

# 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

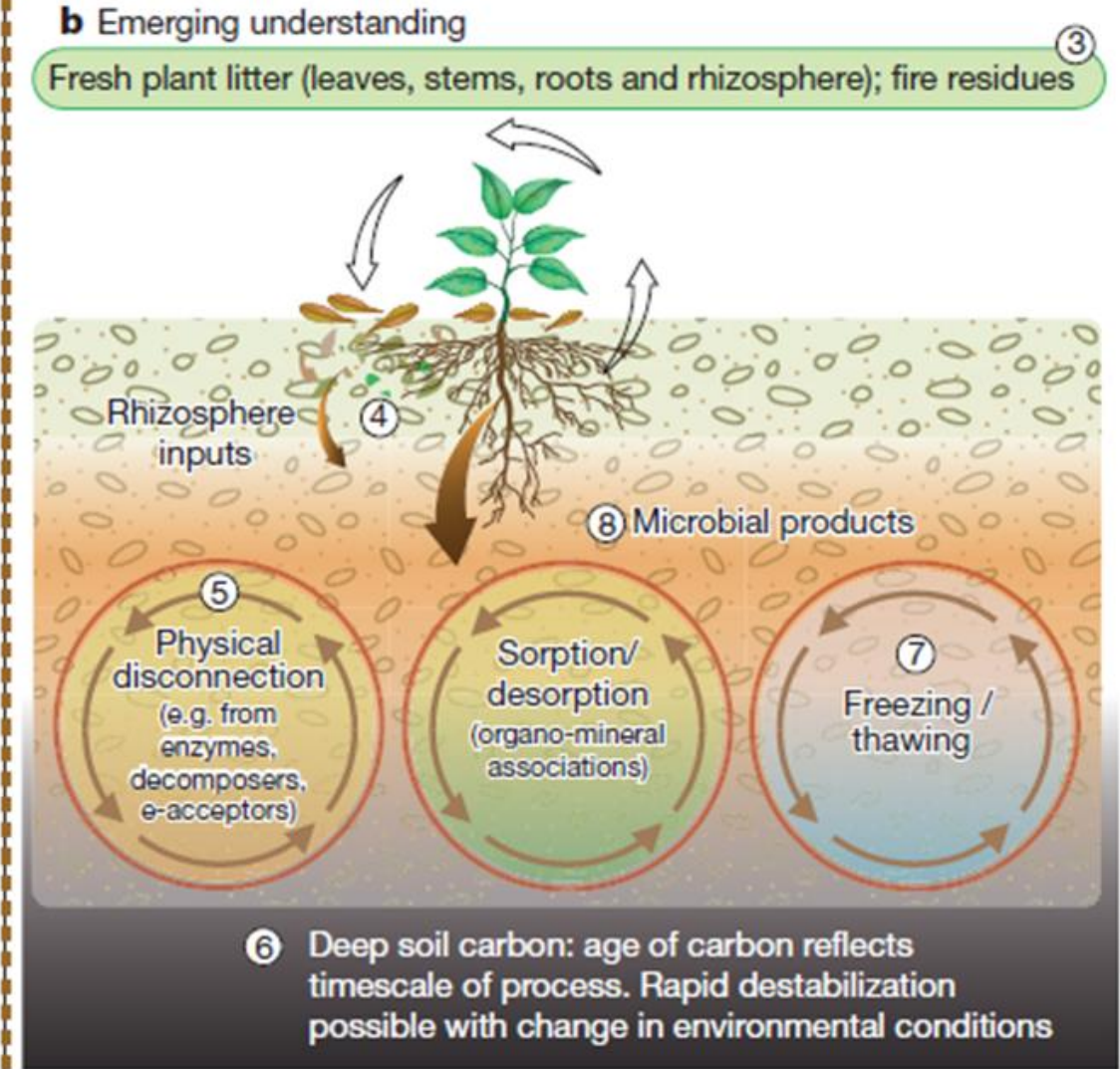
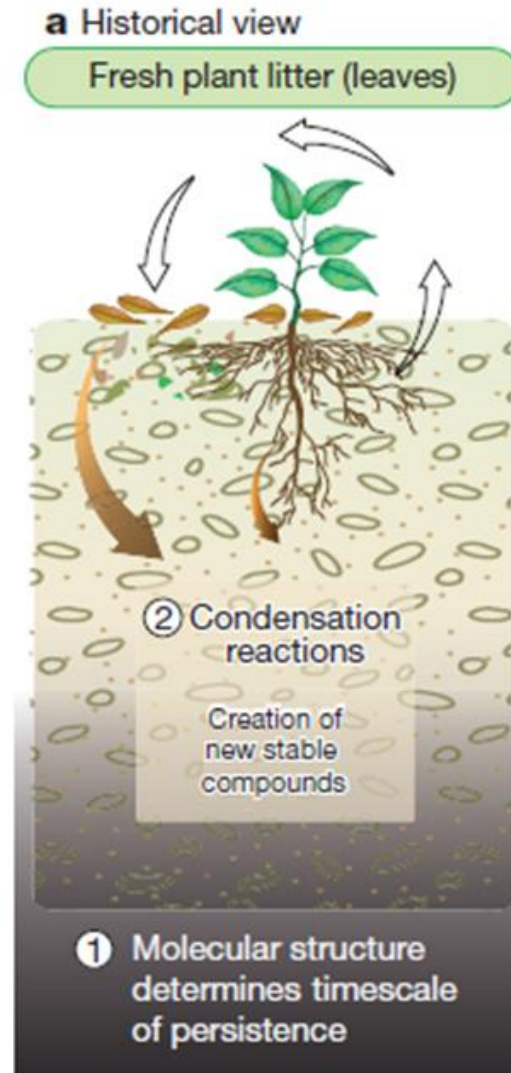
- Controlled by physical and chemical environment
- Molecular characteristics of are secondary controls

## PERSPECTIVE

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## Persistence of soil organic matter as an ecosystem property

Michael W. I. Schmidt<sup>1\*</sup>, Margaret S. Torn<sup>2,3\*</sup>, Samuel Abiven<sup>1</sup>, Thorsten Dittmar<sup>4,5</sup>, Georg Guggenberger<sup>6</sup>, Ivan A. Janssens<sup>7</sup>, Markus Kleber<sup>8</sup>, Ingrid Kögel-Knabner<sup>9</sup>, Johannes Lehmann<sup>10</sup>, David A. C. Manning<sup>11</sup>, Paolo Nannipieri<sup>12</sup>, Daniel P. Rasse<sup>13</sup>, Steve Weiner<sup>14</sup> & Susan E. Trumbore<sup>15</sup>



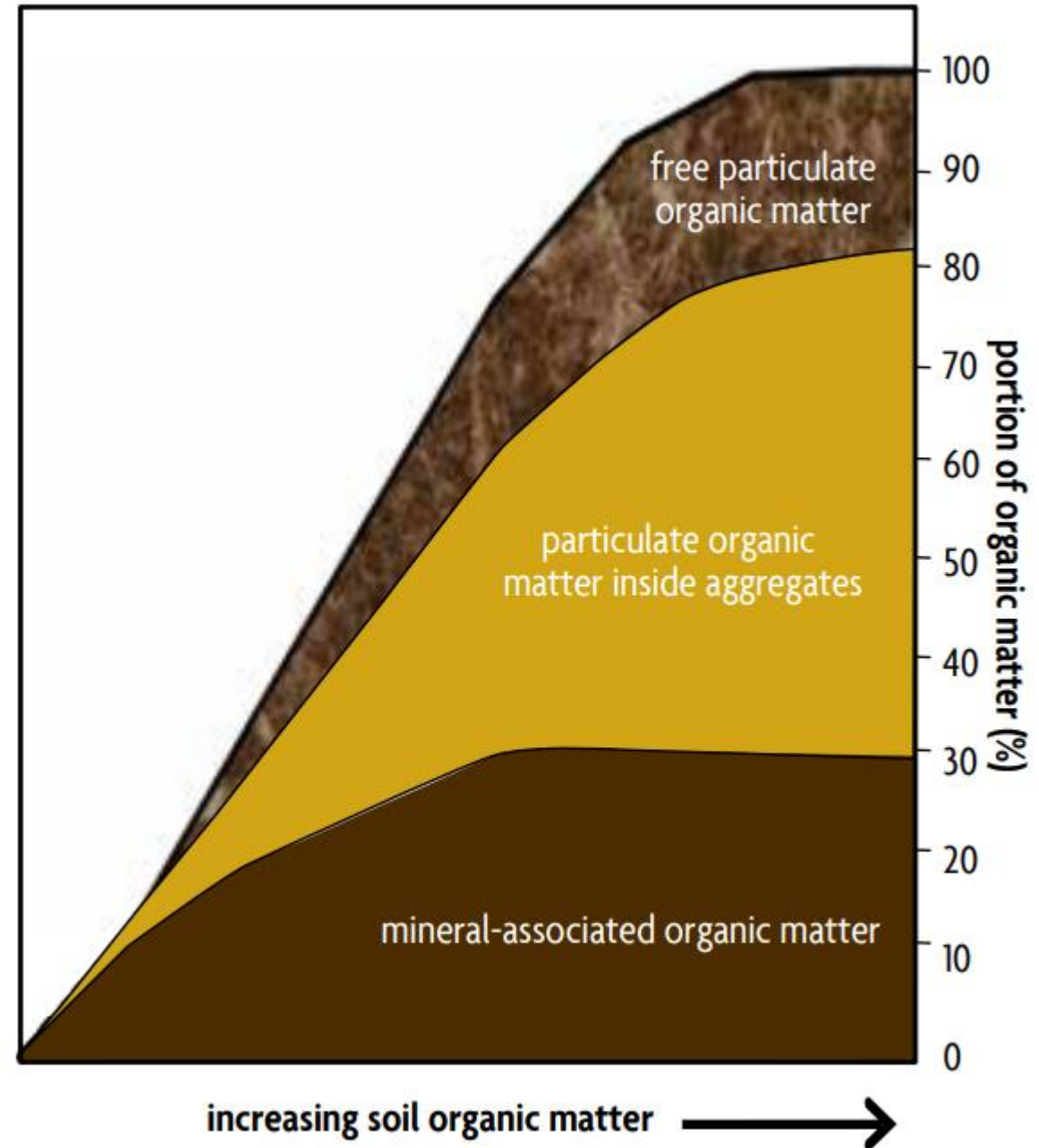
## “New paradigm” Soil Organic Matter dynamics

### SOM persistence

- Controlled by physical and chemical environment
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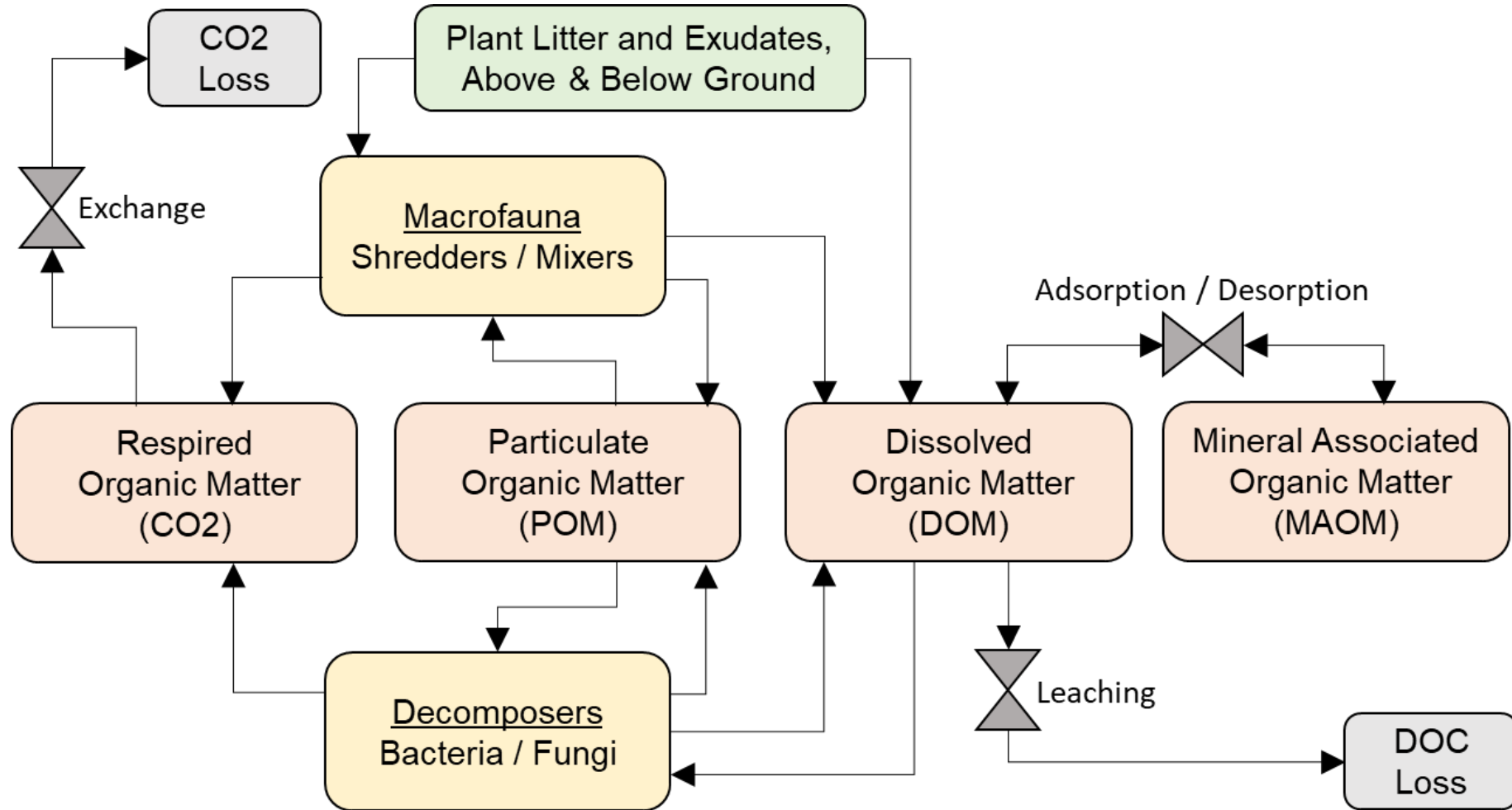
SOM is locked into the fabric of the soils

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



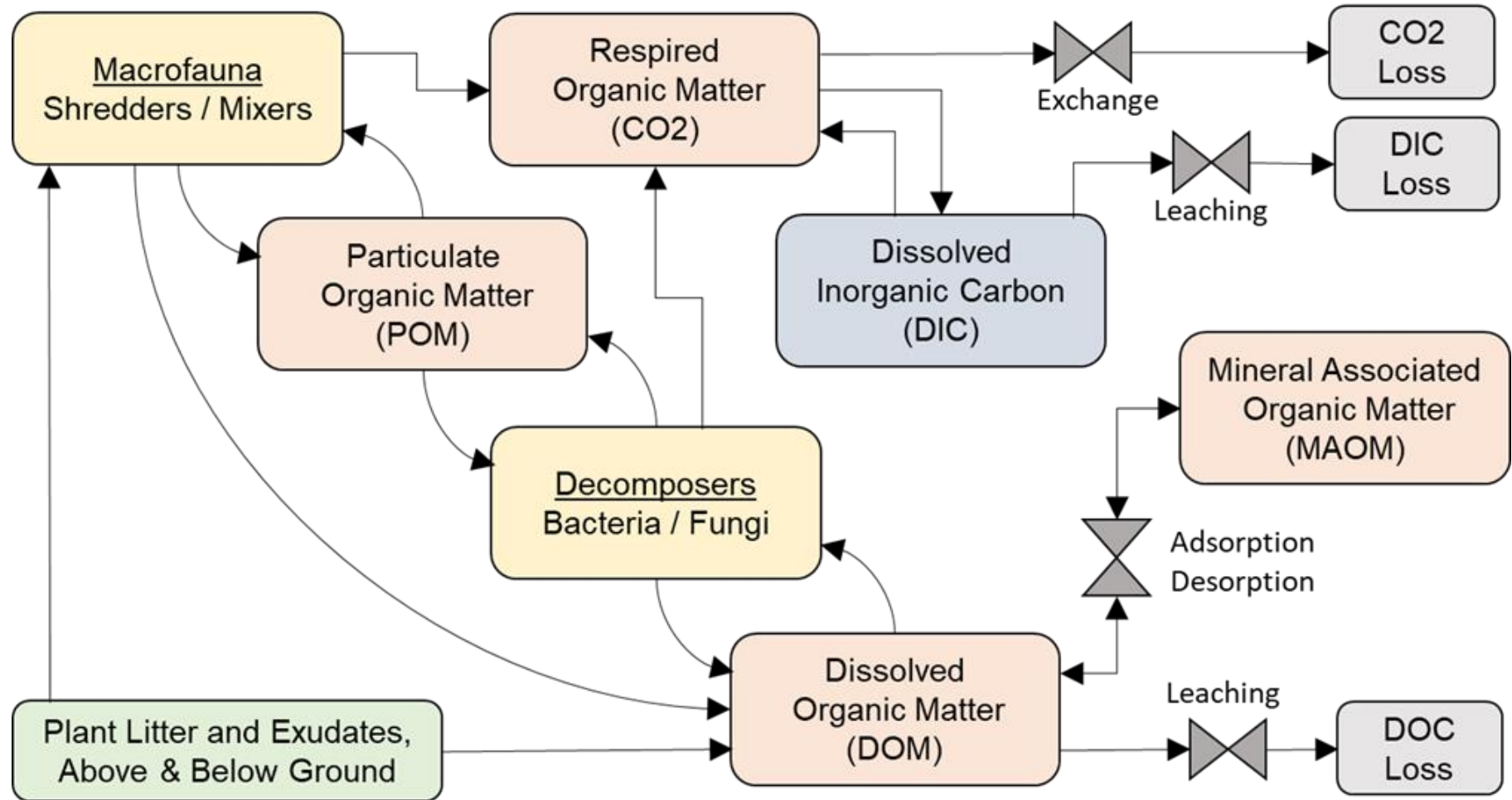
**“New paradigm”  
Soil Organic Matter dynamics**

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



**“New paradigm”  
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## “New paradigm” Soil Organic Matter dynamics

### New links between SOM dynamics and Nutrient Cycles

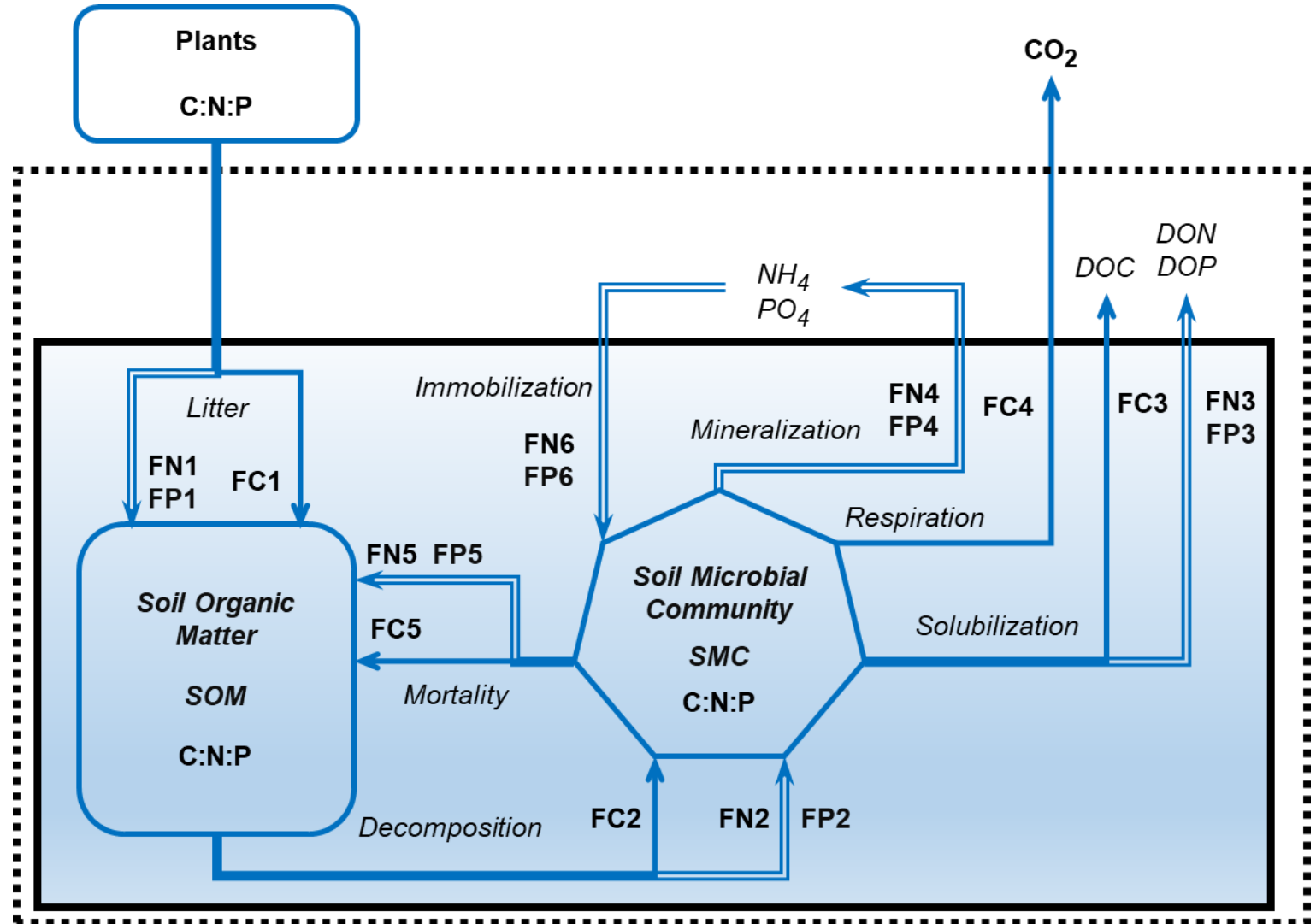
- Soil inorganic chemistry and nutrients affected by SOM dynamics (plus feedbacks)
- Land management increasingly driven by SOM storage and stability (for climate mitigation)
- Assessment of future LRTAP effects will require models of SOM dynamics (critical loads N, etc.)

#### 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?**

Project  
Management Board

Jack Cosby  
David Robinson  
Bridget Emmett  
Niall McNamara  
Rob Griffiths  
Amanda Thomson

Lab

Data

Field

Models

Community  
Engagement



# Thank you...

## Questions ?   Comments?

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