

The background is a detailed botanical illustration featuring various plants and fruits. At the top left, there's a branch with leaves and small flowers labeled 'Hímcs virág.'. Next to it is a magnified view of a fruit labeled 'A termő barka nagyobbítva.'. On the left side, there's a branch with leaves labeled 'Termő barka.' and another labeled 'Viasz (Myrica)'. On the right side, there's a magnified view of a fruit labeled 'Hosszant metszetti gyümölcs.' and another labeled 'Hímcs virág.'. At the bottom, there's a large, textured fruit labeled 'Gyümölcs.' and another labeled 'Mag.'. The central text 'ECOSYSTEM MODELS' is overlaid on a white rectangular area with a blue header bar.

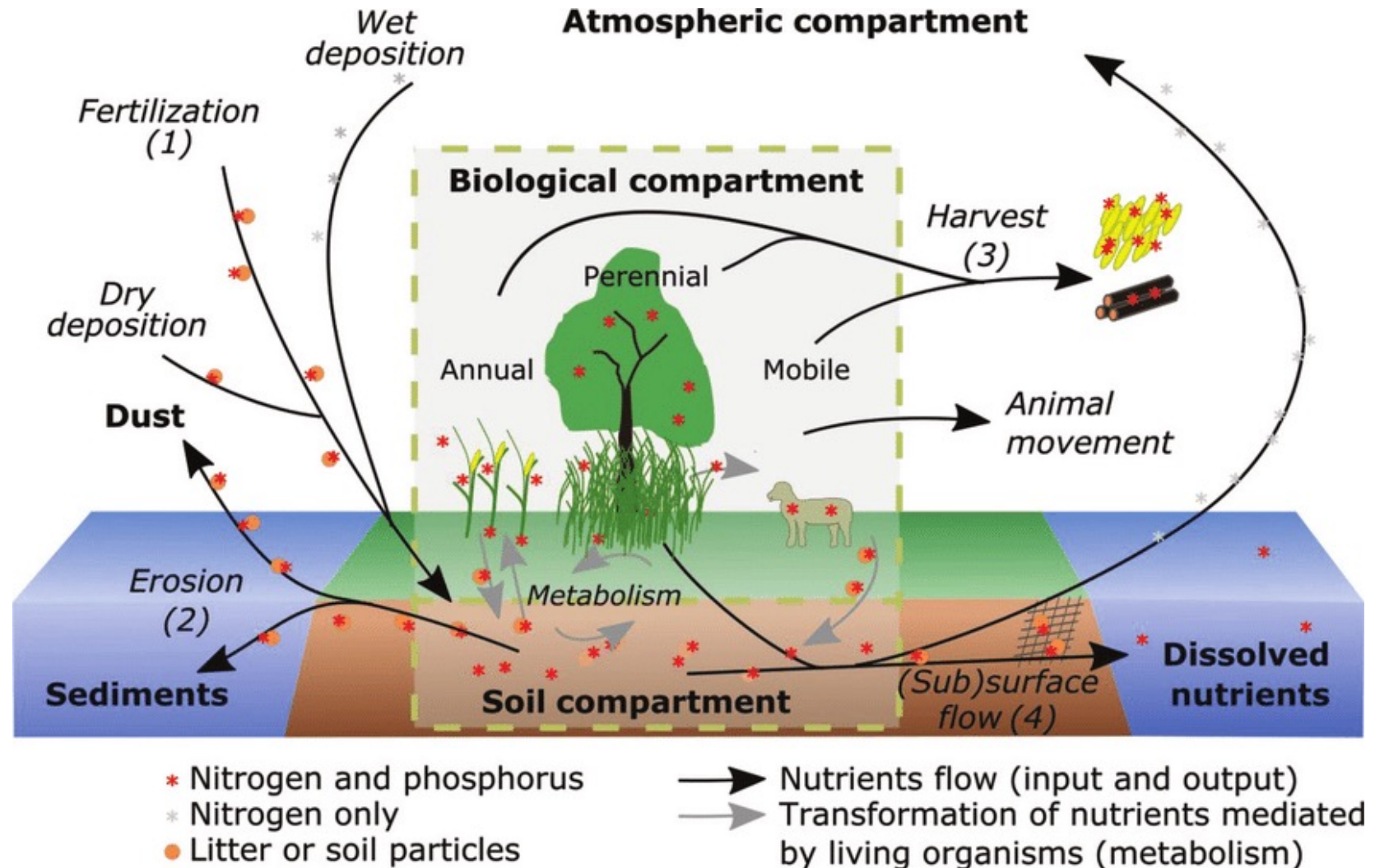
ECOSYSTEM MODELS

But first...data!

- Pacific halibut (*Hippoglossus stenolepis*)
 - Size-at-age
 - Abundance index time series
- Chimney swift (*Chaetura pelagica*)
 - Breeding bird survey (BBS) counts time series
- Tree seedlings (< 1" diameter at breast height; 6" conifers, 12" hardwood)
 - USDA Forest inventory and analysis
 - Not species-specific
- What else?

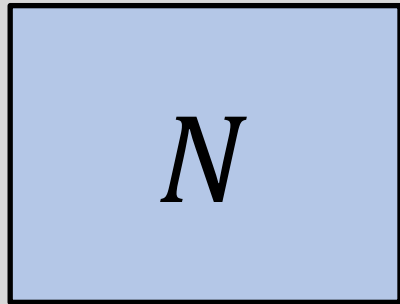
How do we model ecosystems?

- Mass balance
 - Law of Conservation of Mass
 - Flow of energy/mass/stuff between compartments

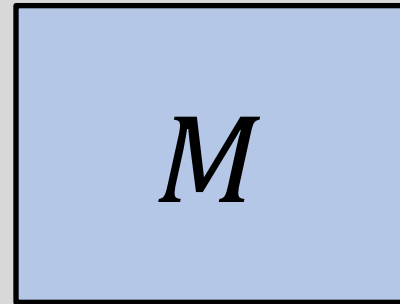


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$$\frac{dN}{dt} = aM - bN$$

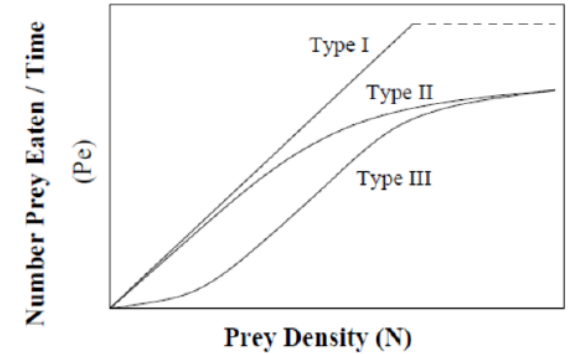


$$\frac{dM}{dt} = bN - aM$$



Ecopath with Ecosim

- Determines un-observed "compartments" with observed, often single-species data + some assumptions regarding rates and efficiency of energy transfer
 - Growth
 - Reproduction
 - Mortality
- Models include several components
 - Functional responses between predators and prey
 - Removal by humans ("fishing")
 - Compartments for each ecosystem component
 - Age-specific stages (stanzas)



Rpath

- A new implementation of EwE within R
- What do you need?
 - Model: parameters, including biomass, production, consumption, etc.
 - Diet: proportion of diet arising from other compartments in the model
 - Stanzas: age classes
 - Pedigree: data origin and reliability