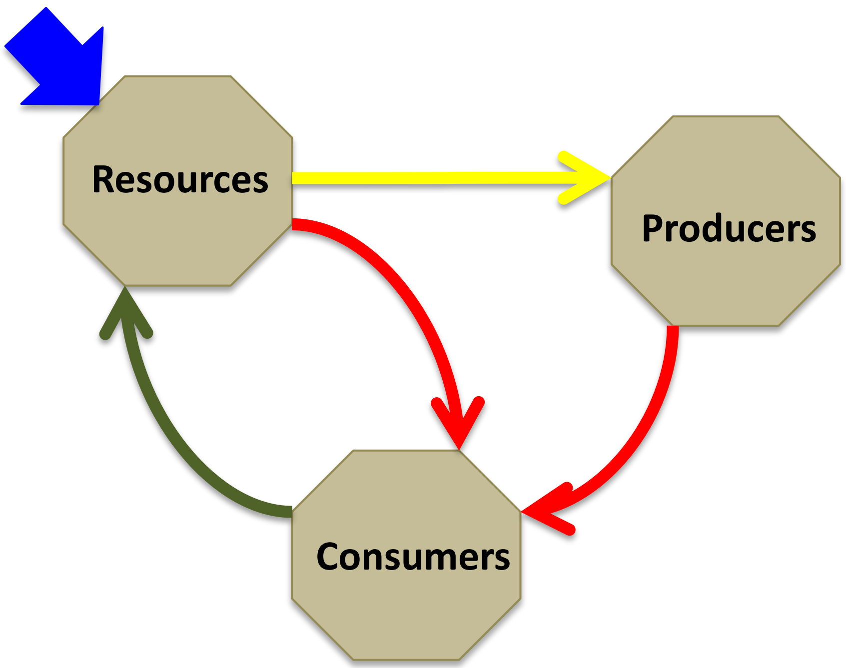
What determines the rate of system responses to resource perturbations?

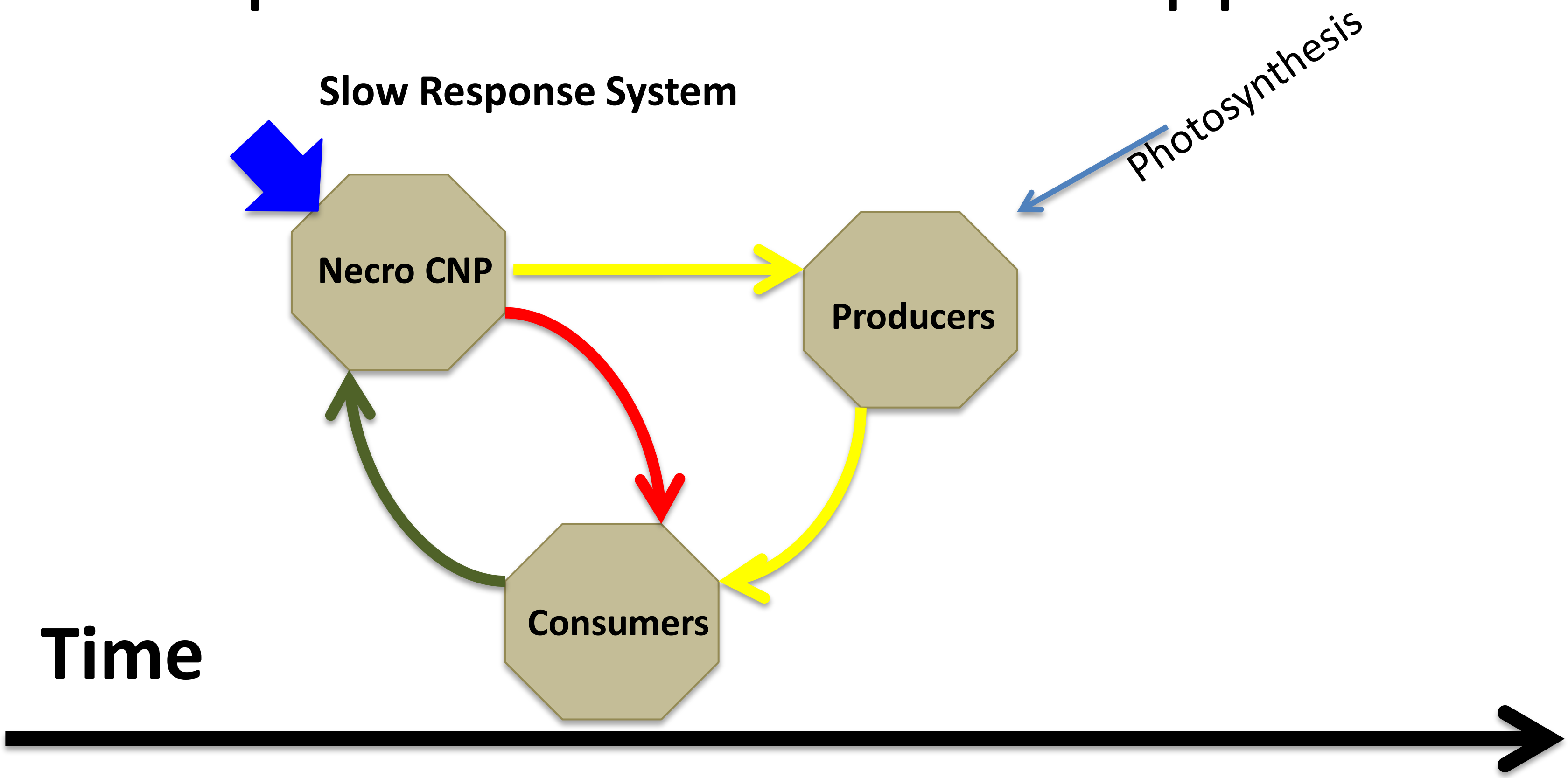
System response to nutrient perturbations will depend on:

1. Temporal mismatch in turnover rates
2. Stoichiometric mismatch



These mismatches will vary strongly by system and will determine the rate at which systems will respond to nutrient perturbations

What determines the lags of system responses to resources supplies?



Resource Supply

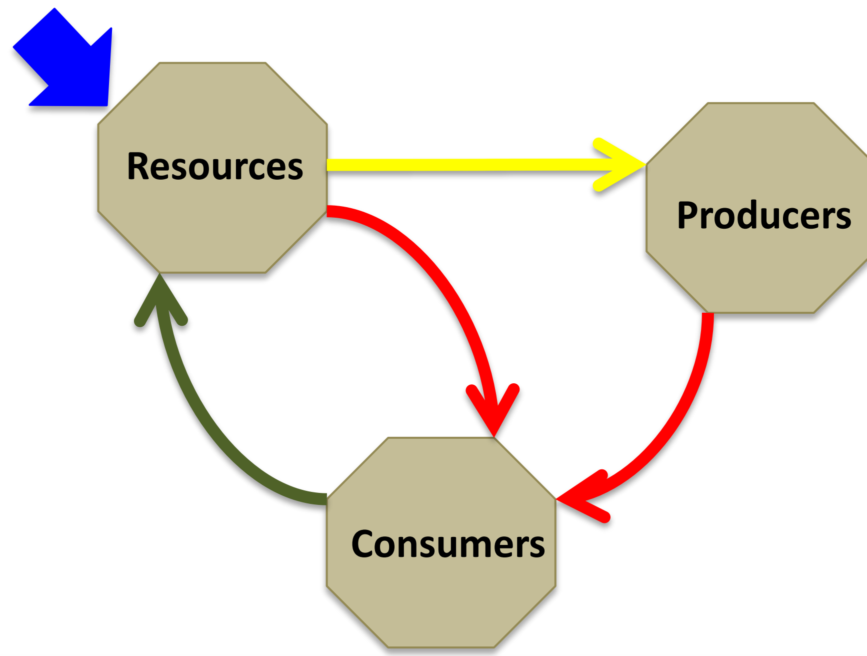
Physiology: Growth and Tissue Chemistry

Demography: Birth and Death

Community and Composition: Extinction and Colonization

What determines the rate of system responses to resources supplies?

Fast Response System

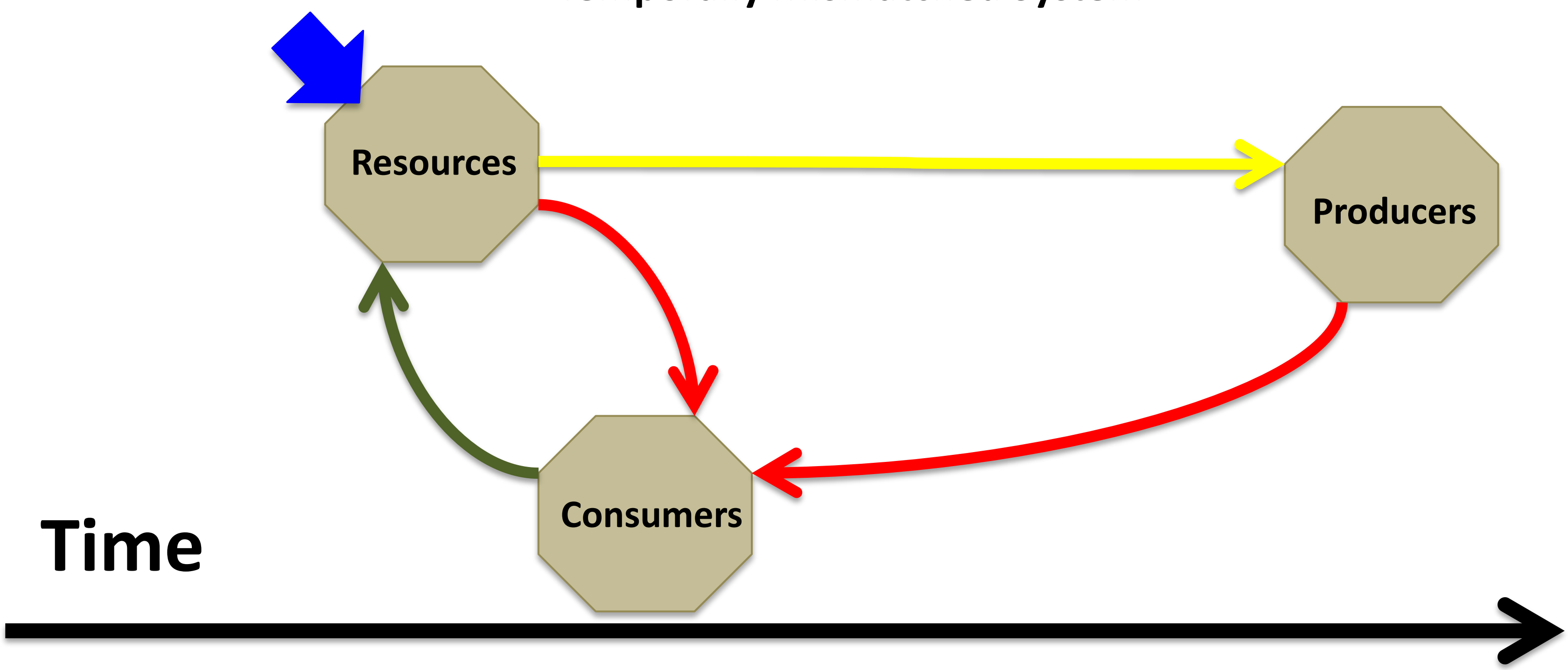


Time

Resource Supply	**Physiology:** Growth and Tissue Chemistry	**Demography:** Birth and Death	**Community and Composition:** Extinction and Colonization

What determines the rate of system responses to resources supplies?

Temporally Mismatched System



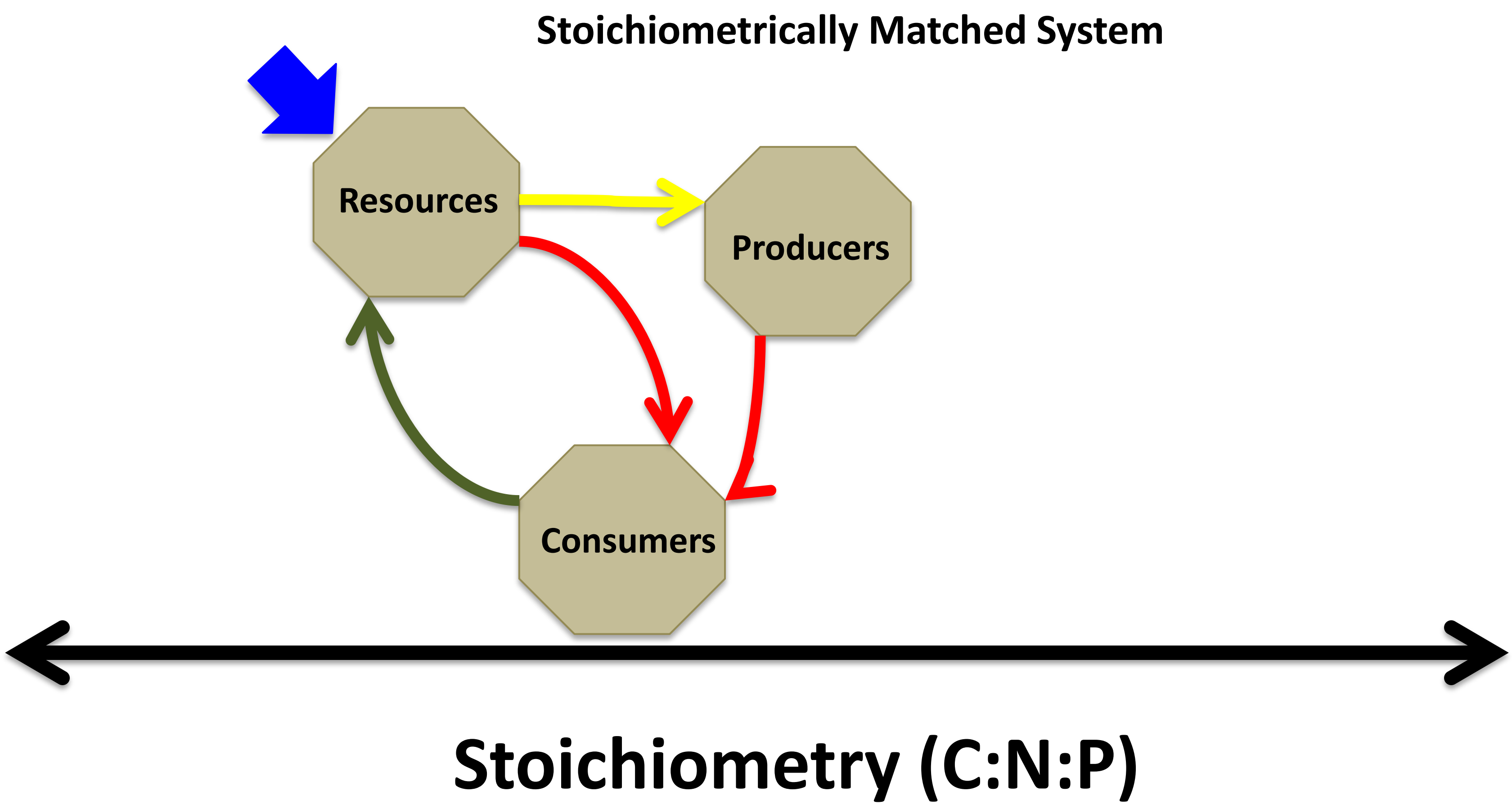
Resource Supply

Physiology: Growth and Tissue Chemistry

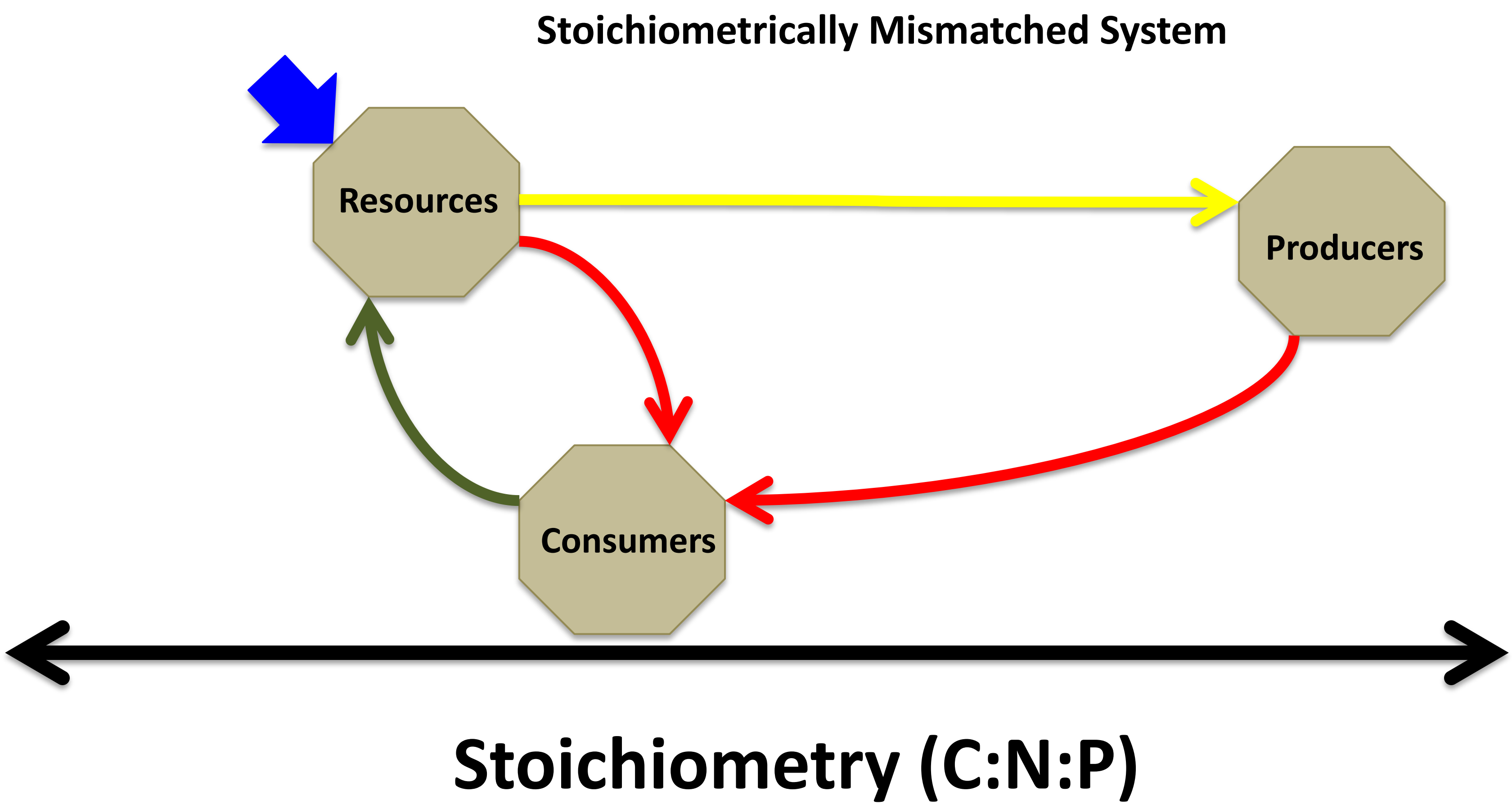
Demography: Birth and Death

Community and Composition: Extinction and Colonization

What determines the rate of system responses to resources supplies?



What determines the rate of system responses to resources supplies?

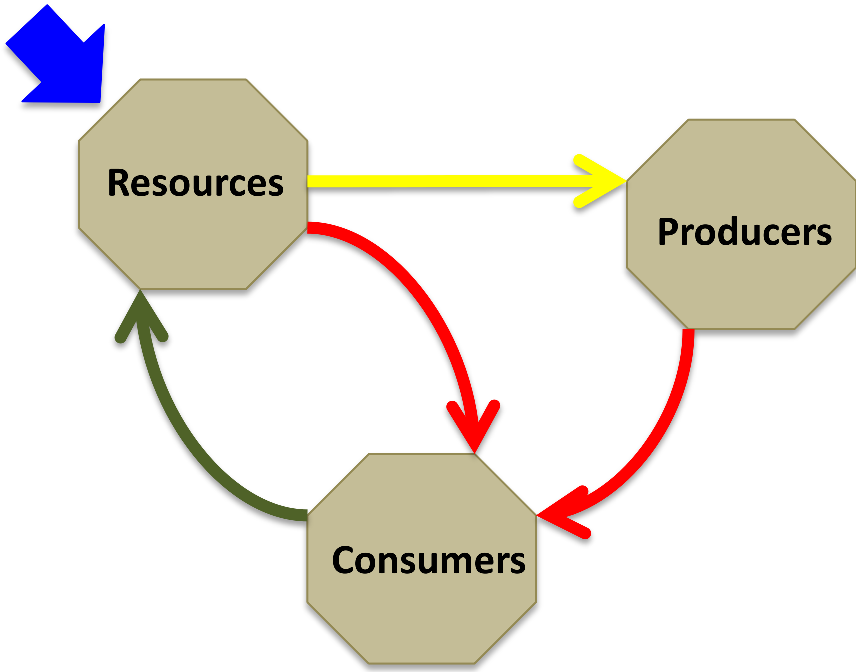


Lags in the response to increases in nutrient availability

Response occurs through changes in primary producers that affect heterotrophs (Indirect yellow route)

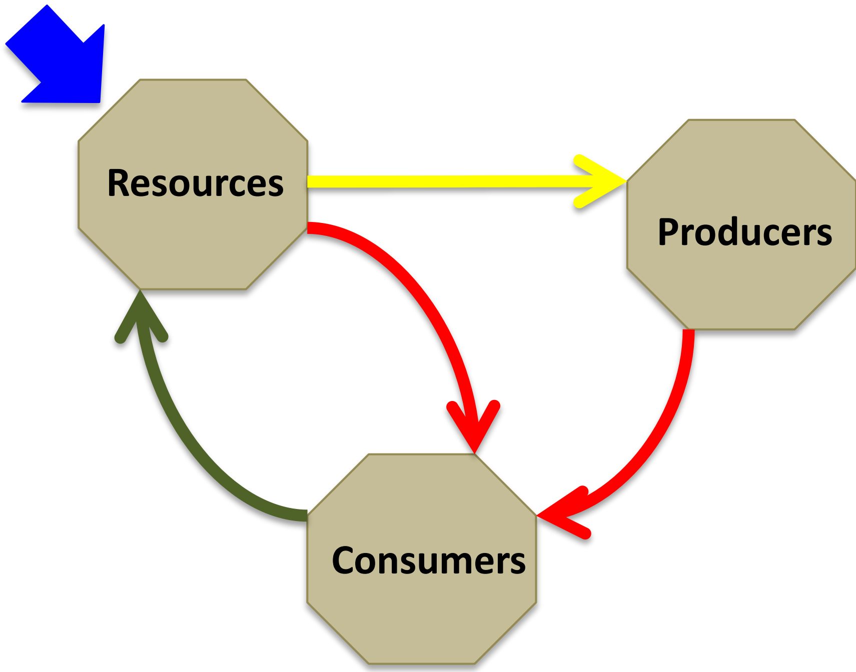
Response occurs through direct changes on heterotrophs (Direct red route)

H1 R/(R+Y) increases positively with the ratio of generation time of autotrophs /heterotrophs
H2 Lags depend on the slowest generation time in the ecosystem
H3 Lags increase as other-factor strong co-limited NPP
H4 Lags increase as pools over input increases



Lags in the response to increases in nutrient availability

Goal: Collect long term fertilization data on resource, consumer, and producer responses to nutrient perturbations.

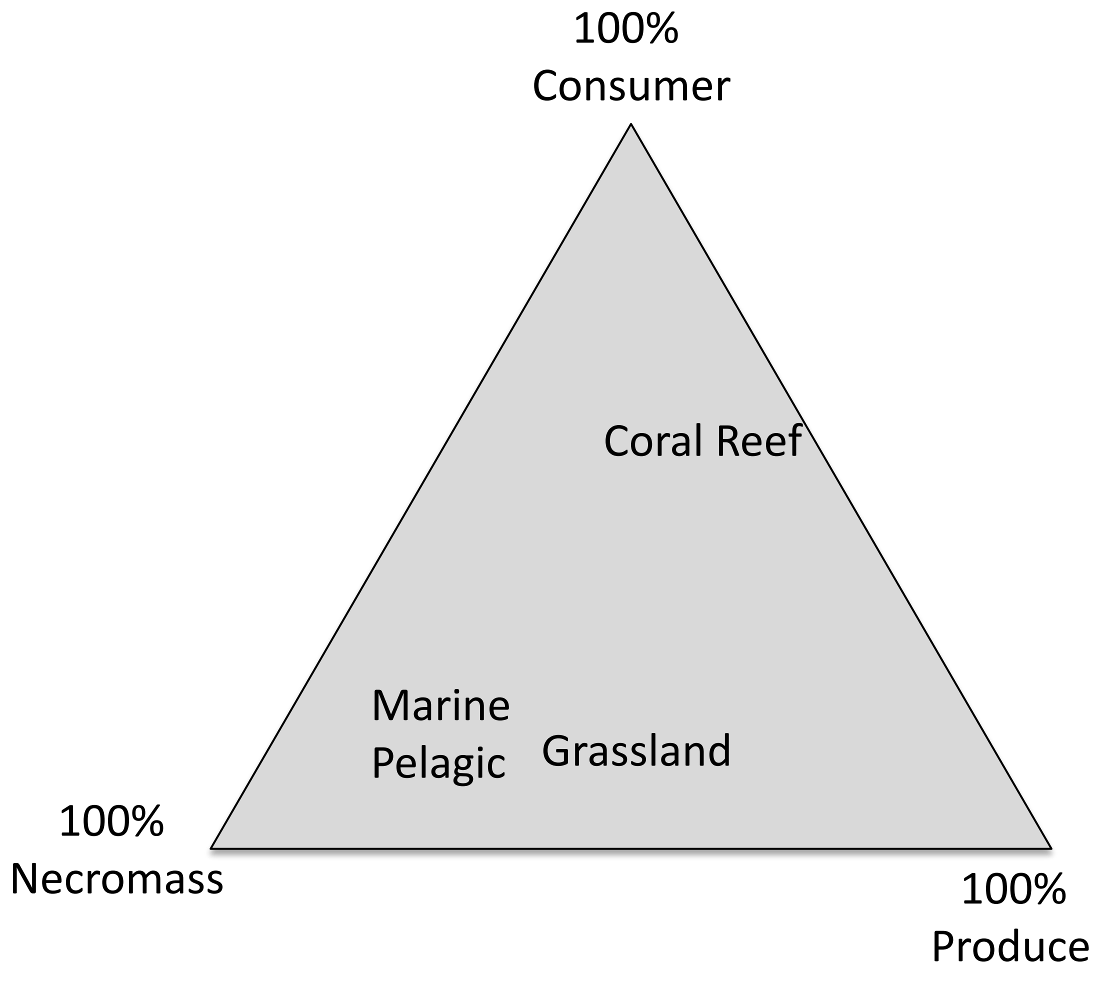


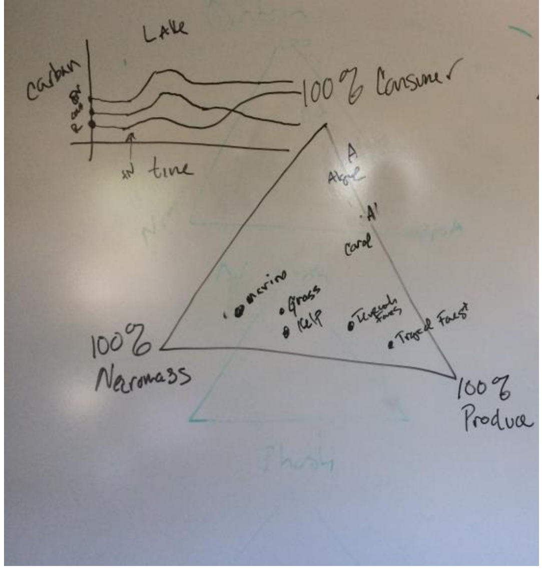
Predicting Lag Times in N Fertilization

1. What are model predictions for the effects of residence time of N on system transience?
2. What is the distribution of N and C pools in Consumers, Producers, and Necromass in different ecosystems ?
3. What is residence time of N in these pools based on 15N or Mass Balance Studies?
4. What is the length of transience in N fertilization studies?

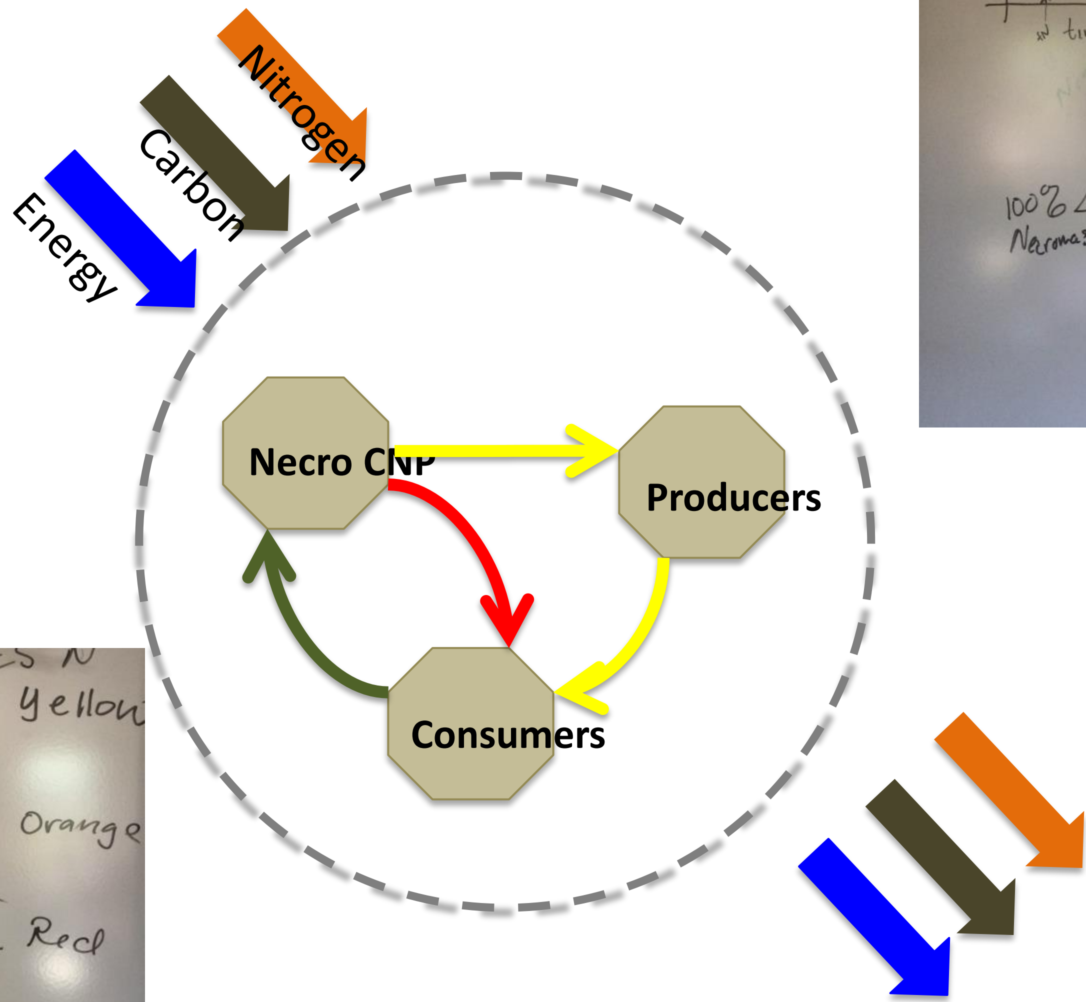
Starting states can be characterized by pool distributions

- Carbon or Nitrogen Distribution in different ecosystems

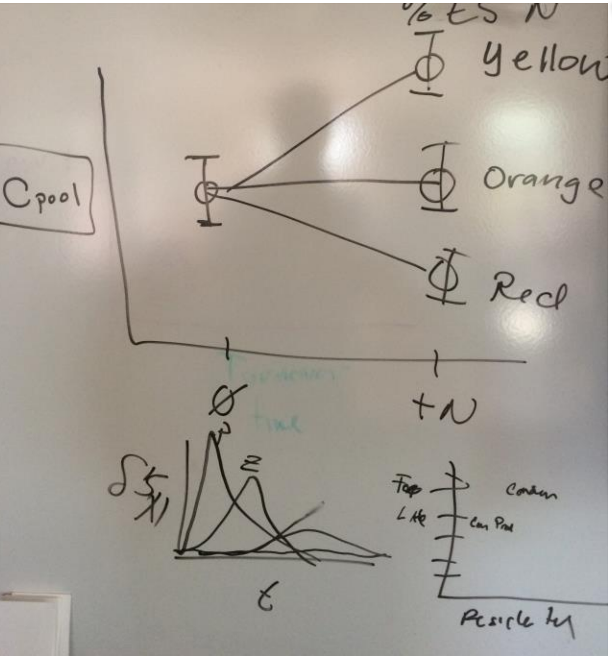




LAKE
carbon
time
100% Consumer
Algae
coral
kelp
grass
100% Necromass
100% Producer



Nitrogen
Carbon
Energy
Necro CNP
Producers
Consumers



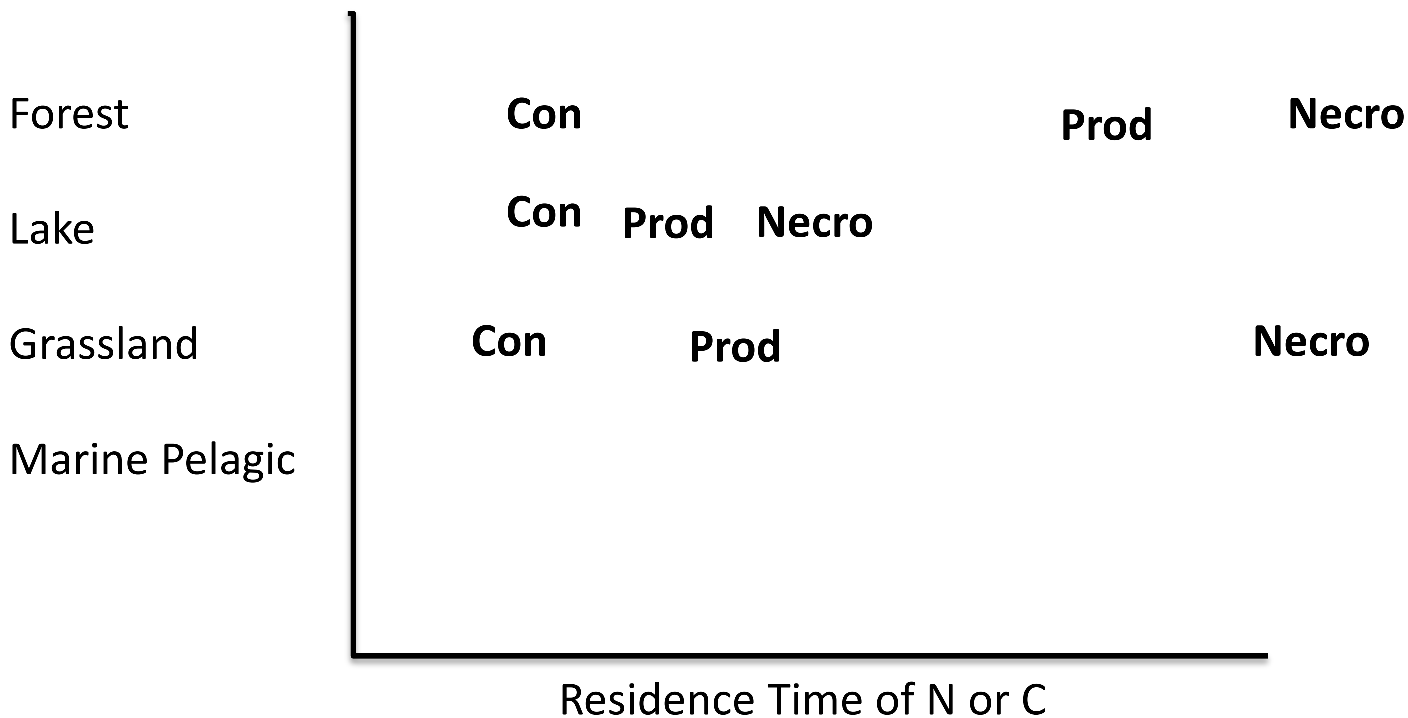
Cpool
yellow
Orange
Red
+N
time

What is mean residence time of N in Producers Consumers and Necromass

- Mass balance or 15N studies can be used to estimate mean residence time of Nitrogen in plants, consumers, and necromass.
- Relativized Consumer:Producer residence time will

Residence time of Nutrients in different pools will determine transience time

- Plots of residence time of Nitrogen and Carbon in Producers, Consumers, and Necromass will predict time lags



Predicting the response the lag in ecosystem response to N Fertlization

- The lag in ecosystem response to N fertilization will depend on rate at which N moves through the producer, consumer, necromass pathway. This is indicated by 15N studies.
- Fertilization lags will increase with retention of 15N in producer biomass.

Modeling Component

- Three equation model of Heterotrophs, Autotrophs, and Necromass
- This can be generally parameterized to predict transience periods for N fertilization.

Data Needs

- Data on distribution of mass (CN) across Consumer, Producer, Necromass Pool) triangle plot
- 15N experiments to estimate residence time
- Mass balance estimates of residence time
- Long term N fertilization studies with NPP and maybe Decomposition