

# Session 4: Soil Carbon, Biomass Carbon, and Climate Smart Agricultural Practices

**Stephen M. Ogle, Ph.D.**

**Department of Ecosystem Science and Sustainability**

**Natural Resource Ecology Laboratory**

**Colorado State University**

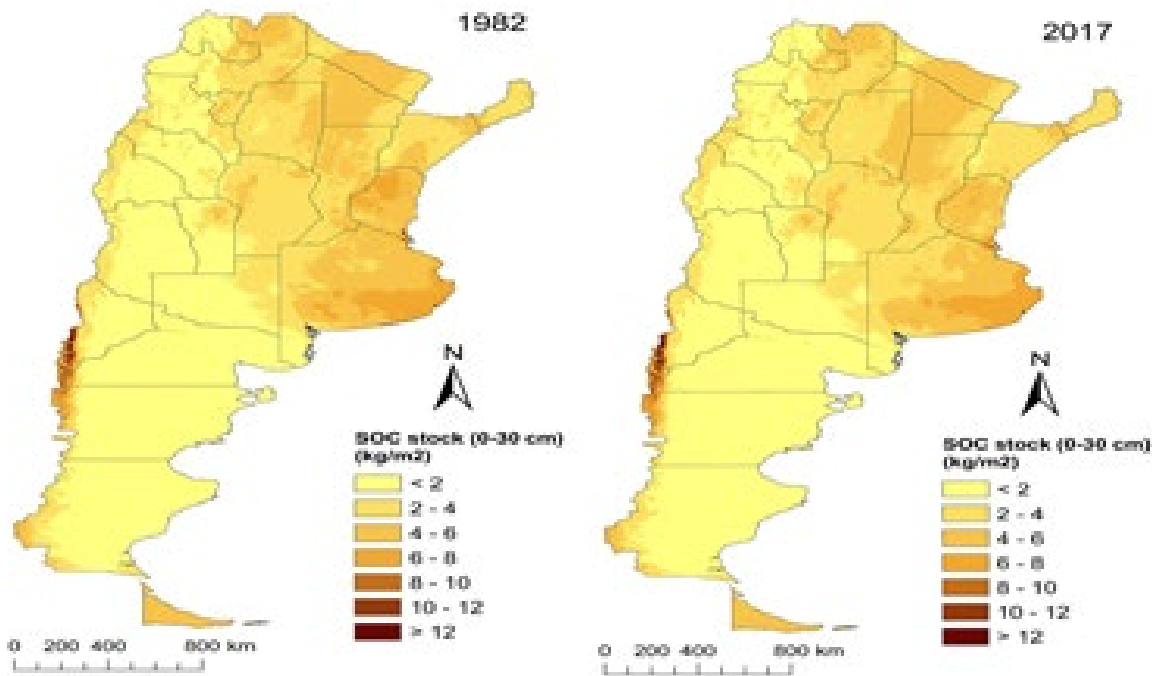


# Roadmap for Presentation

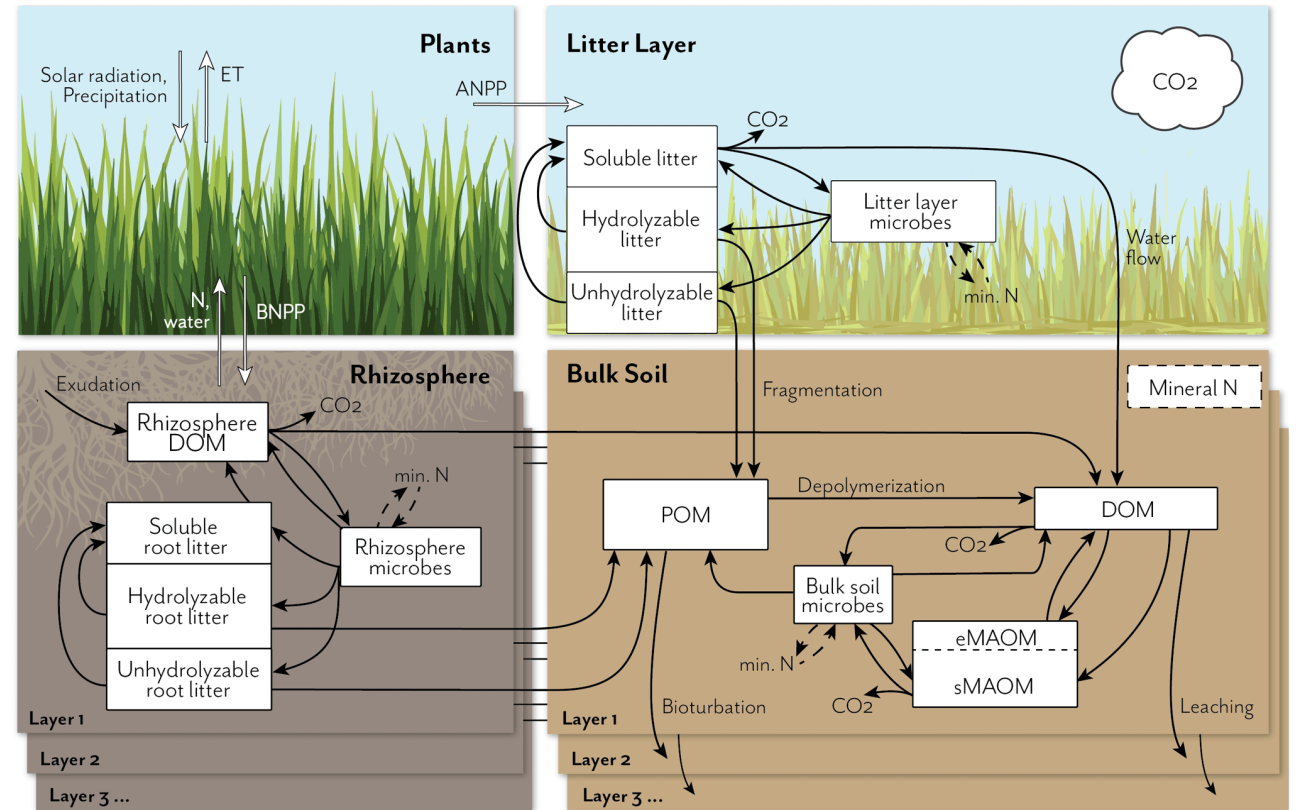
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- **General Model-Based Methods**
- **DayCent Process-Based Model Framework**
- **Limitations**

# Model-Based Methods



*Heuvelink et al., 2021 European Journal of Soil Science*



*Zhang et al., 2021 Biogeosciences*



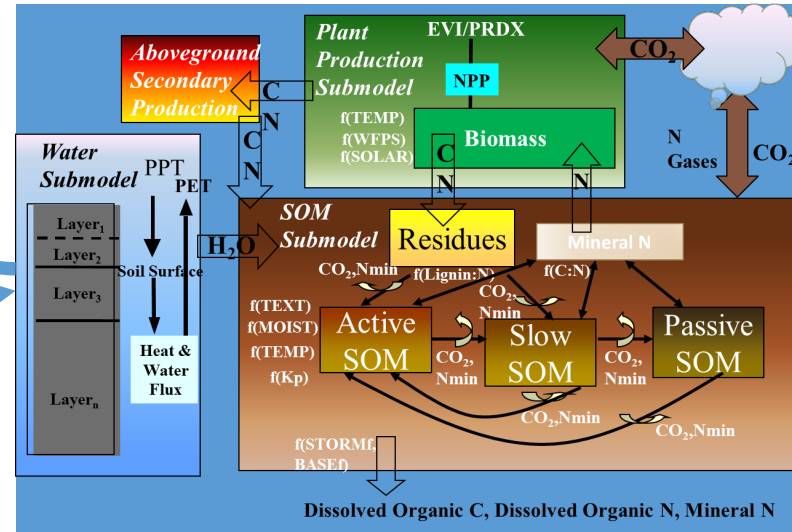
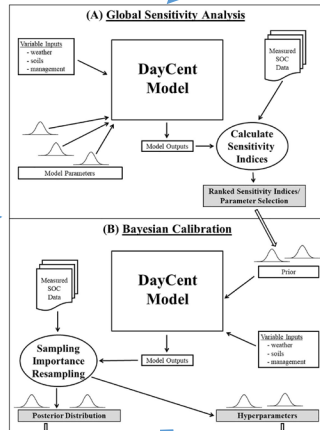
# Roadmap for Presentation

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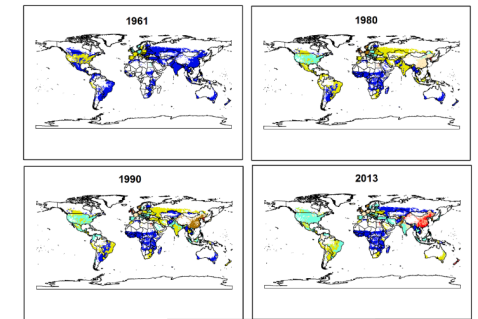
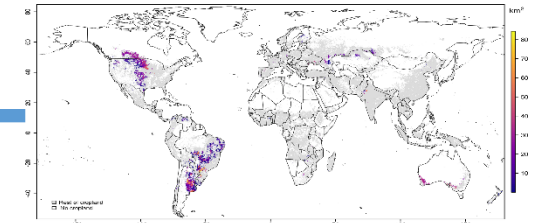
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# DayCent Ecosystem Modeling Platform

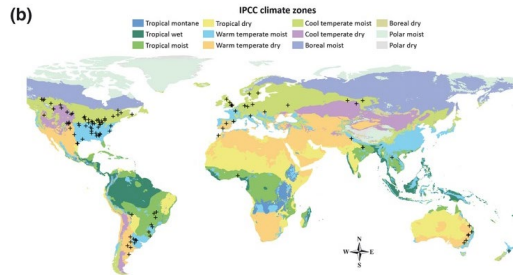
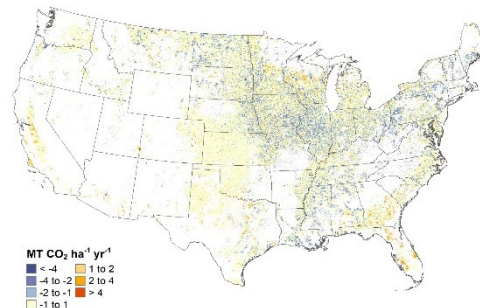
## Model Development/ Calibration



## Input Data: Geospatial Datasets/Surveys



## Output Data: SOC and Other GHG Emissions

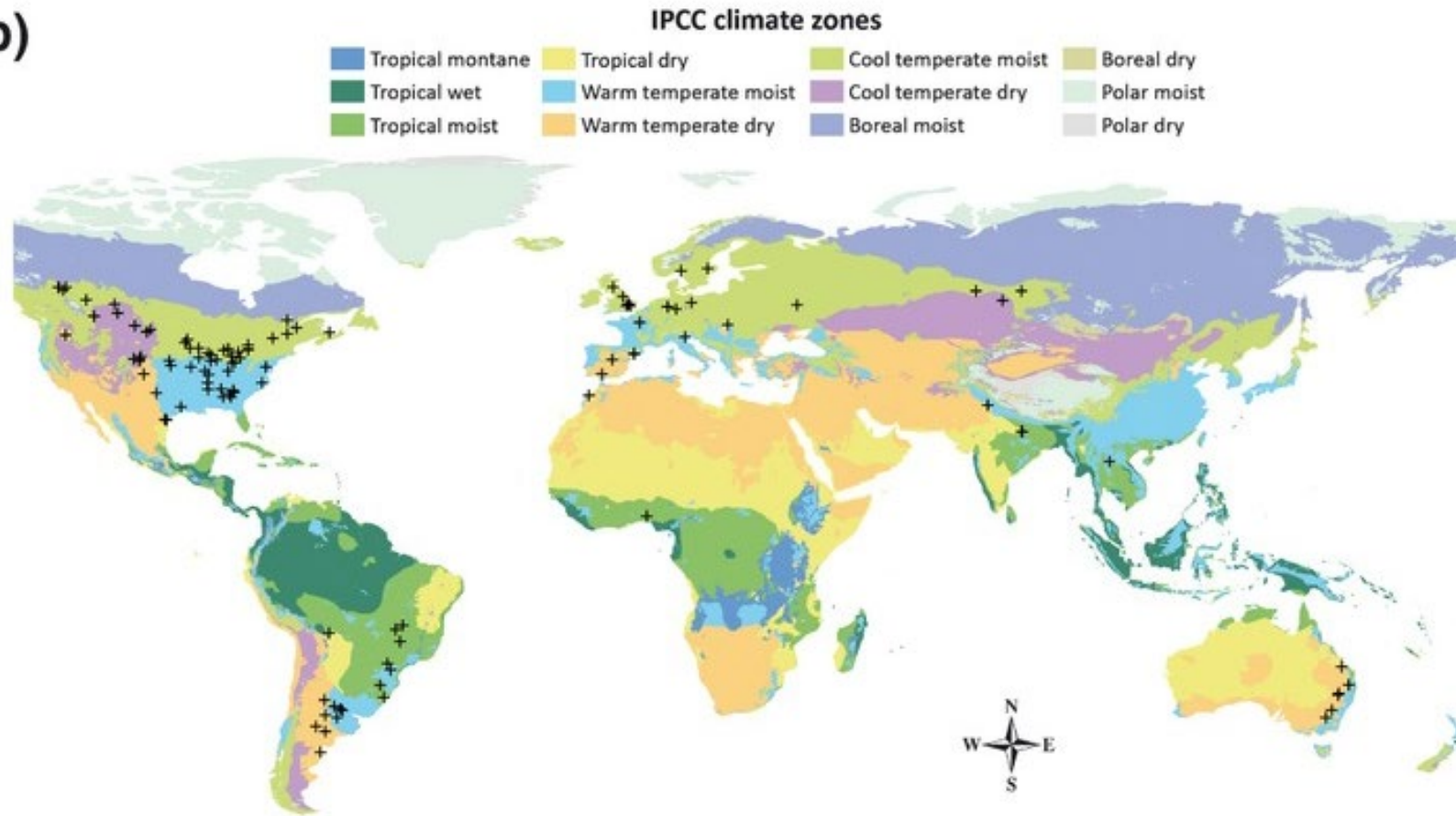


## Observations

Ogle et al. 2010, *Global Change Biology*; US-EPA National GHG Inventory Report, 2021

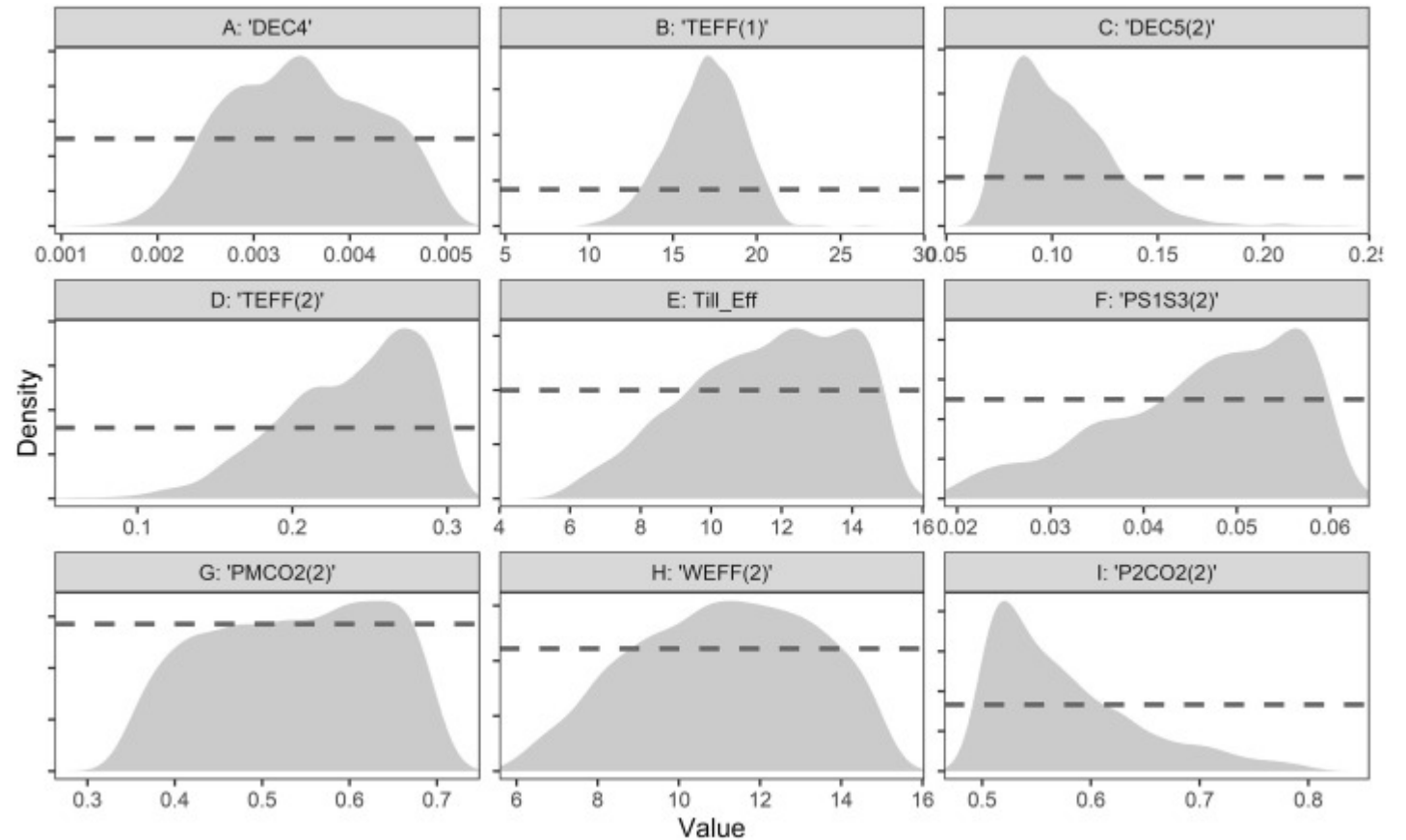
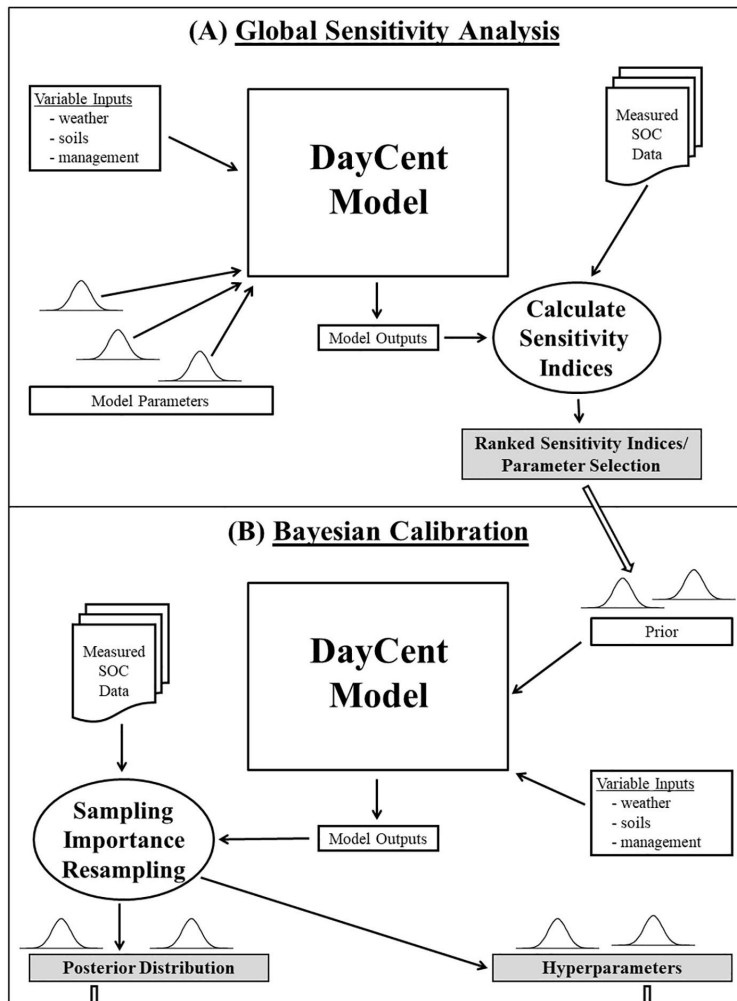
# Observations/Measurements

(b)



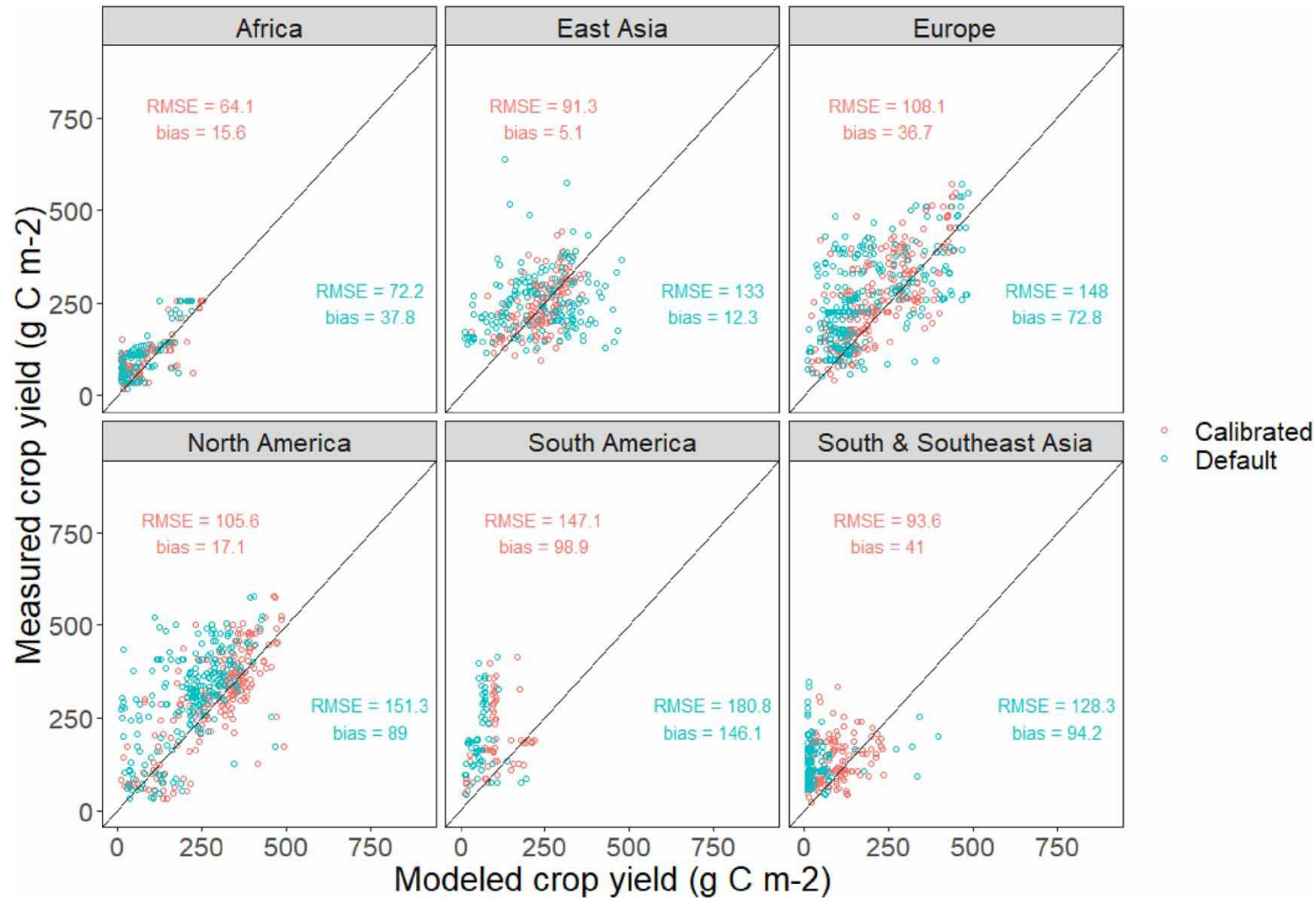
*Smith et al. 2012, Global  
Change Biology*

# Bayesian Calibration – SOC Dynamics



*Gurung et al. 2020,  
Geoderma*

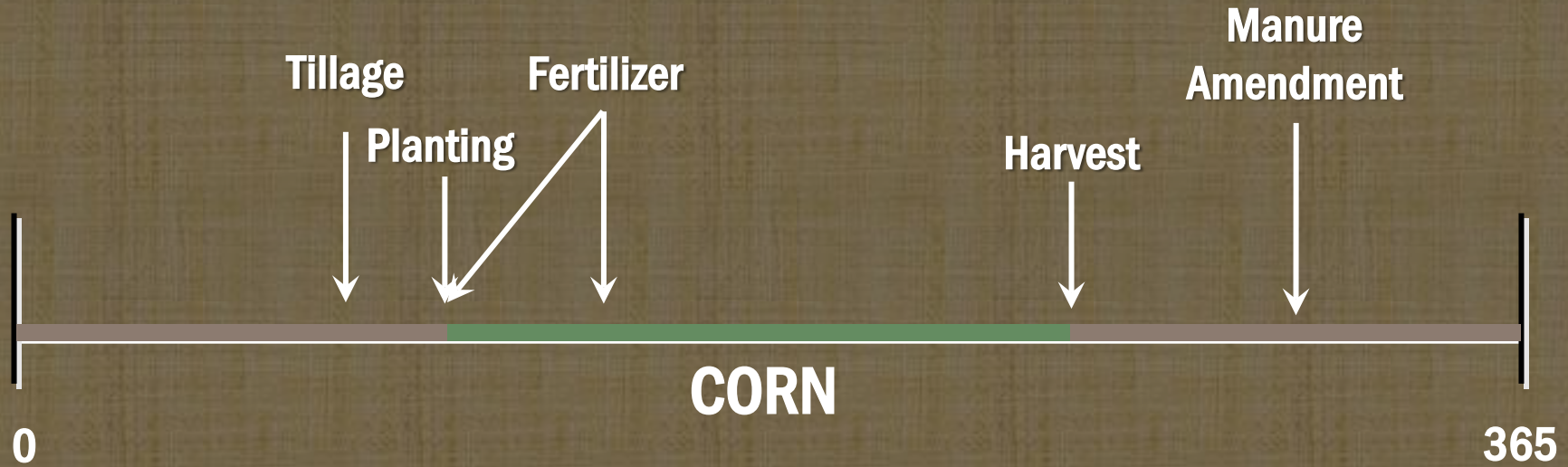
# Bayesian Calibration – Crop Production



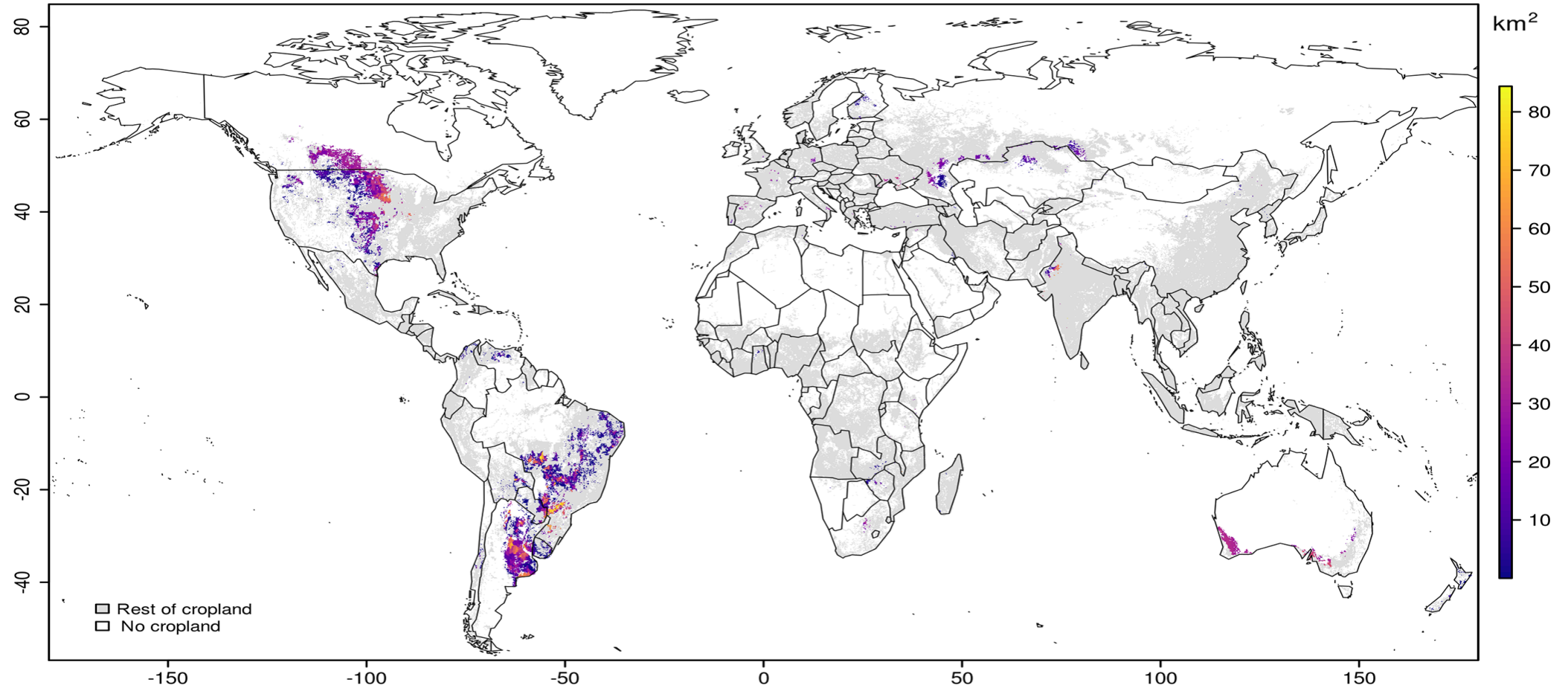
*Yang et al. 2022, Env. Research Letters*



# Management Practices

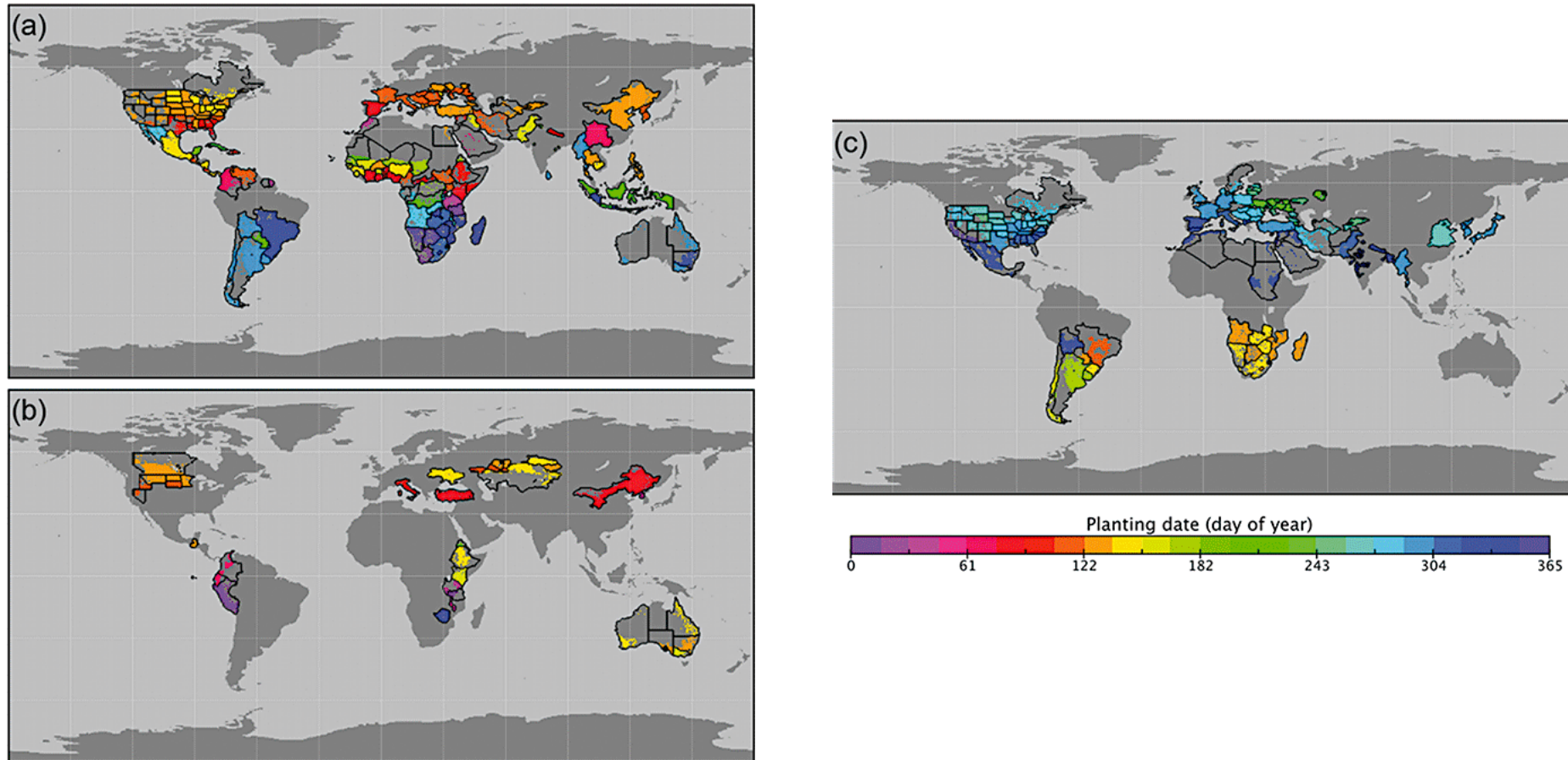


# Conservation Tillage



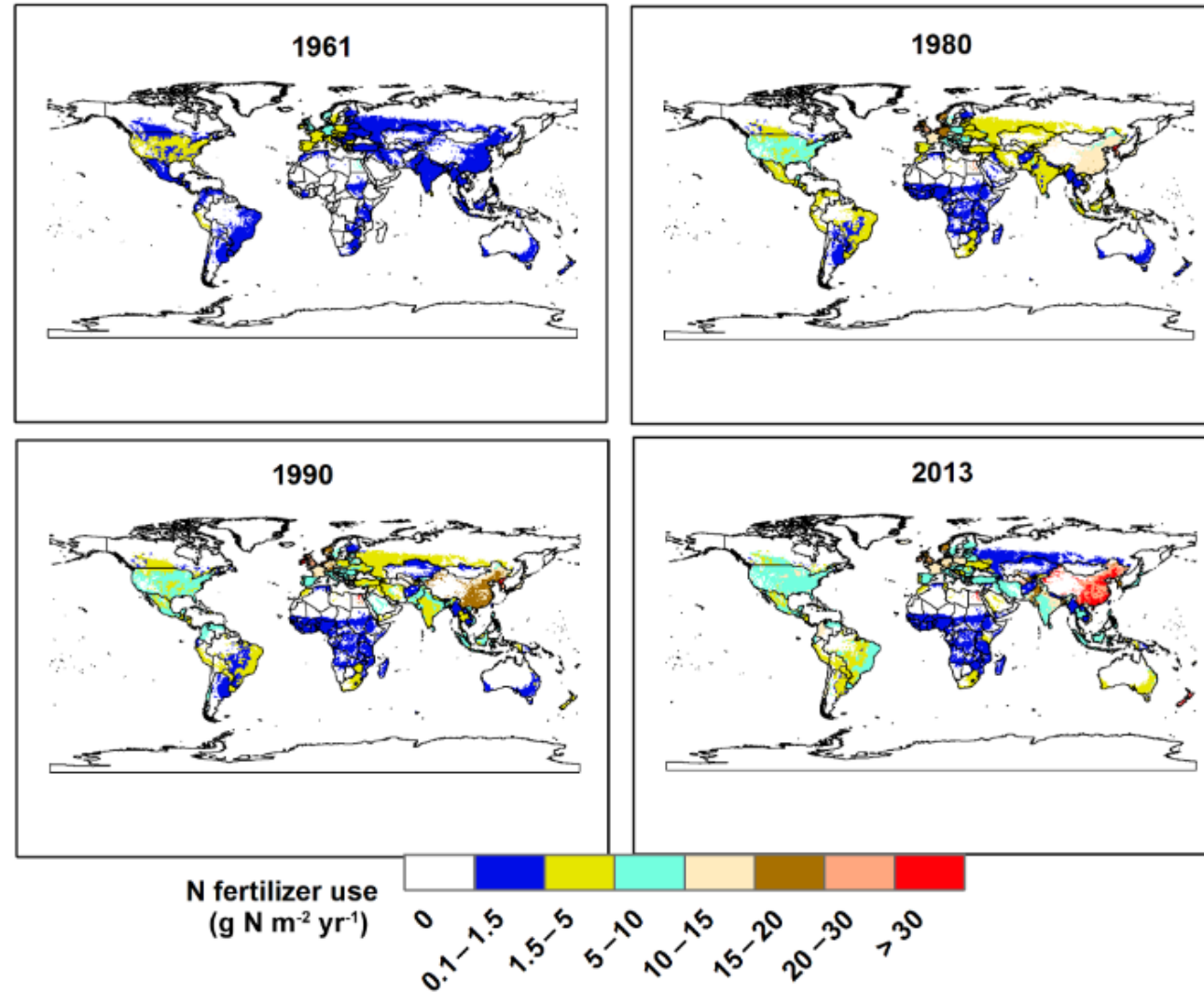
*Porwollik et al. 2019, Earth  
Syst. Sci. Data*

# Planting Date – Corn, Spring and Winter Wheat



*Sacks et al. 2010, Global Ecology and Biogeography*

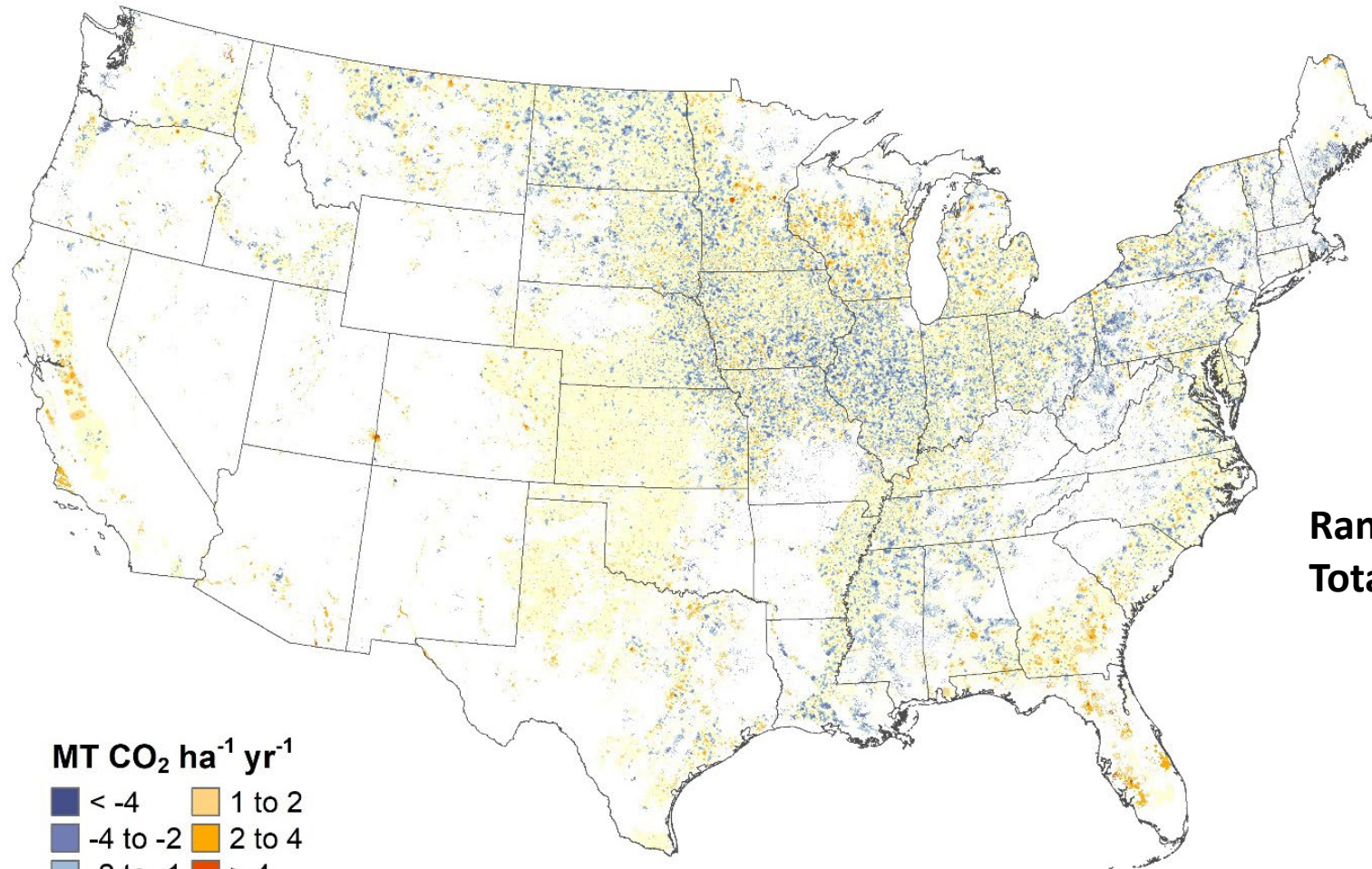
# Global Fertilizer Datasets



*Lu and Tian 2017, Earth Syst. Sci. Data*



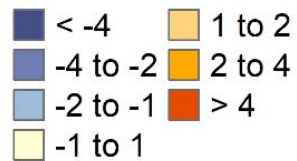
# Soil Organic C Stock Change (2015)



Range from 1990-2015

Total: ~45-65 MMT CO<sub>2</sub> eq. yr<sup>-1</sup>

MT CO<sub>2</sub> ha<sup>-1</sup> yr<sup>-1</sup>



*US-EPA, National GHG  
Inventory Report, 2021*

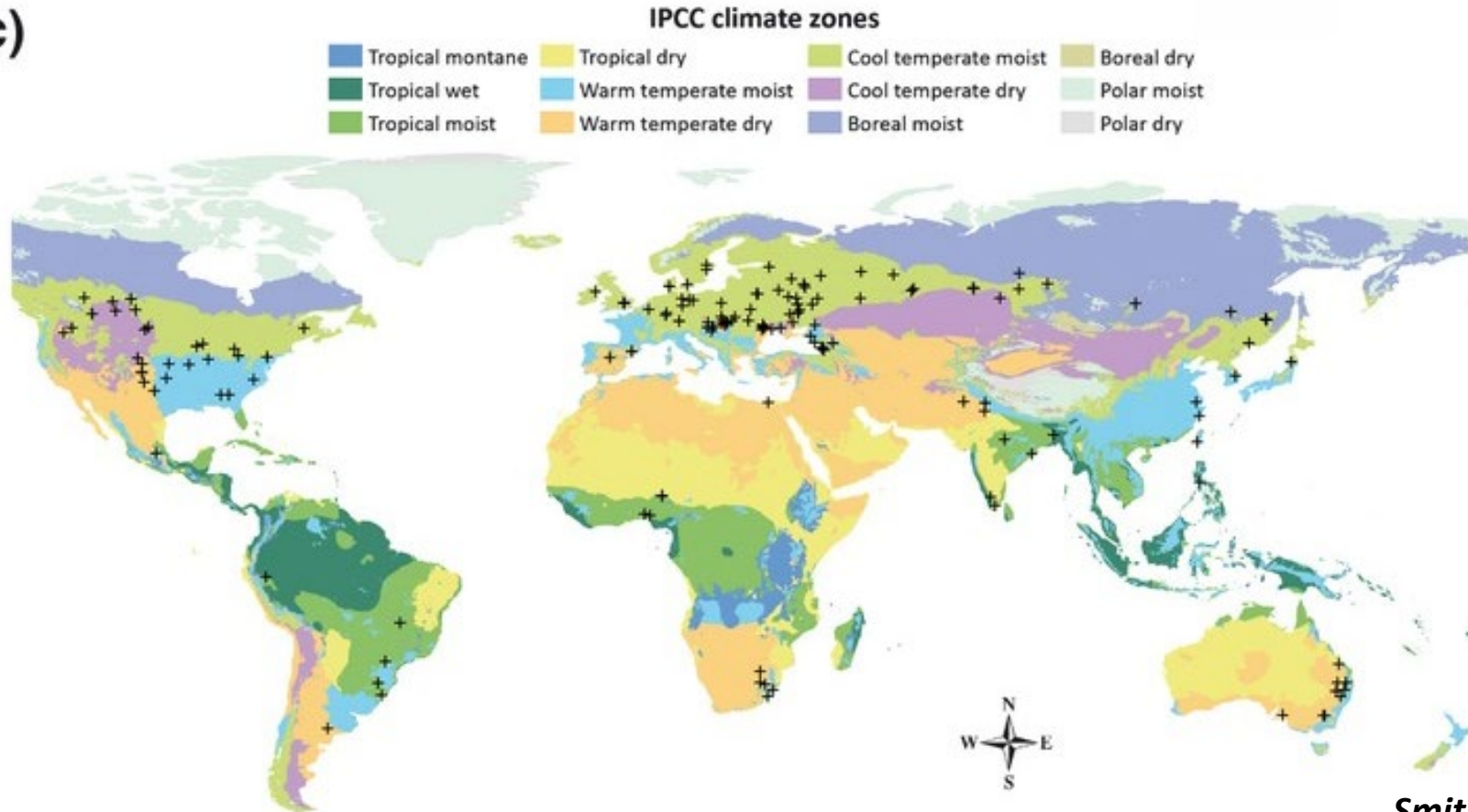
# Roadmap for Presentation

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- **DayCent Process-Based Model Framework**
- **Limitations**

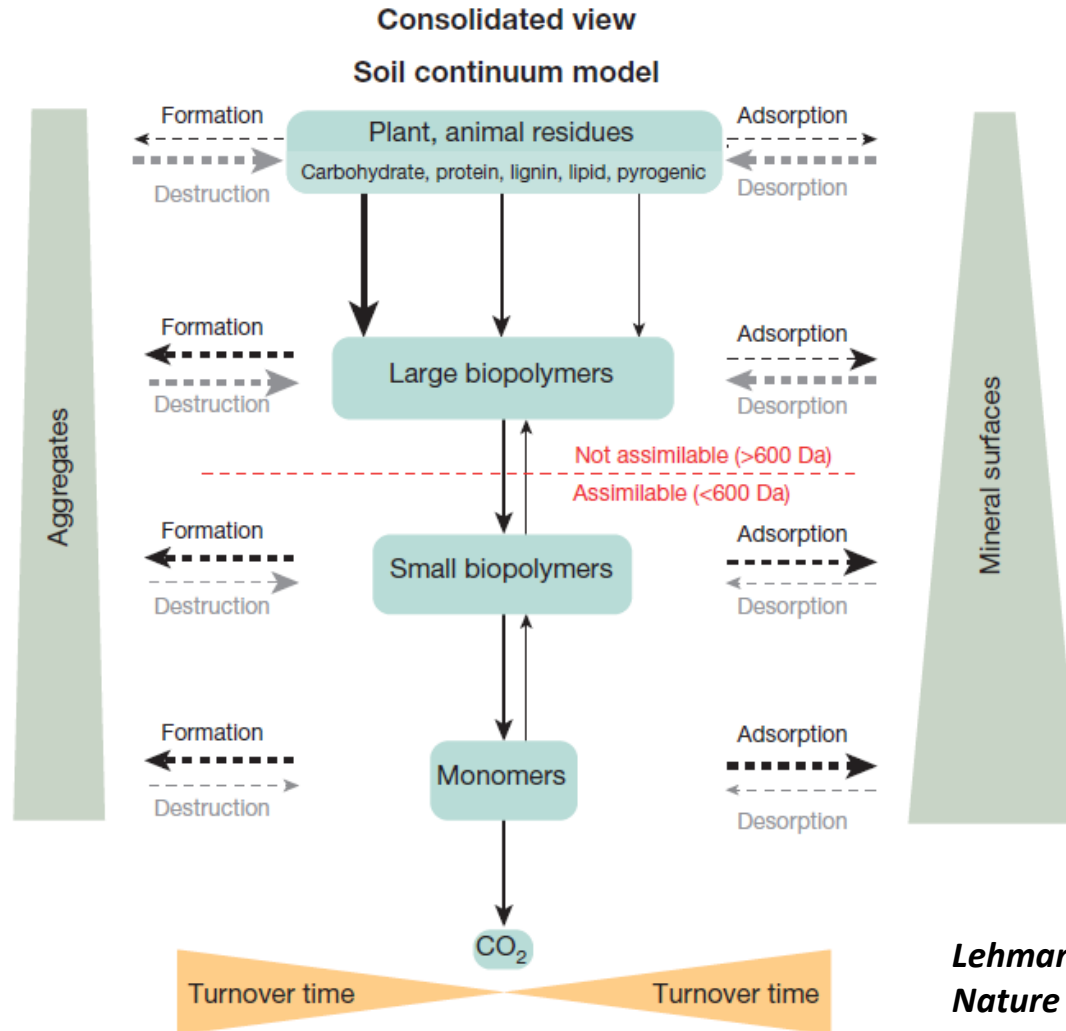
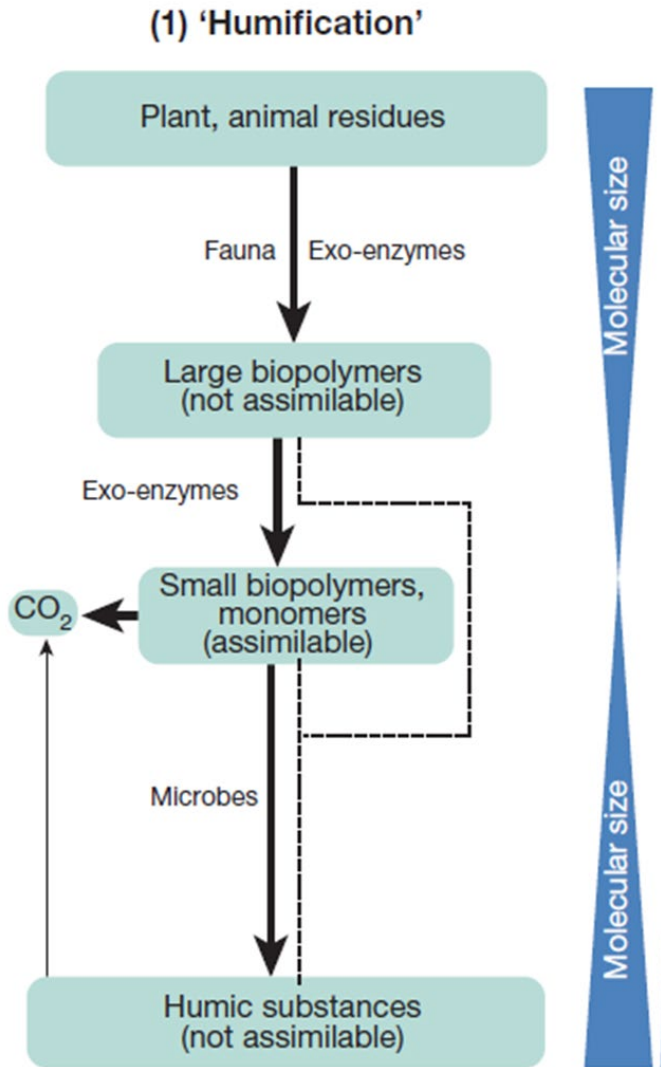
# Limitation: Observational/Measurement Sites

(c)



*Smith et al. 2012, Global  
Change Biology*

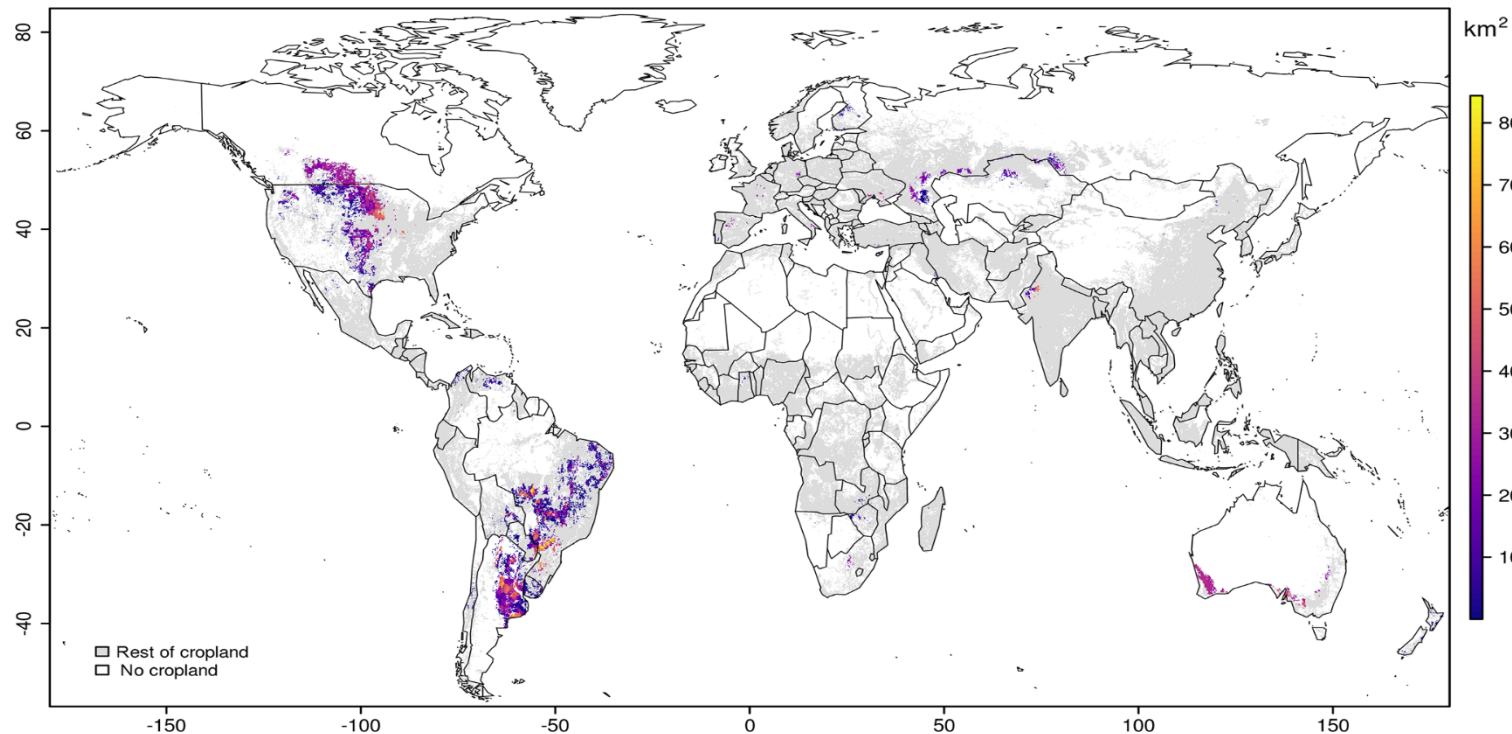
# Limitation: Process-Based Understanding



Lehmann and Kleber, 2015, Nature



# Limitation: Management Data



- **Crop Rotations**
  - Monocultures
- **Time Series**
- **Other Practices**
  - e.g., Cover crops
- **Spatial Resolution**
  - Bias in data
  - Non-linear responses



# Conclusions

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- **Optimistic about future of soil C modeling**
  - **Further advancements in models**
  - **Expanding observational networks**
  - **Enhancing management activity data collection**
- **Support biofuel analyses and other assessments of GHG mitigation potentials**