

Soil Organic Matter Dynamics and Nutrient Cycling: Updates to the MAGIC Model

**ICP M&M, 37th Task Force Meeting
28th CCE Workshop, 2nd CDM Meeting
Jack Cosby**



“New paradigm” Soil Organic Matter dynamics

SOM persistence

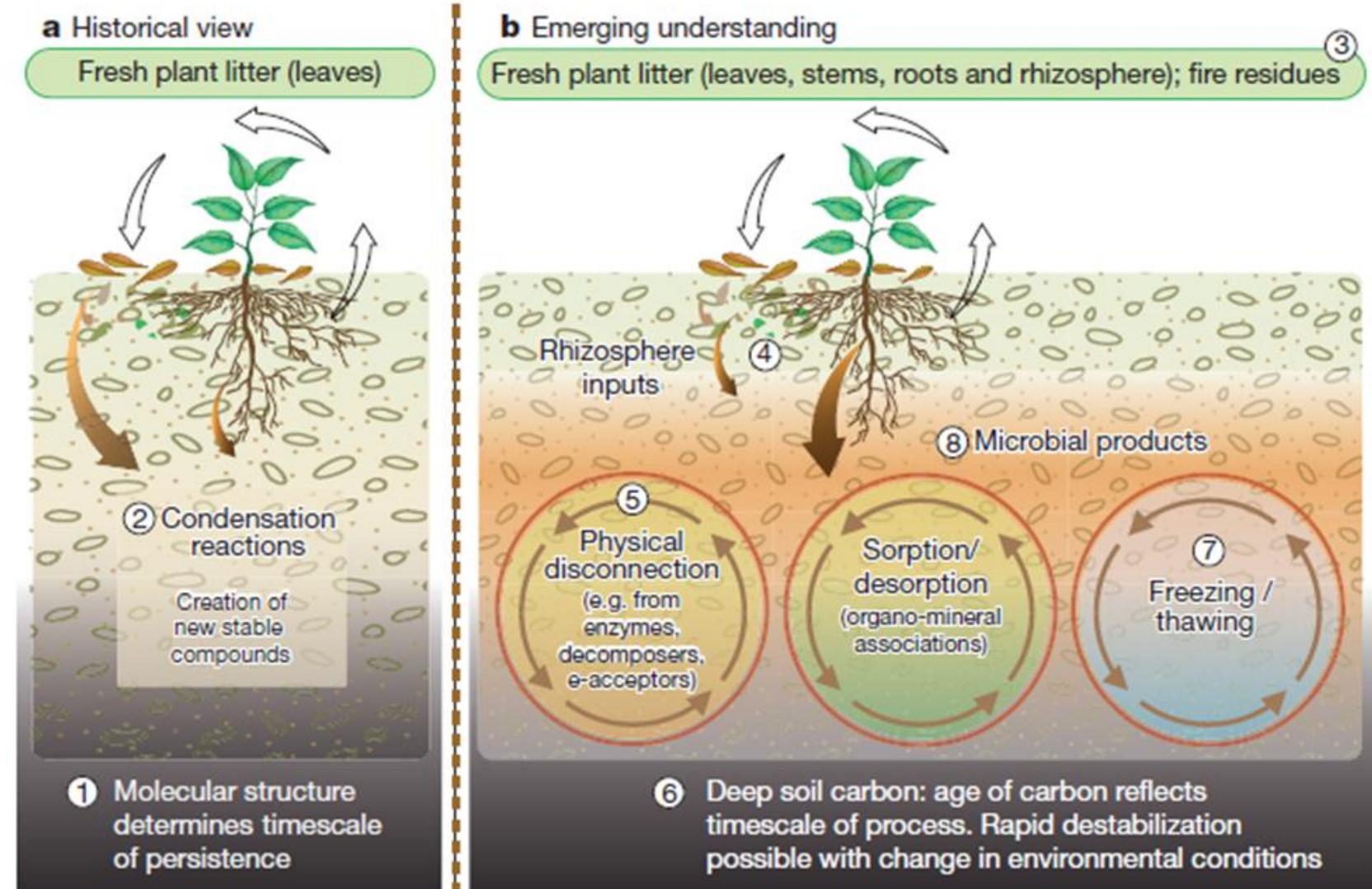
- Controlled by physical and chemical environment
- Molecular characteristics of are secondary controls

PERSPECTIVE

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Persistence of soil organic matter as an ecosystem property

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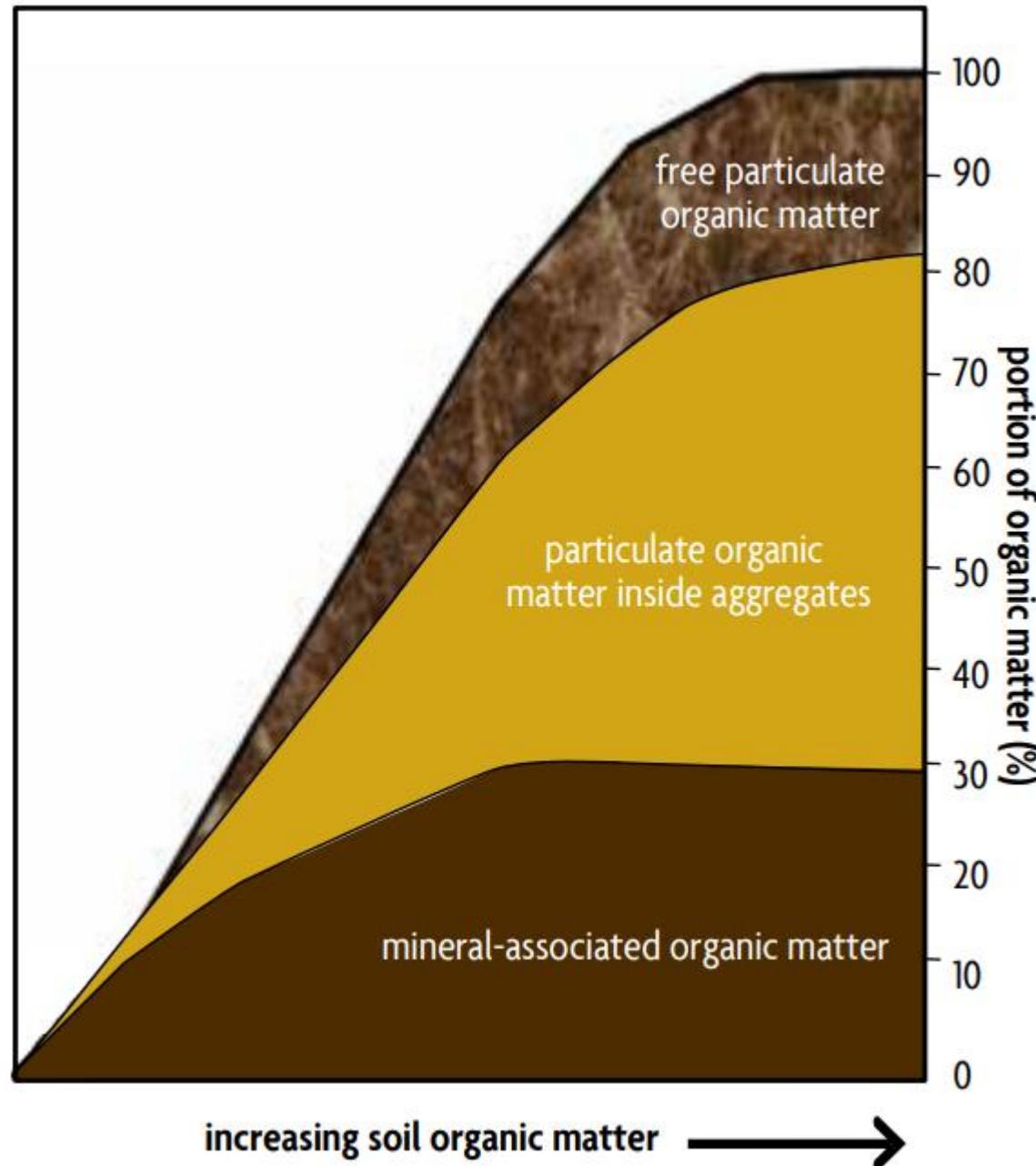
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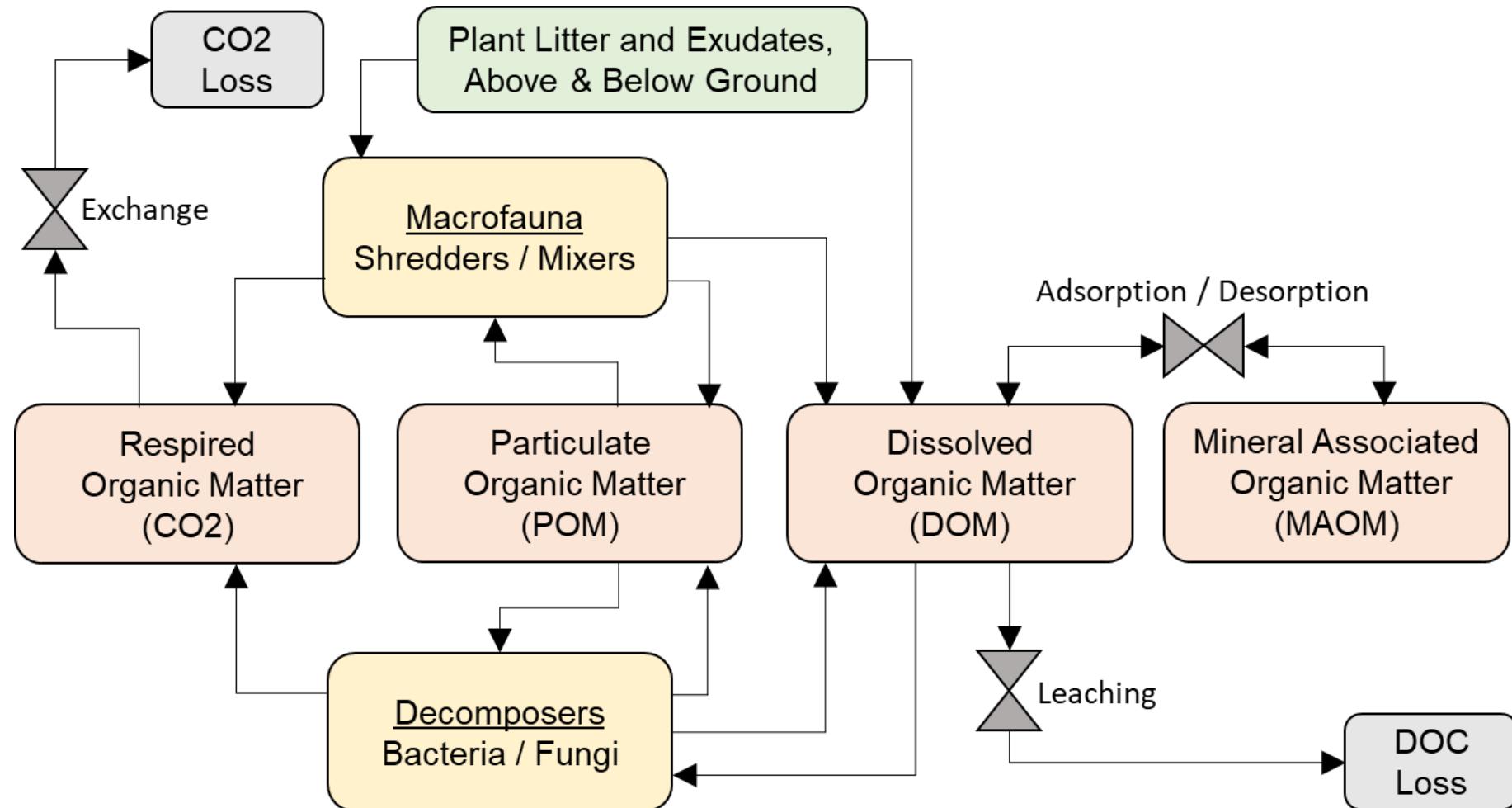
SOM is locked into the fabric of the soils

- forming aggregates protecting SOM from decomposition
- physically shielding SOM from microbial activity
- binding and stabilizing organic molecules
- creating SOC pools with different residence times



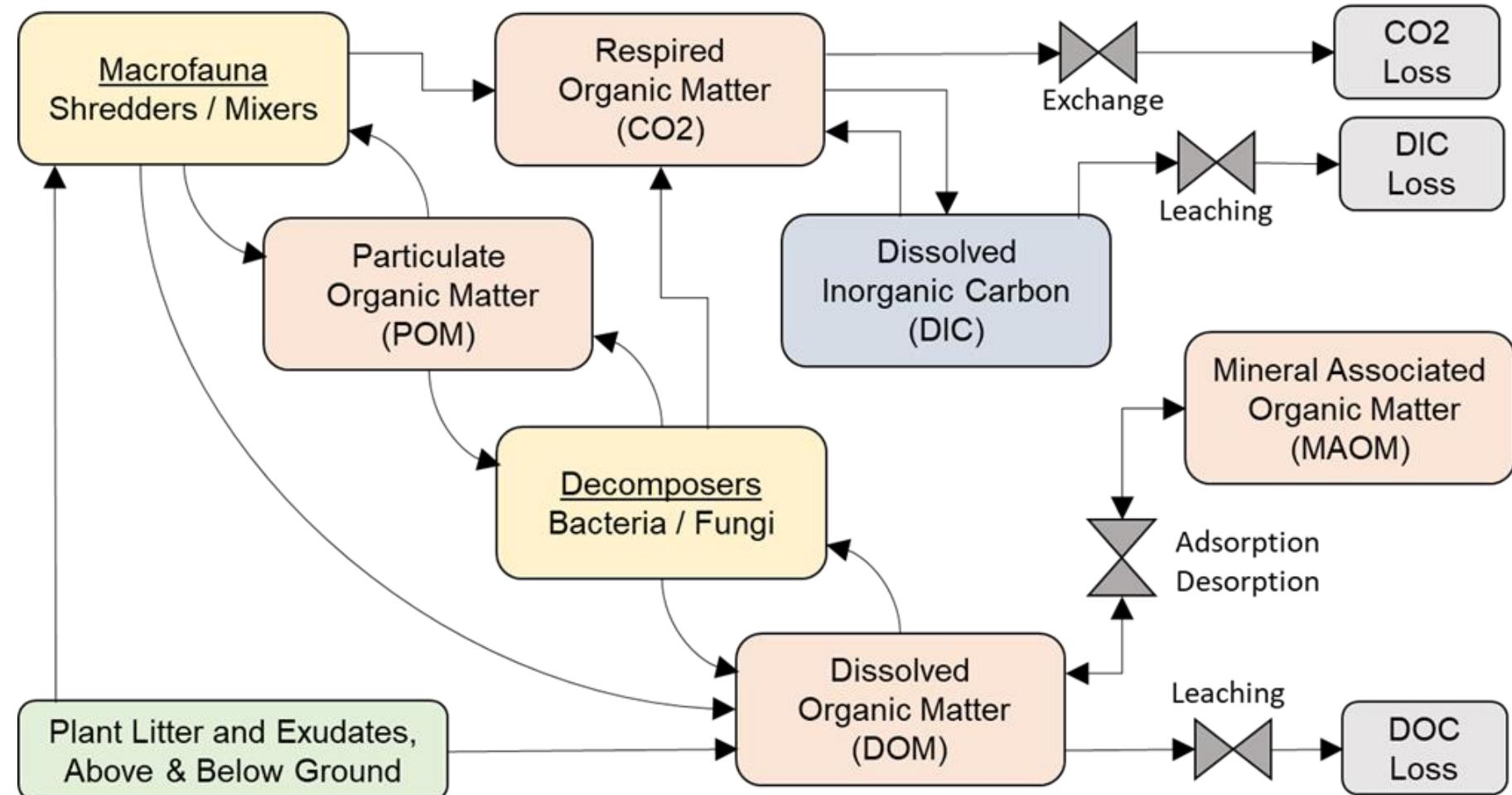
“New paradigm”
Soil Organic Matter dynamics

New definitions of SOM pools in models
New field and lab measurement techniques



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“New paradigm” Soil Organic Matter dynamics

New links between SOM dynamics and Nutrient Cycles

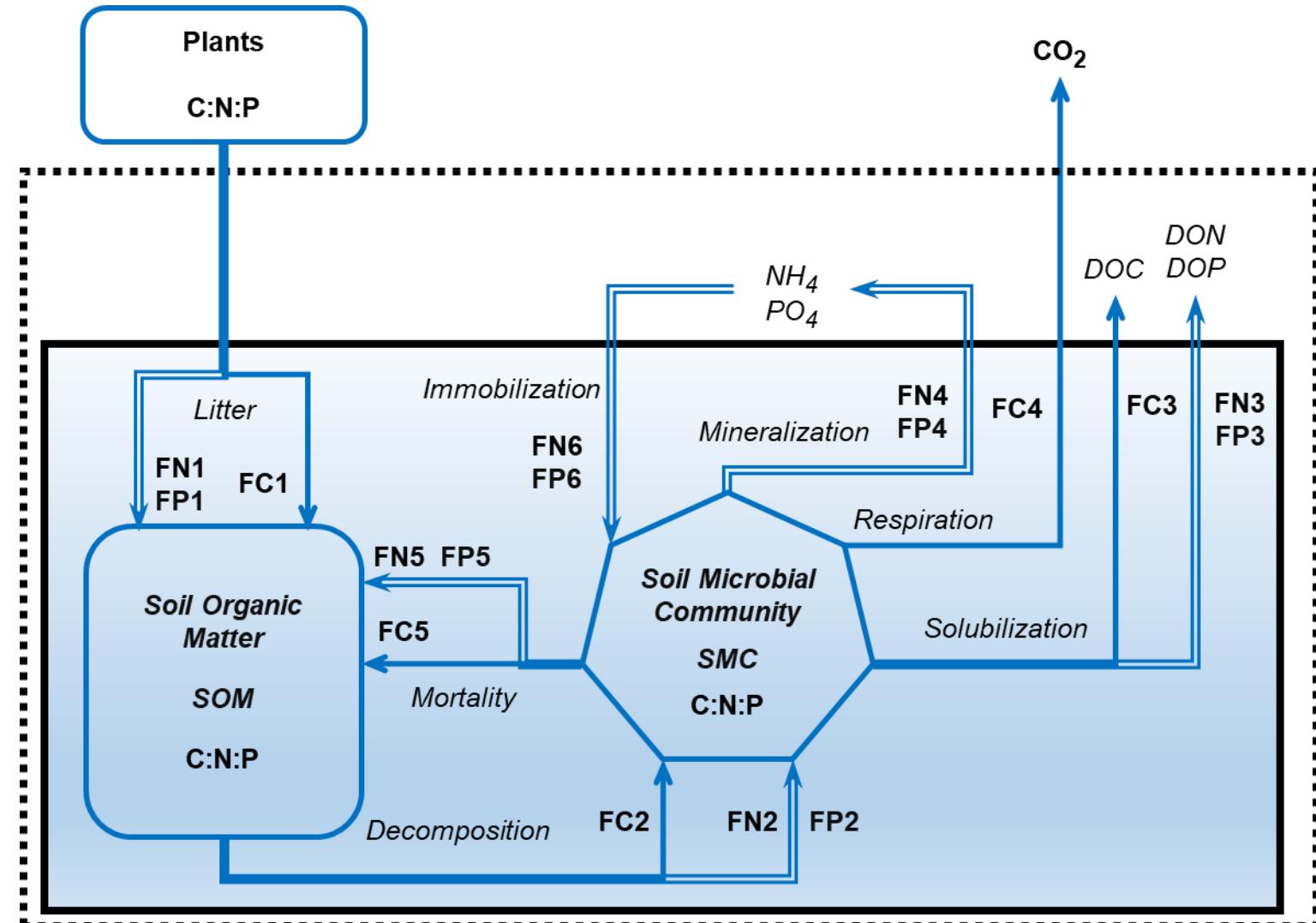
- Soil inorganic chemistry and nutrients affected by SOM dynamics (plus feedbacks)
- Land management increasingly driven by SOM storage and stability (for climate mitigation)
- Assessment of future LRTAP effects will require models of SOM dynamics (critical loads N, etc.)

Input Time Series

Plant Litter
SOM Decomposition

Parameters, $f(t)$

C:N ratios: CN_{LITTER} CP_{LITTER} CN_{SMC} CP_{SMC}
Use Efficiencies: CUE NUE PUE
Solubilisation: SOL



SOC-D UK-SCAPE

- **Science Questions**
- **What is the sensitivity of SOC to local or global changes in climate and land management?**
- **What critical feedbacks link SOC with soil structure, chemistry and functional biota?**
- **What soil metrics and modelling approaches best reflect the new understanding of SOC dynamics?**
- **What areas in the UK are most at risk of losing SOC, and where can SOC be protected or increased?**



Thank you...

Questions ? Comments?

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