Population dynamics project:
Internal dynamics of NPZD type ecosystem models

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Mathematical models in biology

FME-UPC

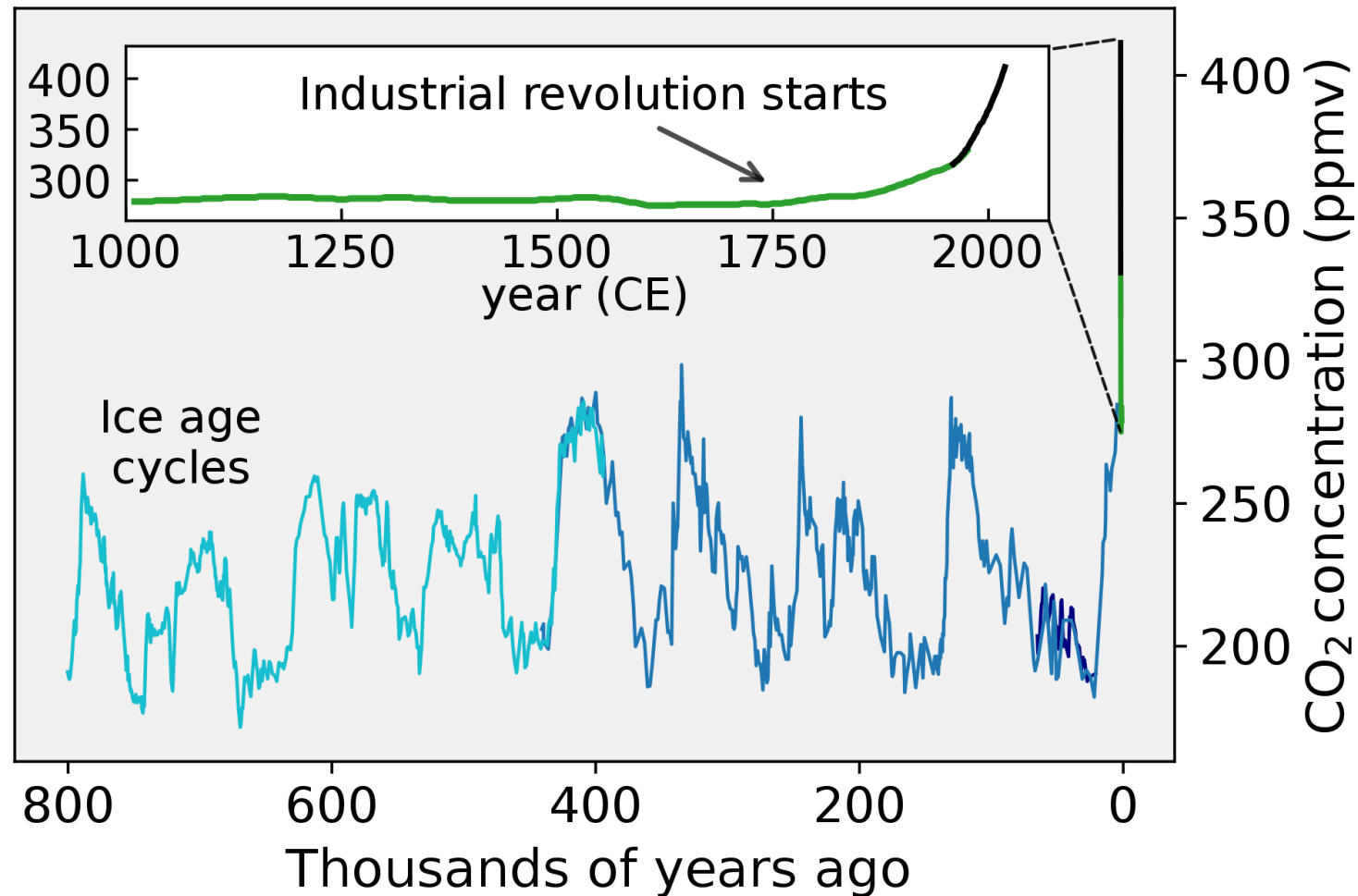# Content

- The problem

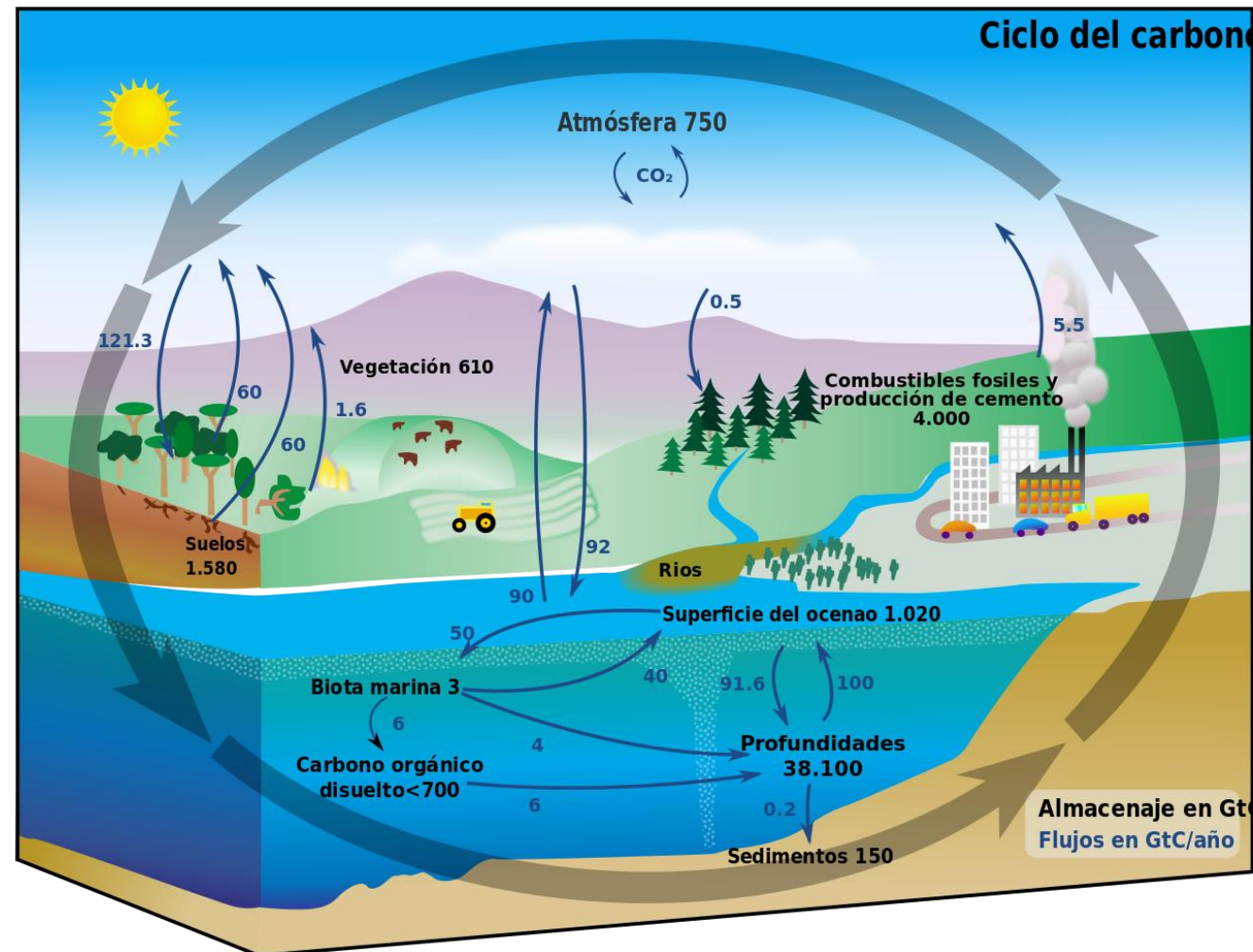- Proposal

- Results

- Our proposal

The problem

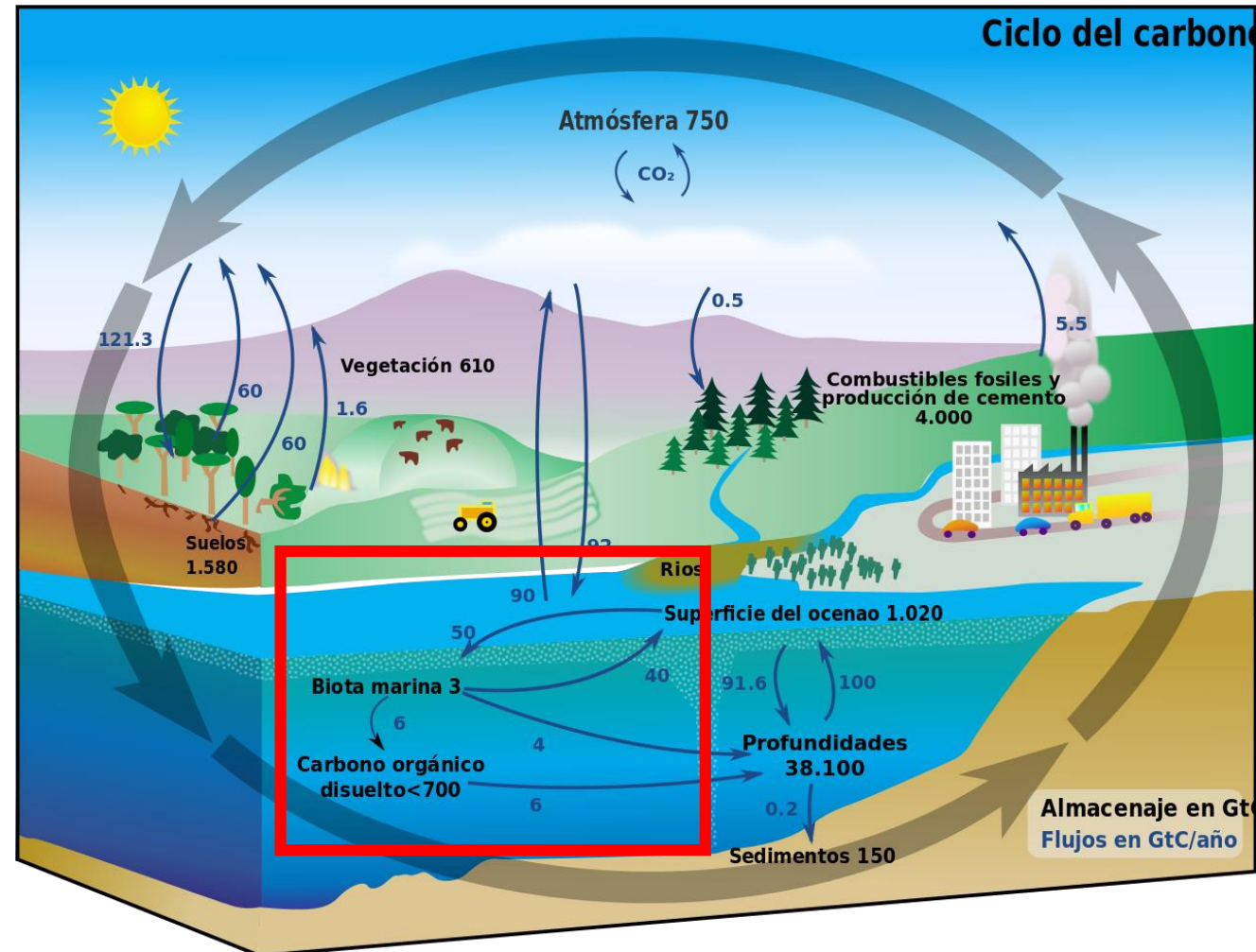# The problem I: Climate change

The problem II: CO2 concentration

Source: https://github.com/Femkemilene/Global-Warming-Figures

The problem III: The carbon cycle

The problem IV: The marine ecosystem (ocean) is an essential part of the Earth carbon cycle

The problem V: How to model the ocean?

- Oceanography

  - Biological Oceanography

  - Chemical Oceanography

  - Geological Oceanography

  - Physical Oceanography

The problem V: How to model the ocean?

- Oceanography

  - **Biological Oceanography**

  - Chemical Oceanography

  - Geological Oceanography

  - Physical Oceanography

The problem V: How to model the ocean?

- Oceanography

  - **Biological Oceanography -> Marine ecosystem**

  - Chemical Oceanography

  - Geological Oceanography

  - Physical Oceanography

The problem VI: How to model the marine ecosystem?

The problem VI: How to model the marine ecosystem?
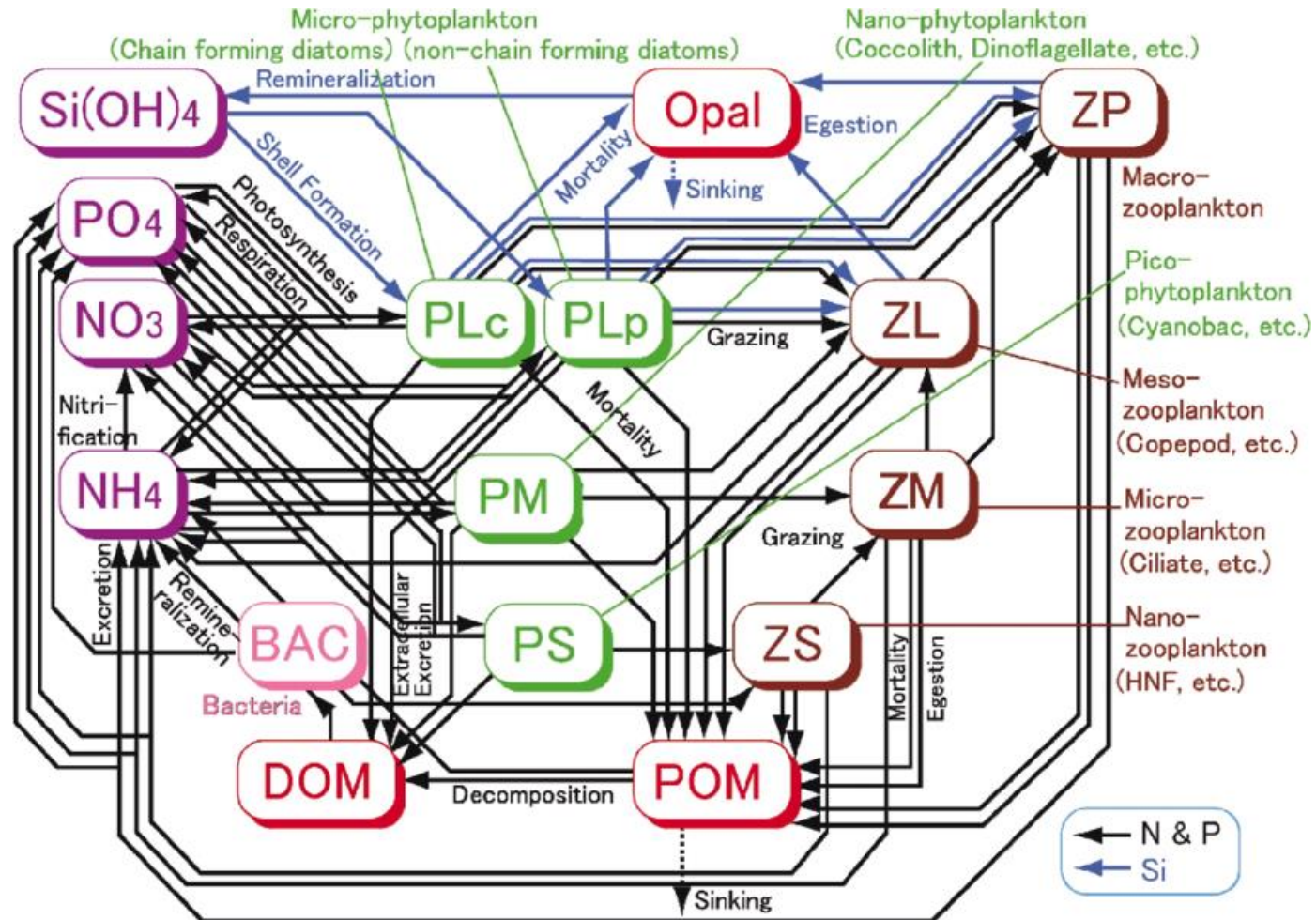
Proposal: NPZD model

- Nutrients (NO3)

- Phytoplankton
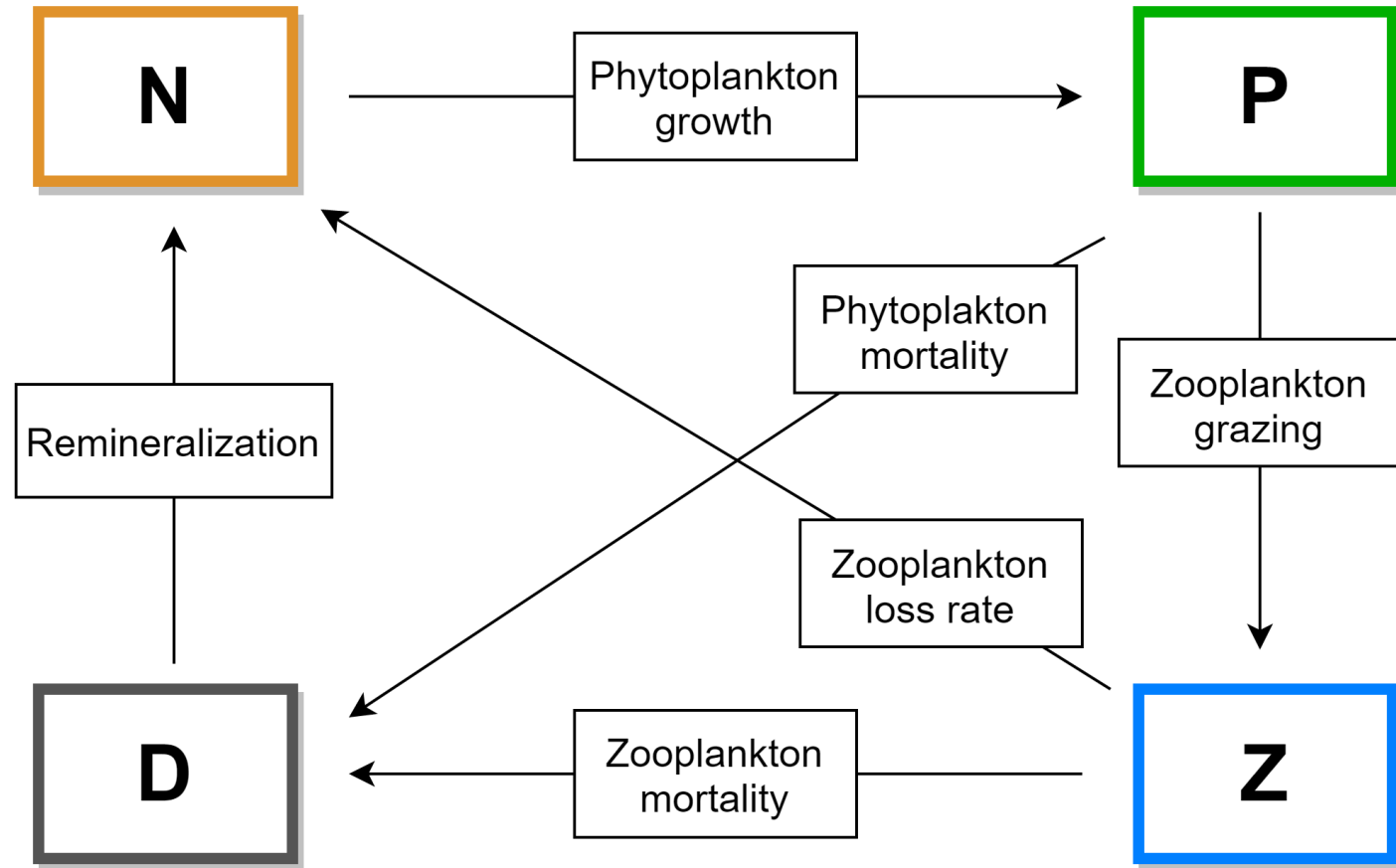
- Zooplankton

- Detritus

NPZD models: What are they used for?

- NPZD models (and concentration based models, more generally) are tools for quantitative investigation of a planktonic ecosystem

- 3 broad uses:
  - Theoretical experiments
  - Explanation of observations
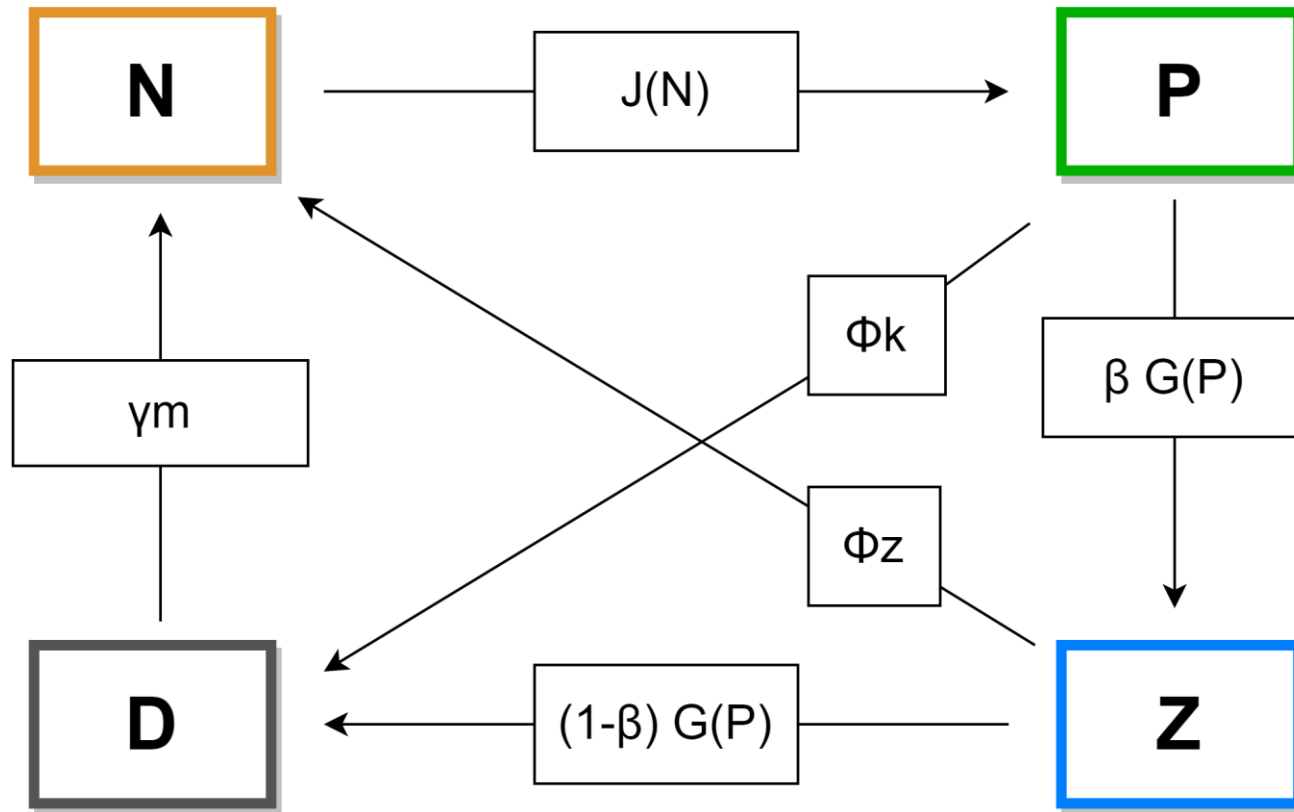 - Prediction

Proposal: NPZD model

- Nutrients (NO3)

- Phytoplankton

- Zooplankton

- Detritus

Proposal: NPZD model

$$J(N) = \mu_m * f_{N(N)} * f_I(I)$$

$$G(N) = \frac{g\varepsilon P\text{^}2}{g + \varepsilon P\text{^}2}$$