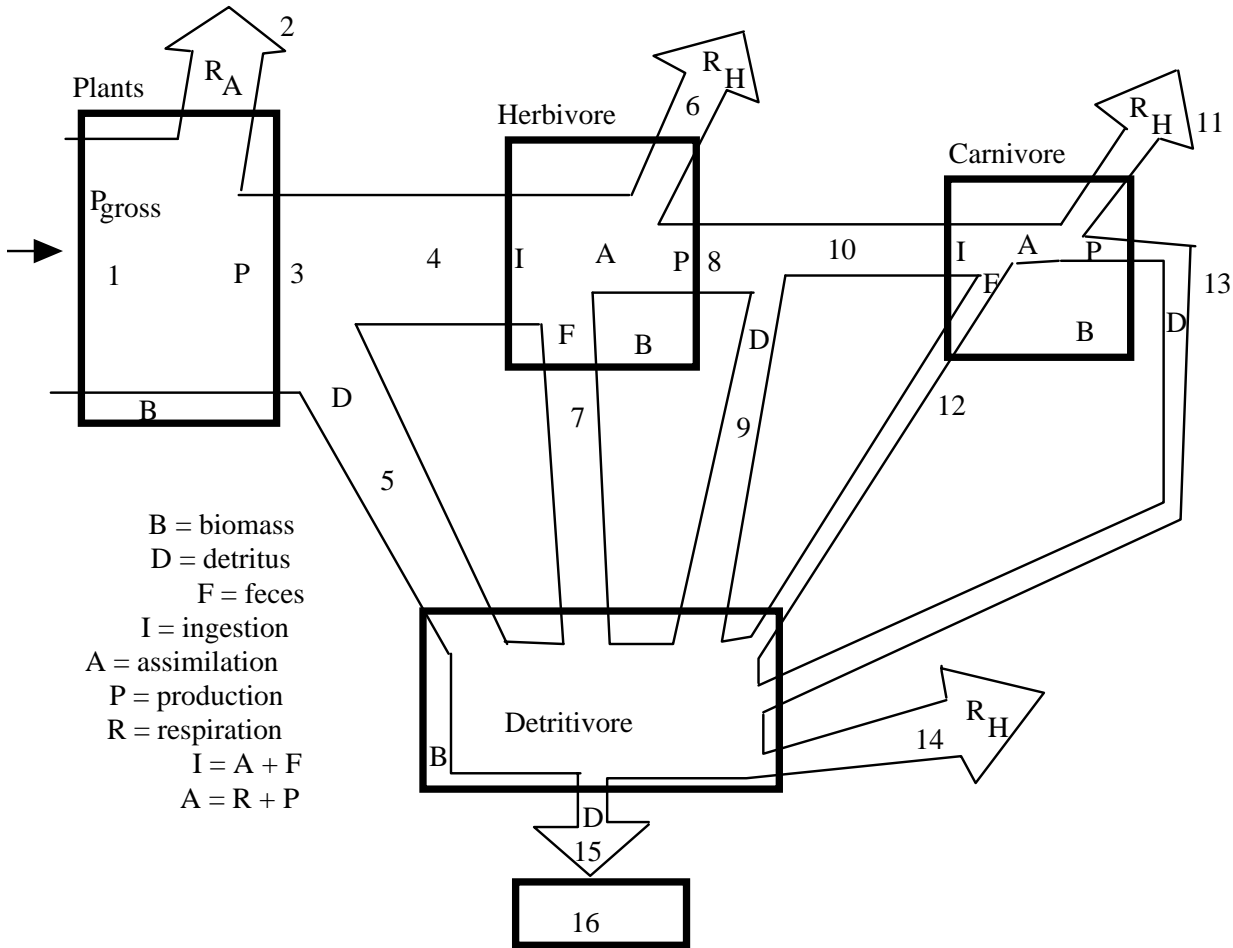


Biogeochemical Cycles—Energy Flows

A. Carbon and Energy in a Food Web. Steady State.



1. What do the arrows in the diagram represent?
2. Why are the arrows of different sizes?
3. How does the energy enter the ecosystem? Is it converted in any way before it is used in the ecosystem?
4. What do each of the following numbers represent?

- | | |
|------|------|
| 1 = | 2 = |
| 3 = | 4 = |
| 5 = | 6 = |
| 7 = | 8 = |
| 9 = | 10 = |
| 11 = | 12 = |
| 13 = | 14 = |
| 15 = | 16 = |

5. Starting with 10^6 kcal/yr of GPP and given the following values, estimate the values of each of the flows from part 4 assuming steady-state conditions.

For plants : net production efficiency = $\frac{NPP}{GPP} = 50\%$

For the herbivores: exploitation efficiency = $\frac{\text{ingestion}}{\text{production from previous trophic level}} = 20\%$

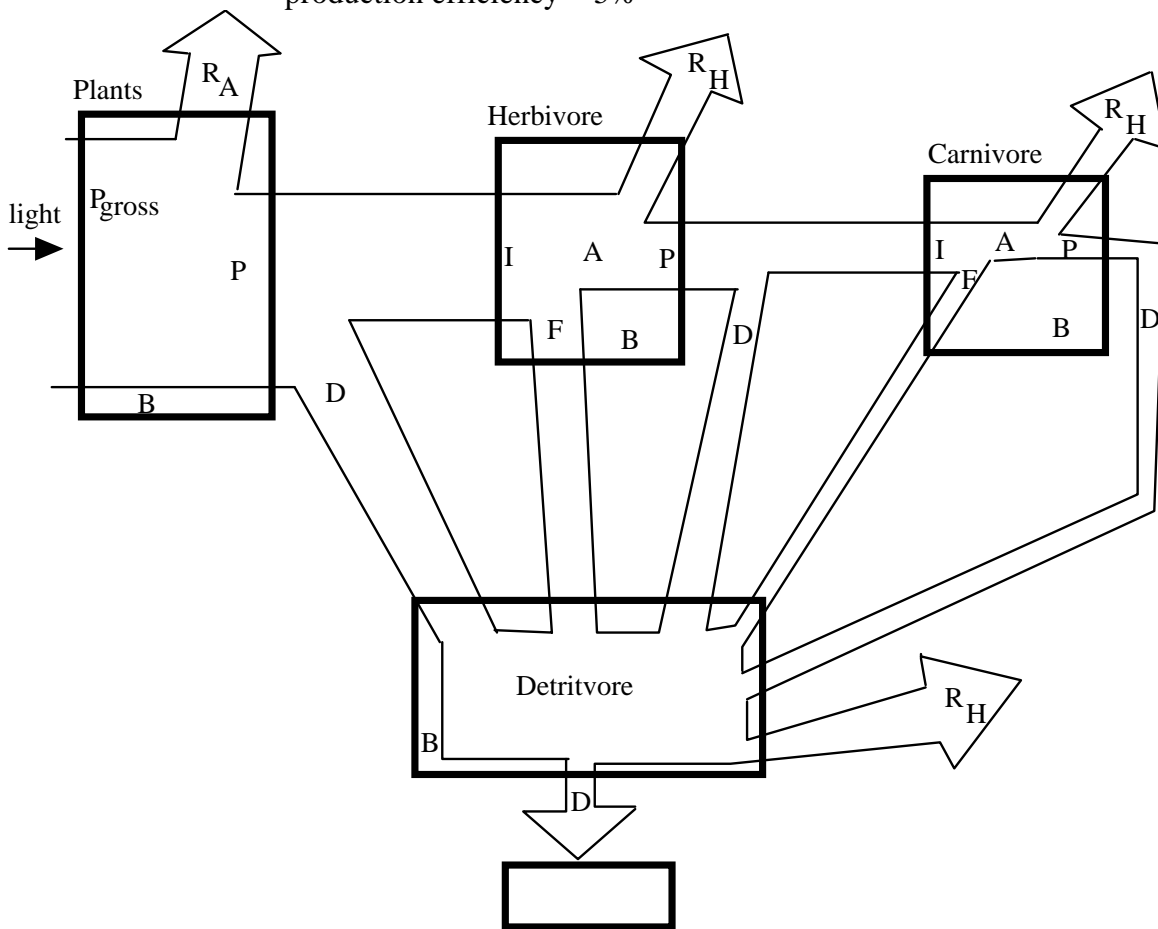
assimilation efficiency = $\frac{\text{assimilation}}{\text{ingestion}} = 25\%$

production efficiency = $\frac{\text{production}}{\text{assimilation}} = 20\%$

For the carnivores: exploitation efficiency = 90% (no reference)

assimilation efficiency = 75%

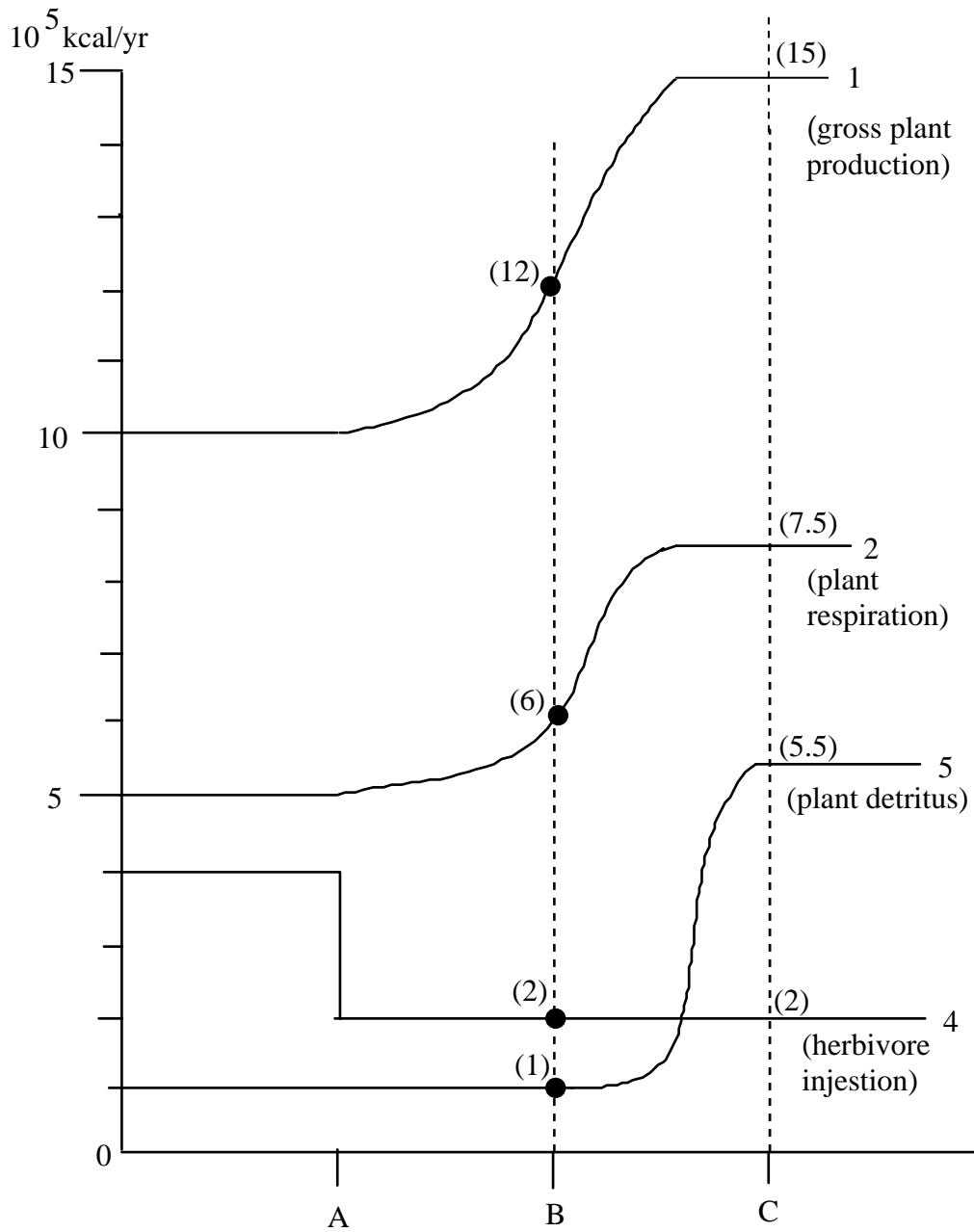
production efficiency = 5%



6. The carbon in respiration (R) flows can be used by other organisms, but the energy in the respiration (R) flows cannot. Both the carbon and energy of all other flows can be used by other organisms. What is different about the R flows?

B. Non-Steady State.

Now consider the non-steady-state. Suppose you remove 50% of the herbivores at time = A. You then measure the plant-associated flows and find the following:



1. What is going on? Consider the state of the ecosystem at times B and C.