Aneesh Chandel
Ph.D. Student
Cornell University
Email: akc76@cornell.edu

Advisor: Dr. Yiqi Luo

Myself

Master's

University of Arkansas at Pine Bluff

Thesis title: N-doped Rice Husk Biochar to Activate Persulfate and Sulfamethoxazole degradation

Advisor: Dr. Hao Chen

Ph.D. (3rd year)

Cornell University

Thesis title: Model Evaluation and development to understand below-ground processes

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Microbial Models for Simulating Soil Carbon Dynamics: A Review

Aneesh Kumar Chandel[1] [iD]**, Lifen Jiang[1]** [iD]**, and Yiqi Luo[1]** [iD]

[1]School of Integrative Plant Science, Cornell University, Ithaca, NY, USA
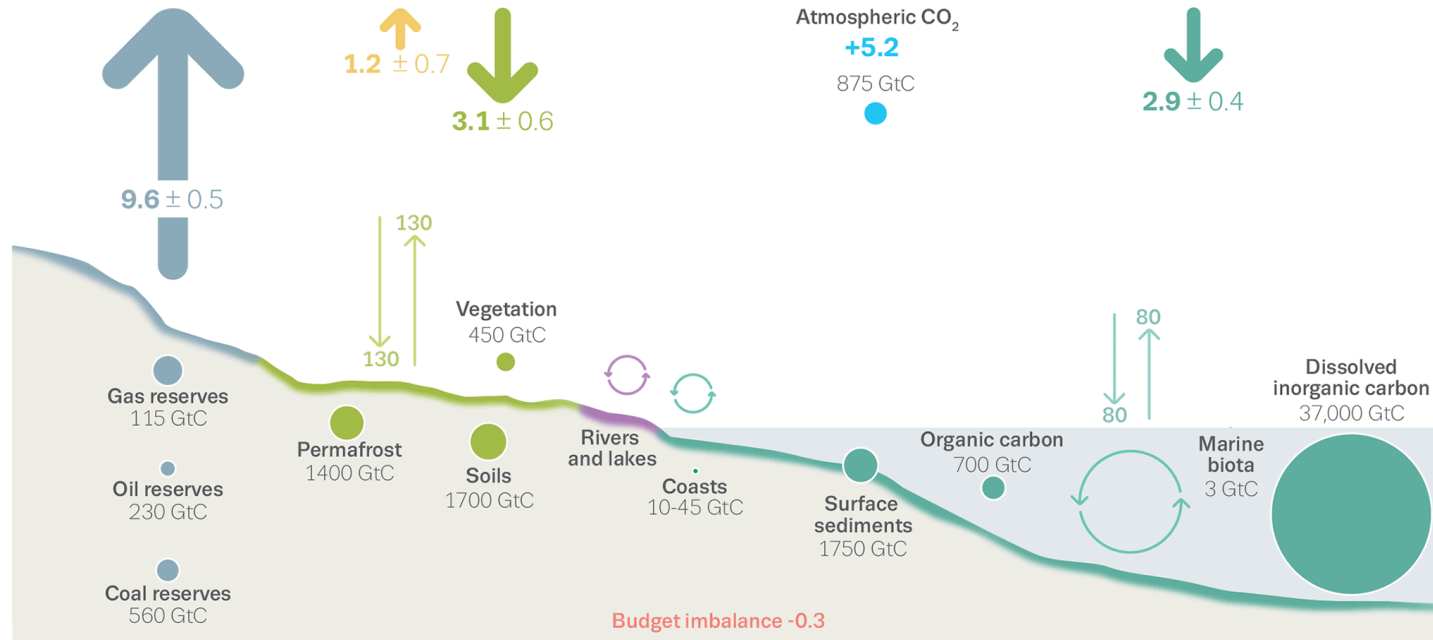
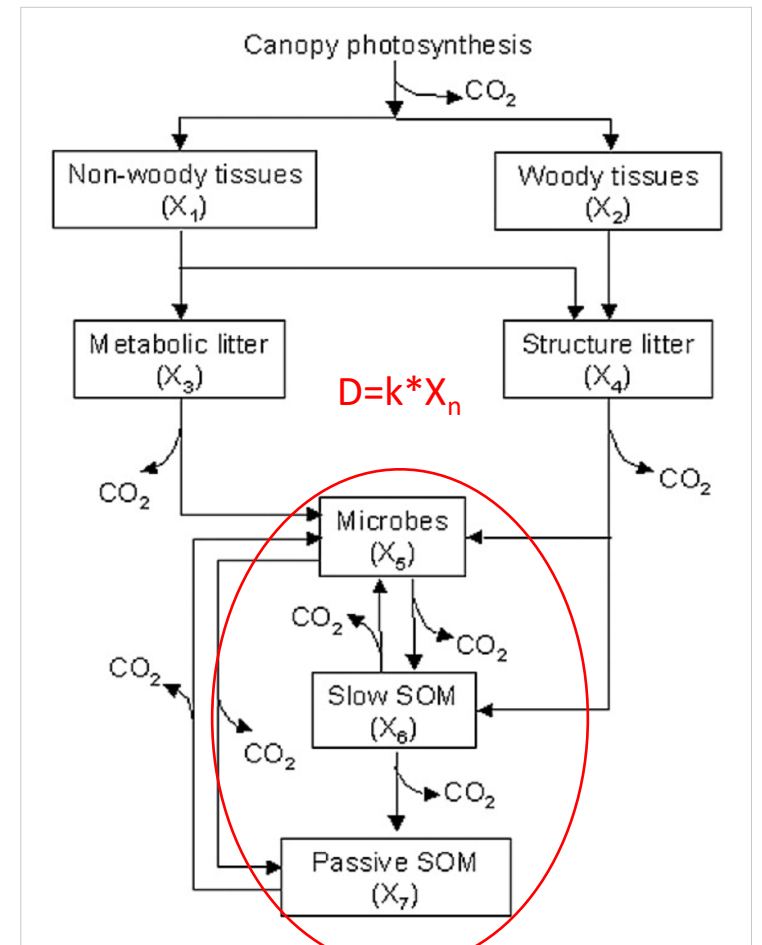# The global carbon cycle
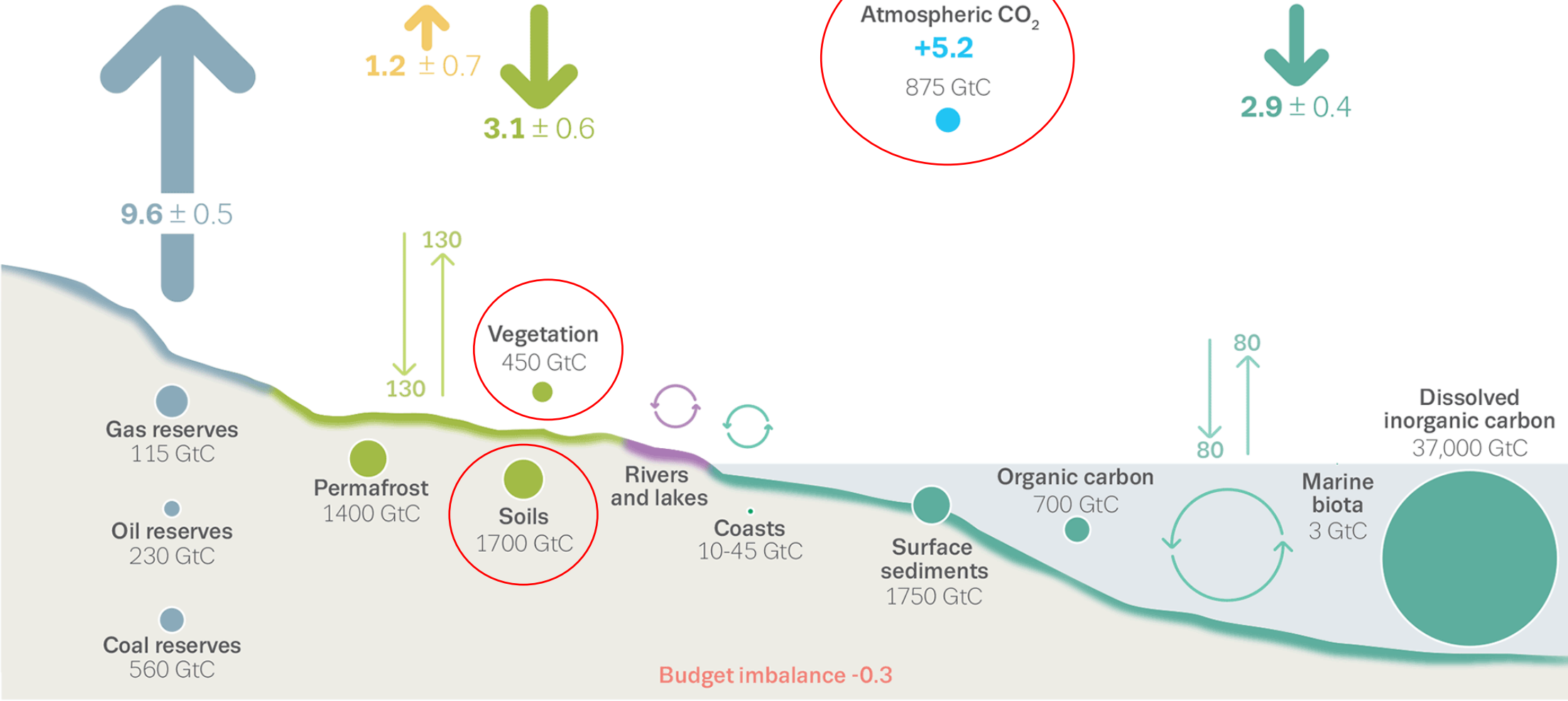
Friedlingstein et al., 2022

The global carbon cycle

Friedlingstein et al., 2022

$D=k*X_n$
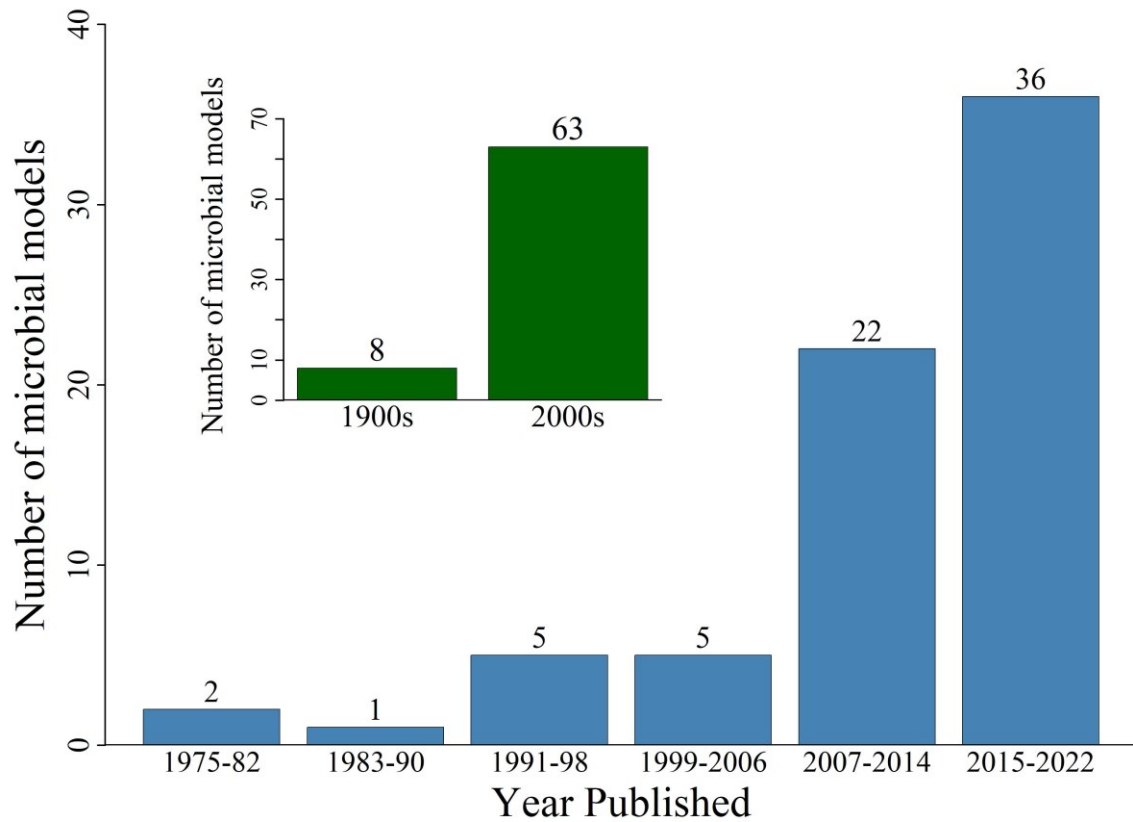
TECO model (Luo et al., 2003)

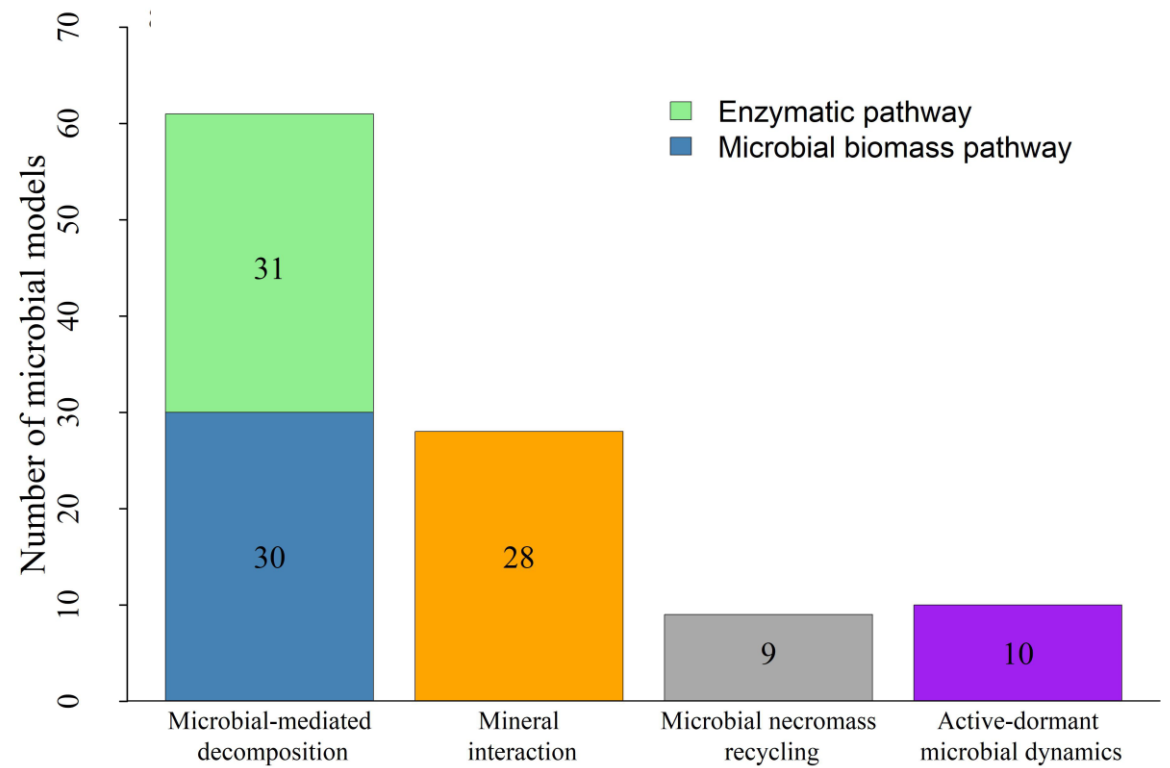Figure 1: Historical Development of Microbial models
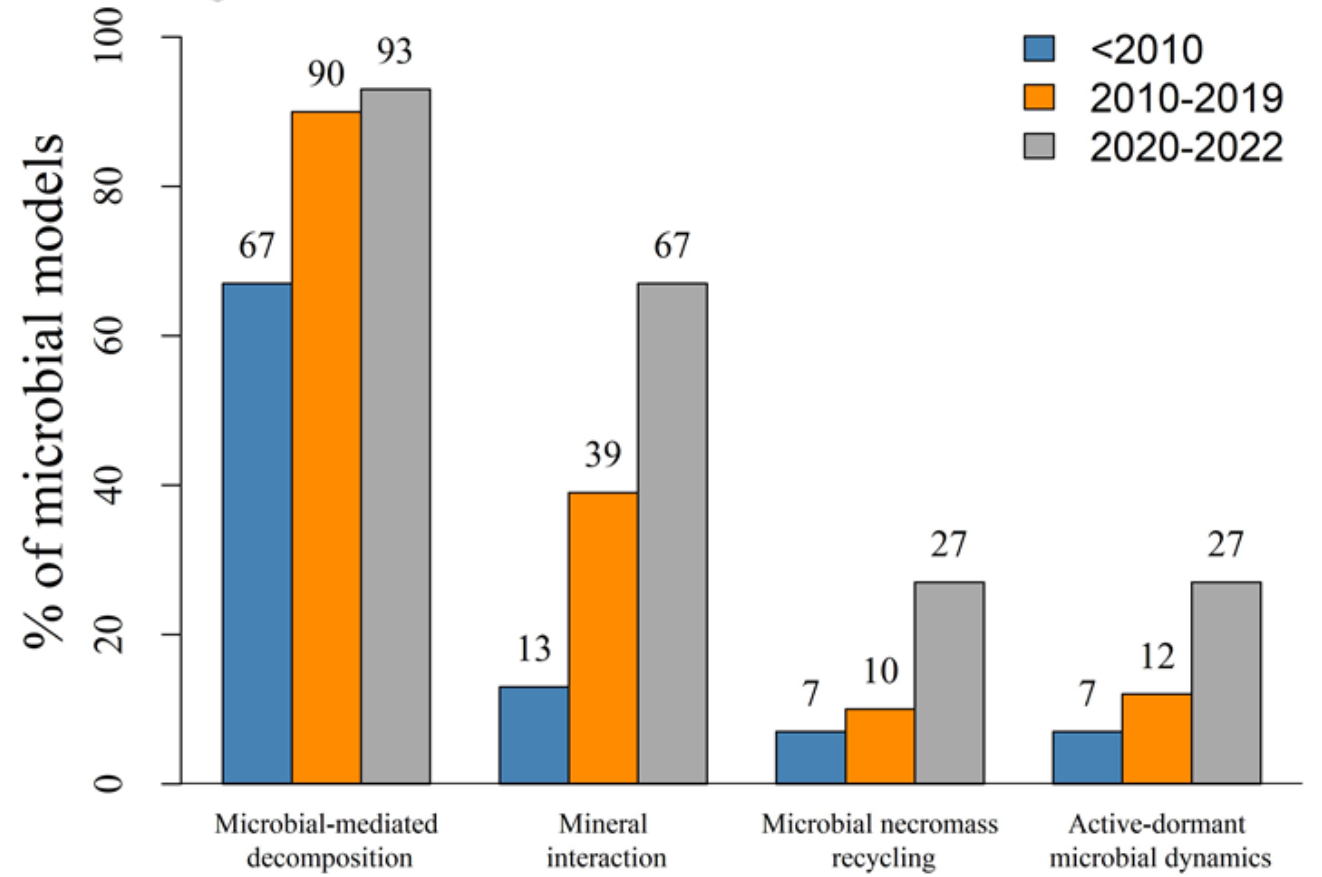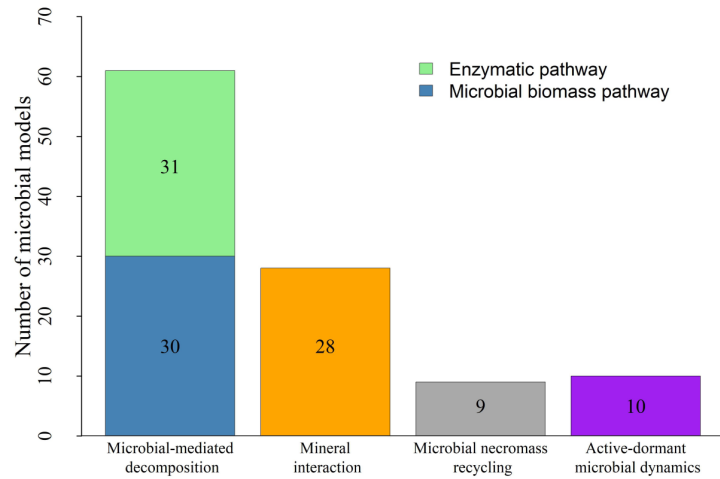

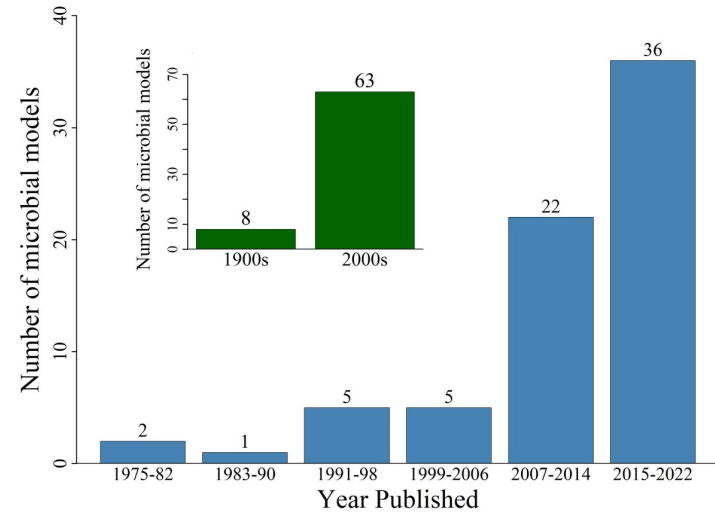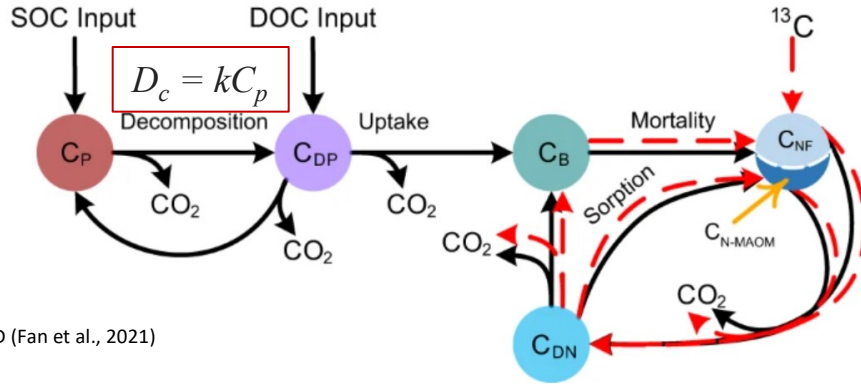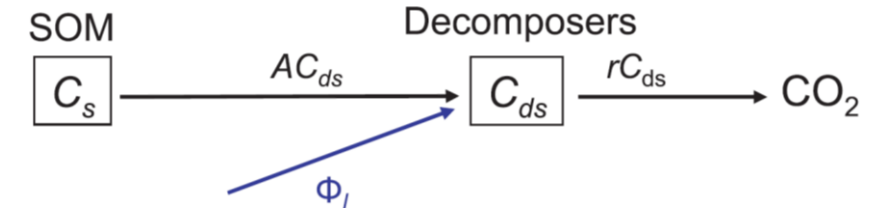Figure 2: Microbial processes present in Microbial models

Figure 3: Consideration of microbial processes

Microbial process 1: Microbial-mediated decomposition of SOC
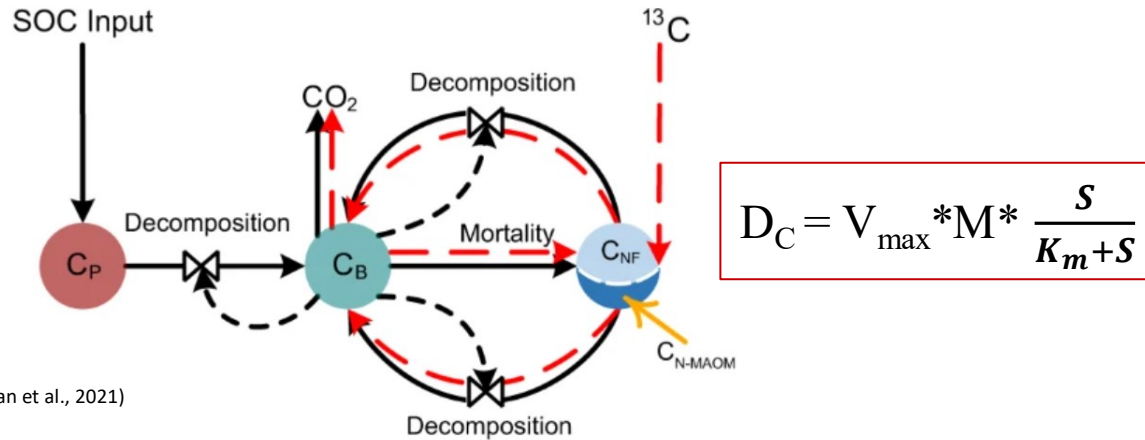
1. Zero-Order Microbial Model (ZO)

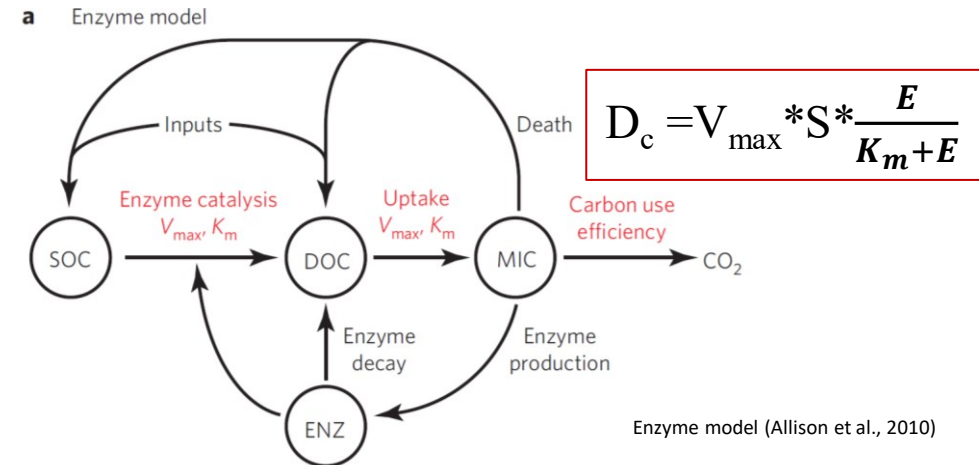$$D_c = kC_p$$

FOND (Fan et al., 2021)

2. First-Order Microbial Model

Barot (Fontaine and Barot, 2005)
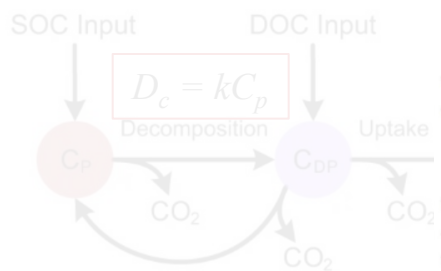
3. Forward Michaelis-Menten Kinetics (FMM)

$$D_C = V_{max} * M * \frac{S}{K_m + S}$$

MIND (Fan et al., 2021)

4. Reverse Michaelis-Menten Kinetics (RMM)

$$D_c = V_{max} * S * \frac{E}{K_m + E}$$

Enzyme model (Allison et al., 2010)

Microbial process 1: Microbial-mediated decomposition of SOC
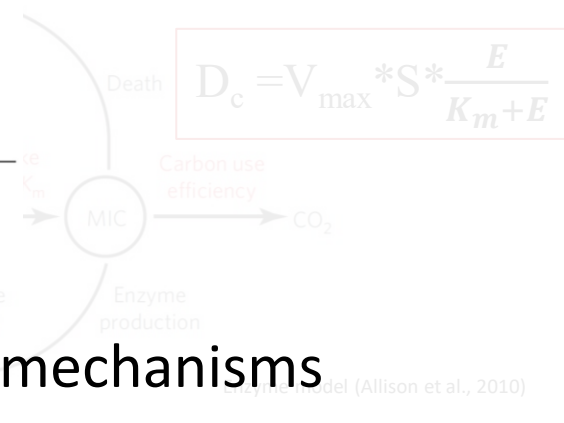
Figure 4: Number of Microbial models adopted decomposition mechanisms

Microbial Process 2: Mineral Interaction
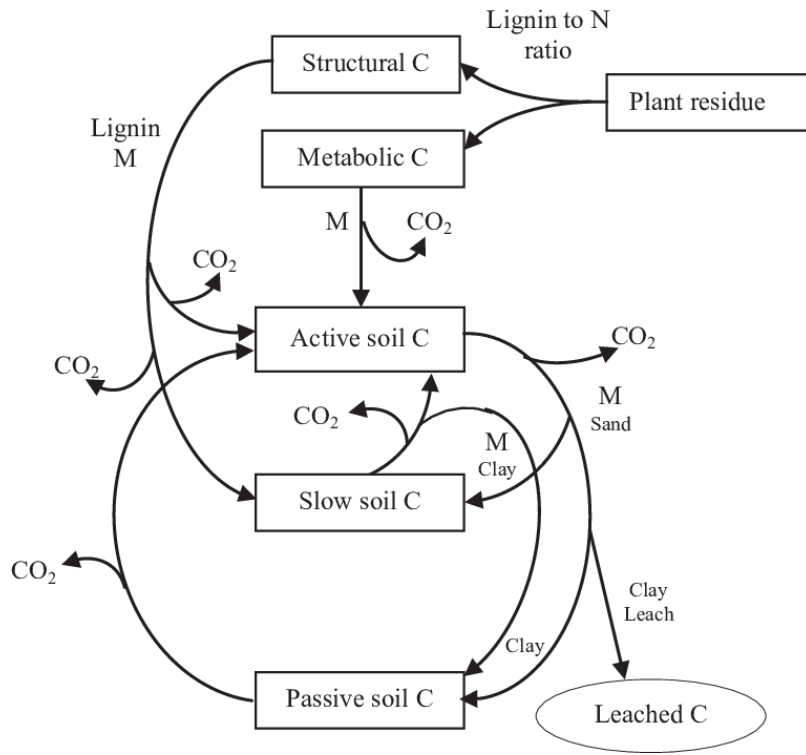
Conventional model (CENTURY)

MIND
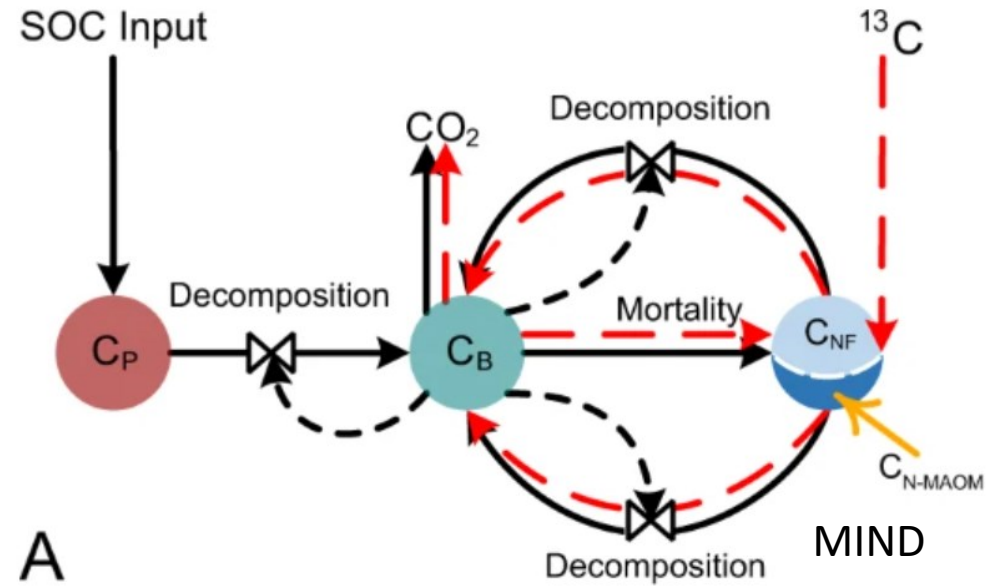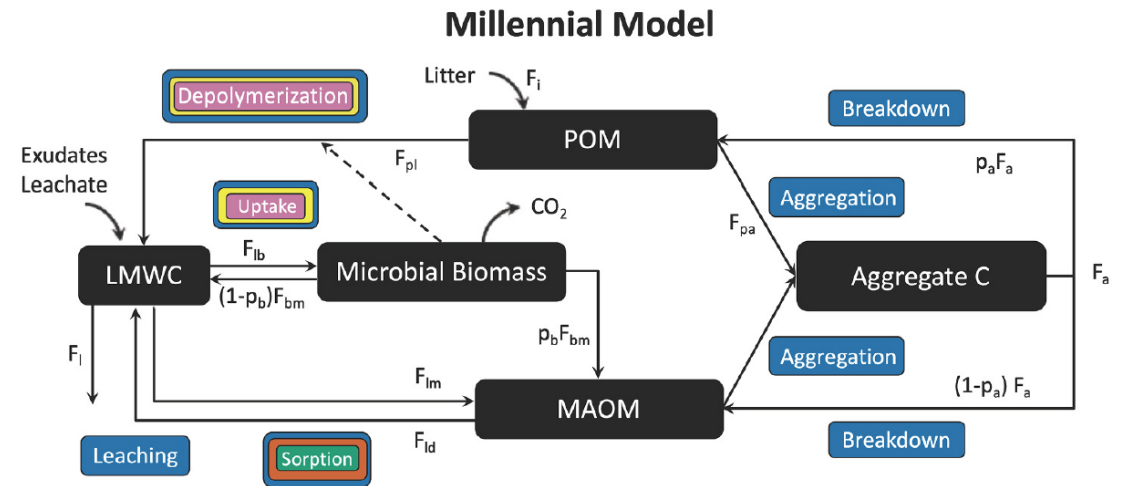
Millennial Model

Millennial v2.0
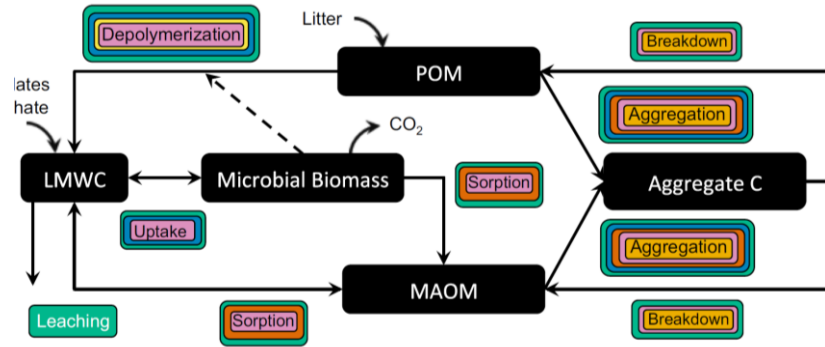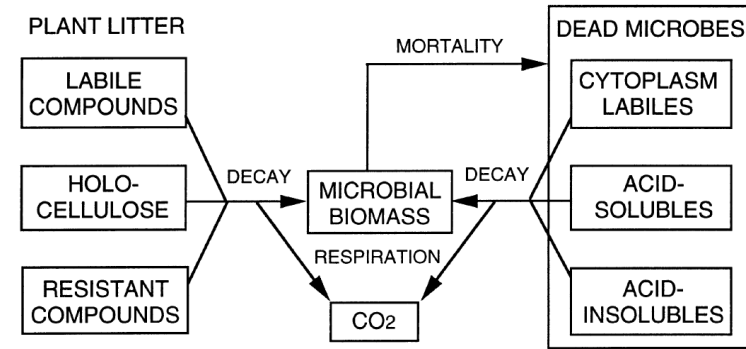
Microbial Process 3: Microbial necromass recycling
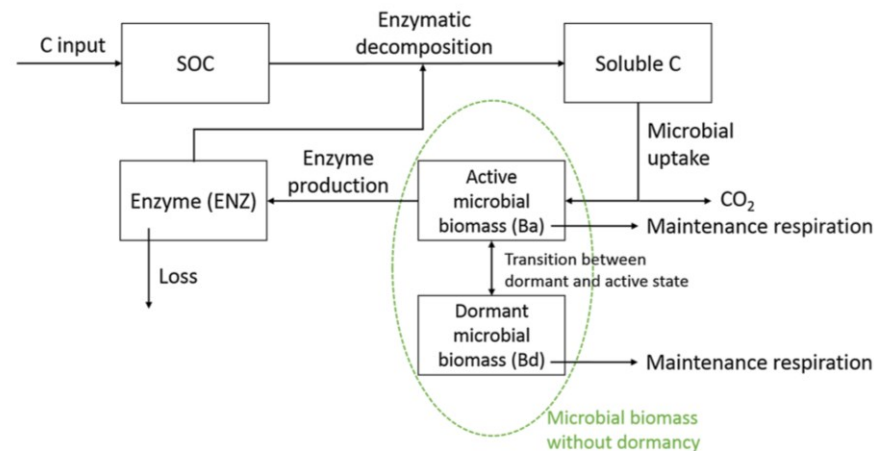

Millennial model

GENDEC model

Microbial Process 4: Active and Dormant Microbial Physiological States

DORMANCY model

Challenges and Recommendations

1. Experimental evidence for rate-limitation in Microbial Models

2. Lack of observational data to estimate model parameters

3. Model complexity

Summary

➢ Four microbial processes were mostly incorporated into models with different mathematical equations
- ▪ Microbial-mediated decomposition
- ▪ Mineral interaction
- ▪ Microbial necromass recycling
- ▪ Active and Dormant Physiological states

➢ Diversity in model structures and parameters indicates uncertainty in translating current knowledge of microbial processes into models.

➢ Data-driven model development and parameterization are highly recommended to improve the prediction of microbial models.

Acknowledgment

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Dr. Biswanath Dari

Thanks
Any question?