- Productivity: growth rate of living things
- Primary (1°) productivity: growth rate of producers
 - Solar energy converted to organic matter (biomass)
 - Stored in living organisms
- Secondary (2°) productivity: growth rate of consumers
 - Organic matter (food) being eaten & used to create new biomass
 - Includes most bacteria, archaea, fungi, and animals

What is productivity?

- Important! –All organisms depend on 1° producers for their energy supply.
- 1° & 2° production is consumed by other organisms, converted to detritus, or accumulated in biomass
- What Hudson River organisms are responsible for 1° production? What about 2° production?



Phytoplankton



Aquatic
macrophytes

Zooplankton

Rotifers

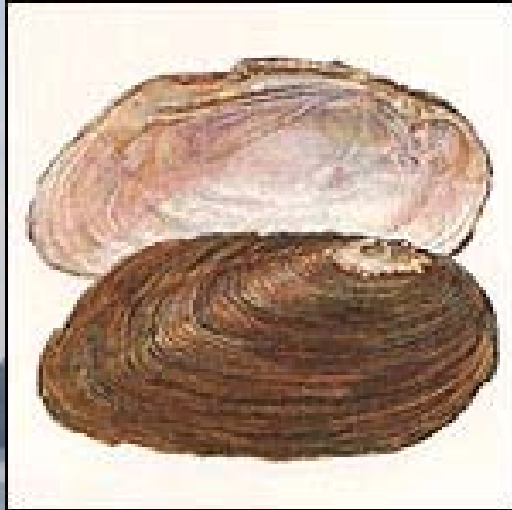


Rotifers

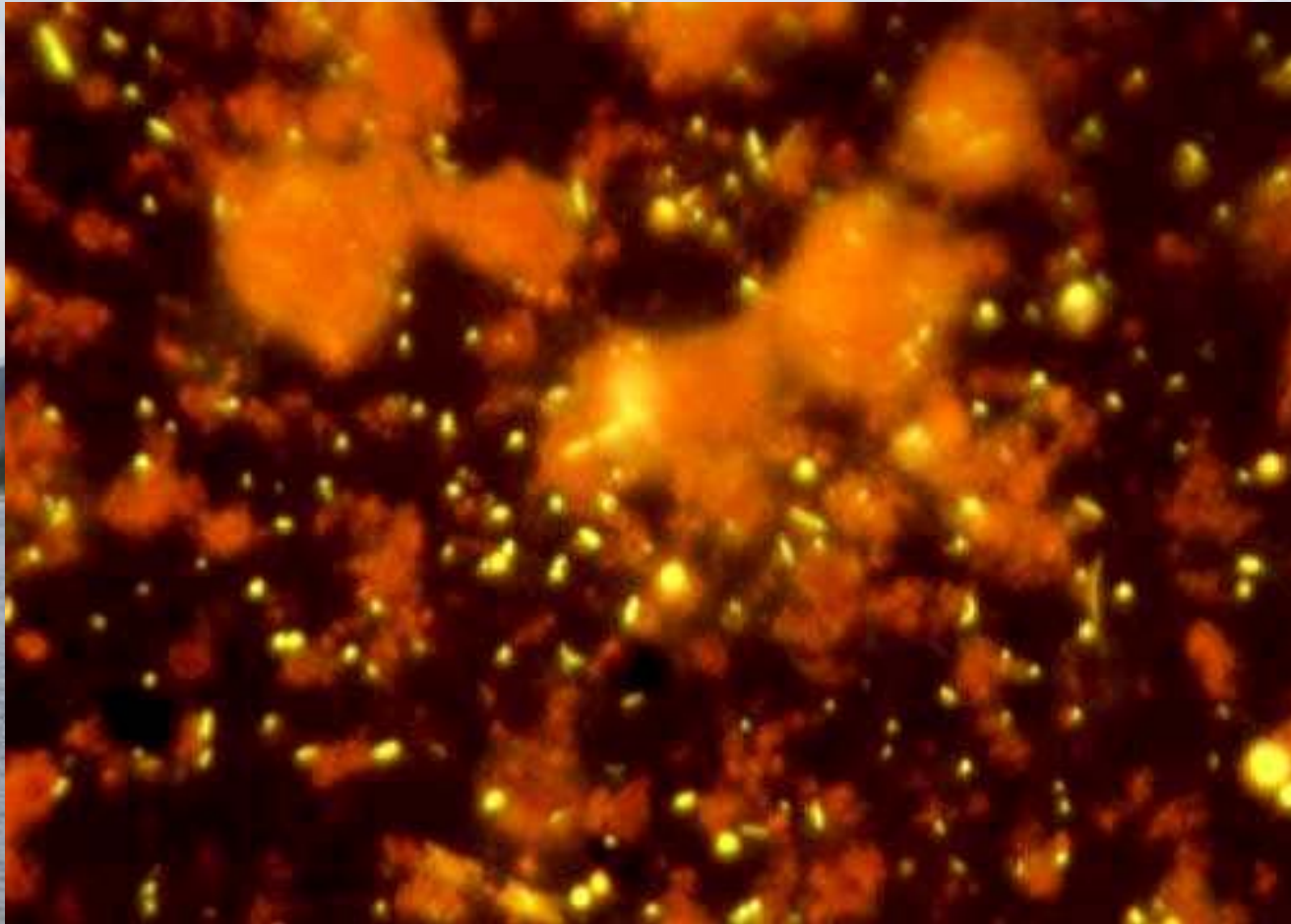


Cladocerans

Macroinvertebrates



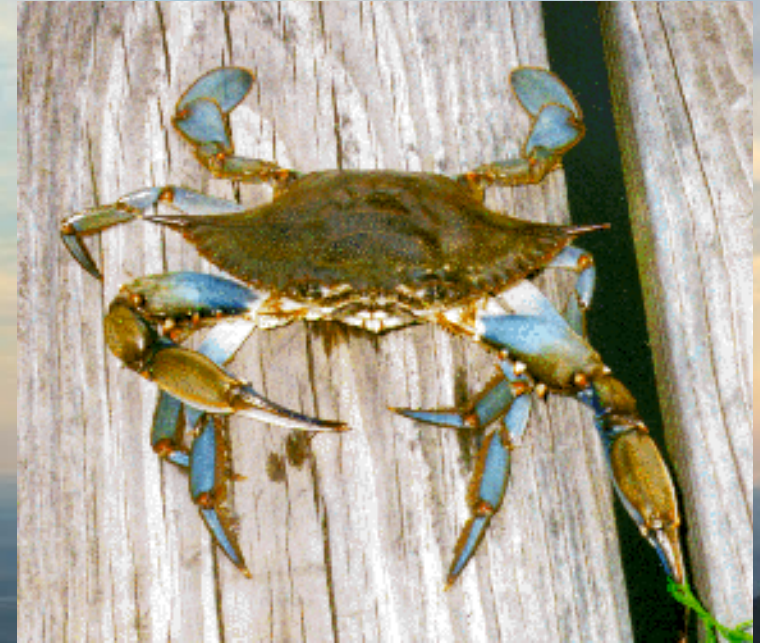
Bacteria



Fishes & other large predators



American shad - *Alosa sapidissima*
averages 14-29 inches



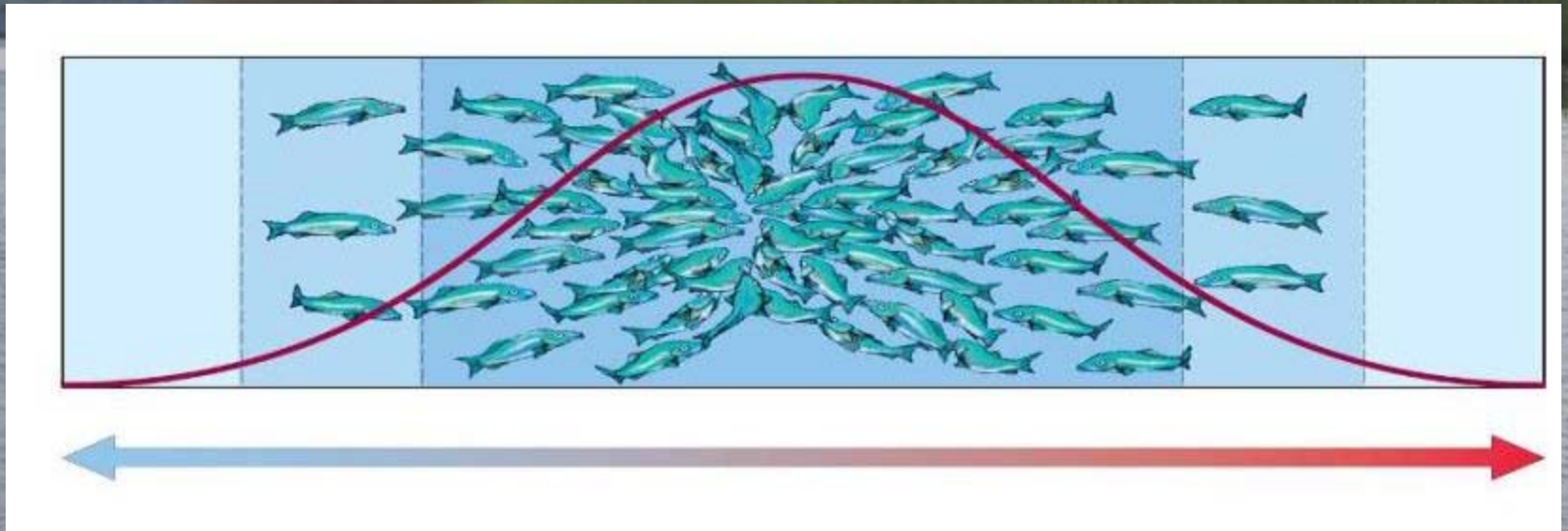
American Eel- *Anguilla rostrata*
averages 24-40 inches



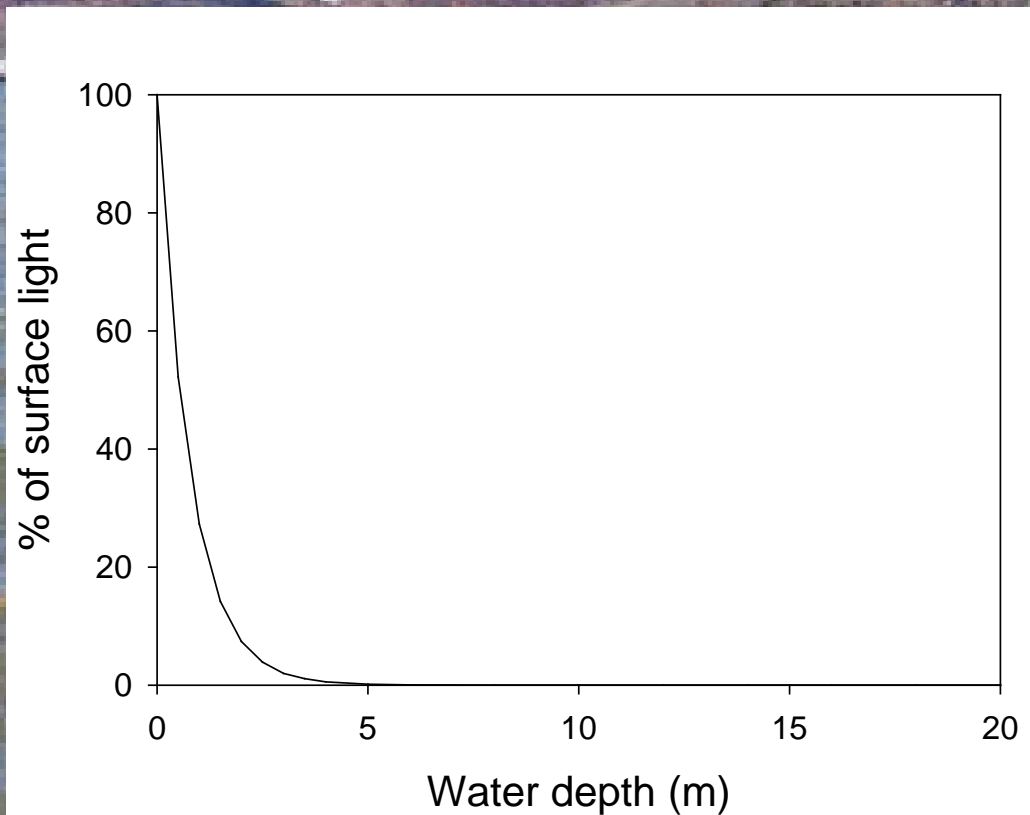
Redbreast- *Lepomis auritus*
averages 4 - 8 inches

What controls productivity?

- “Limiting factors” - Too much or too little of any abiotic factor can limit or prevent growth of a population
- What might be a limiting factor in the Hudson?



What's in the water? Mud.



What happens to the useable energy from one level to the next?



3° consumer

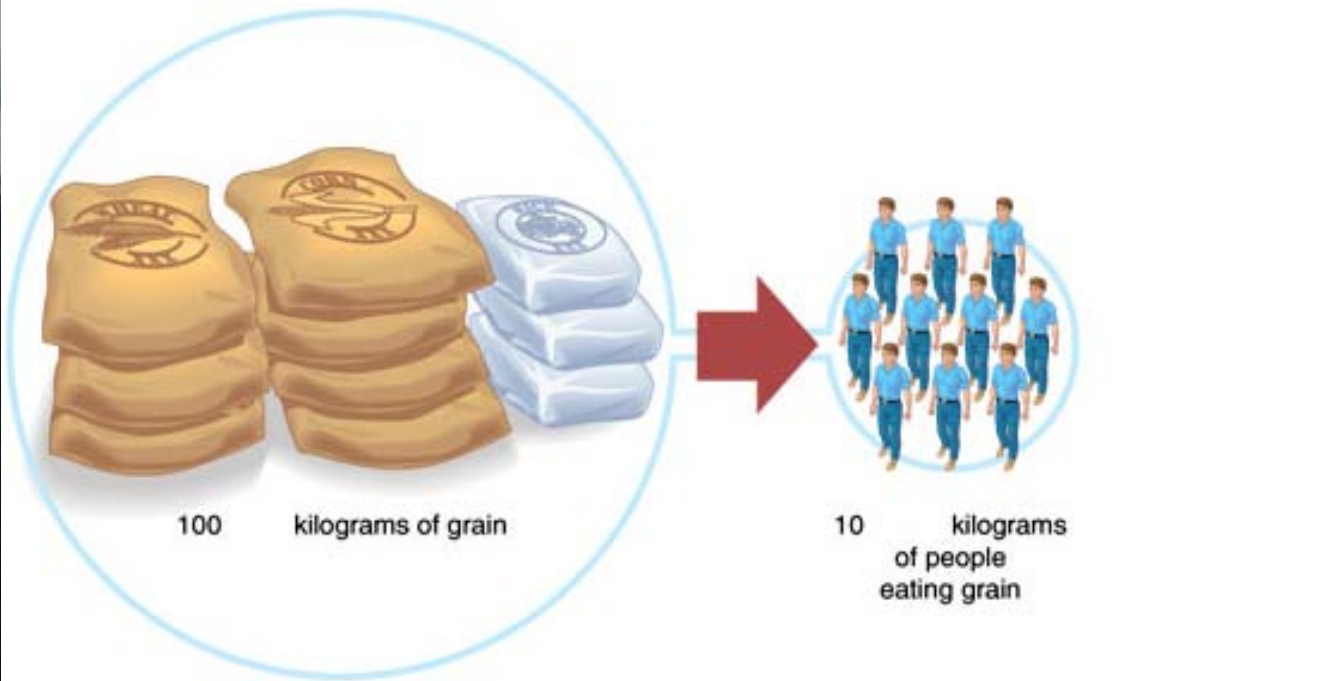
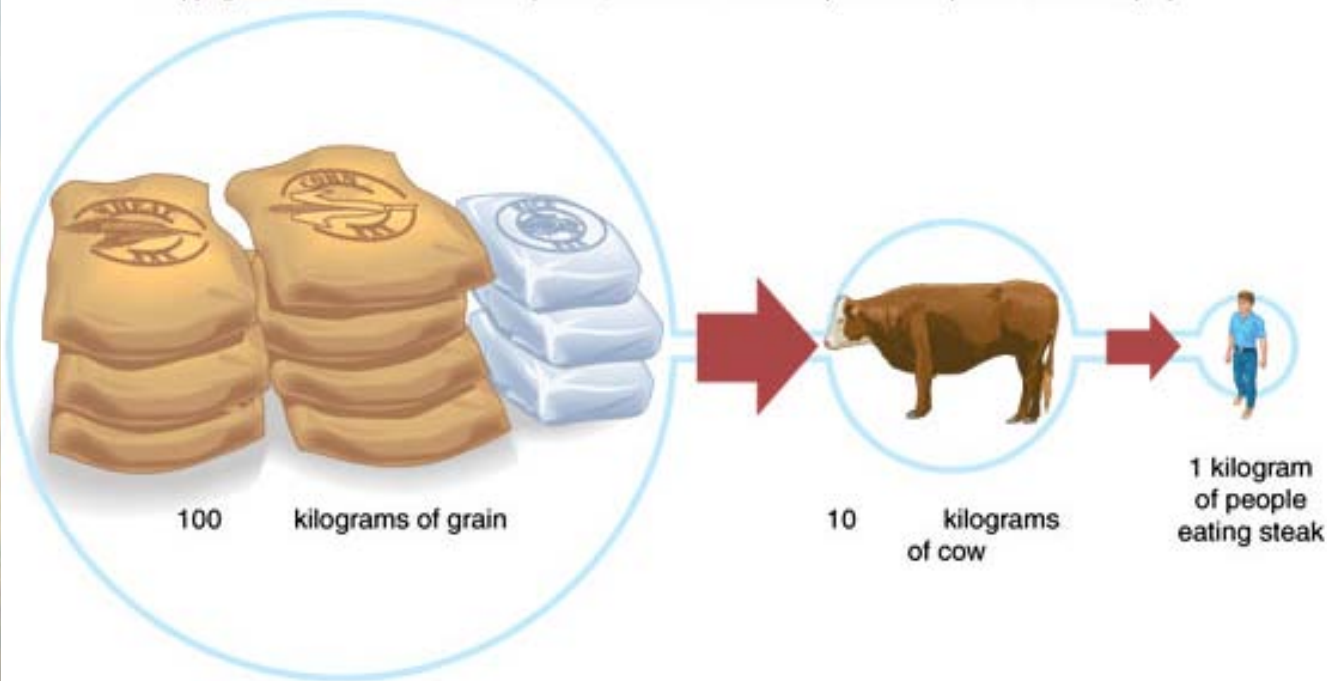


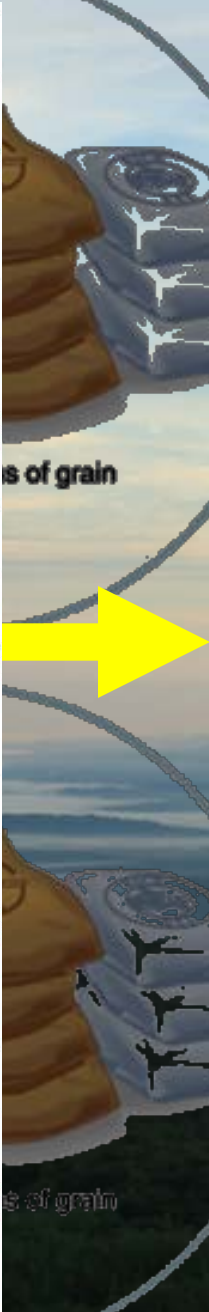
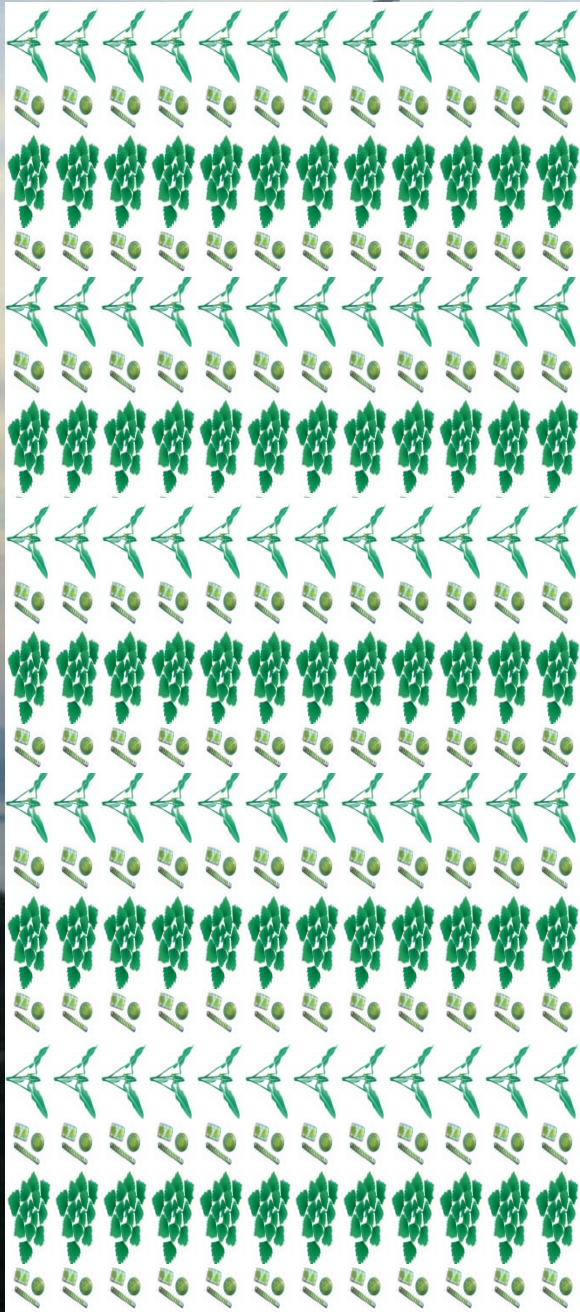
2° consumer



1° consumer







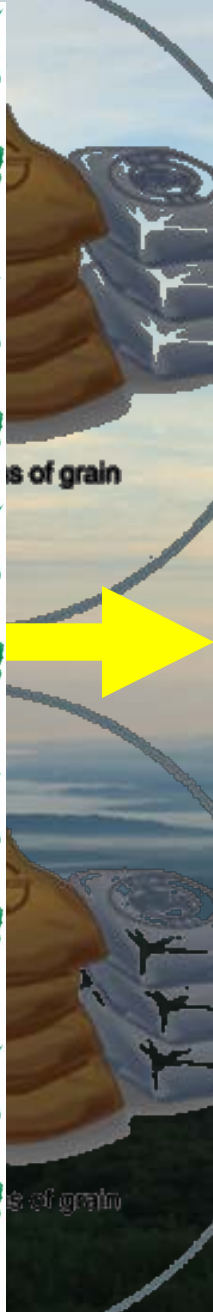
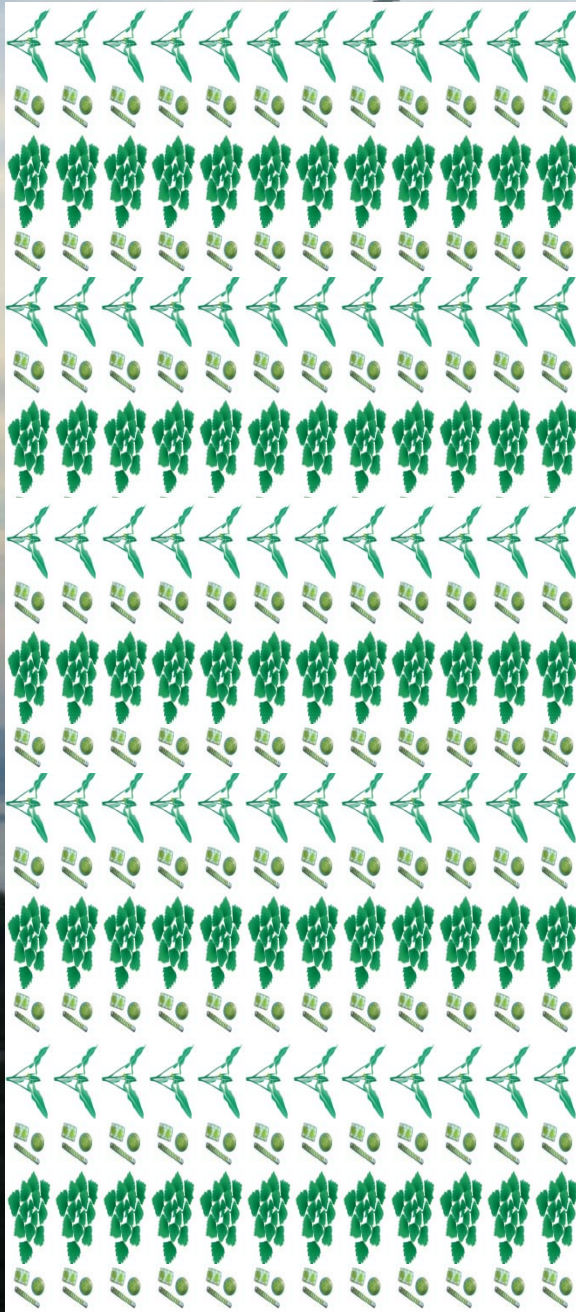
kilograms of grain

kilograms cow

1 kilogram

kilograms people





Organisms and Energy

- Detritus: dead and decaying organic material
- VERY important part of the HR ecosystem (90% of carbon comes from the watershed)

