IPCC Expert Meeting on
Reconciling Anthropogenic Land Use Emissions
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US National Greenhouse Gas Inventory for Croplands and Grasslands

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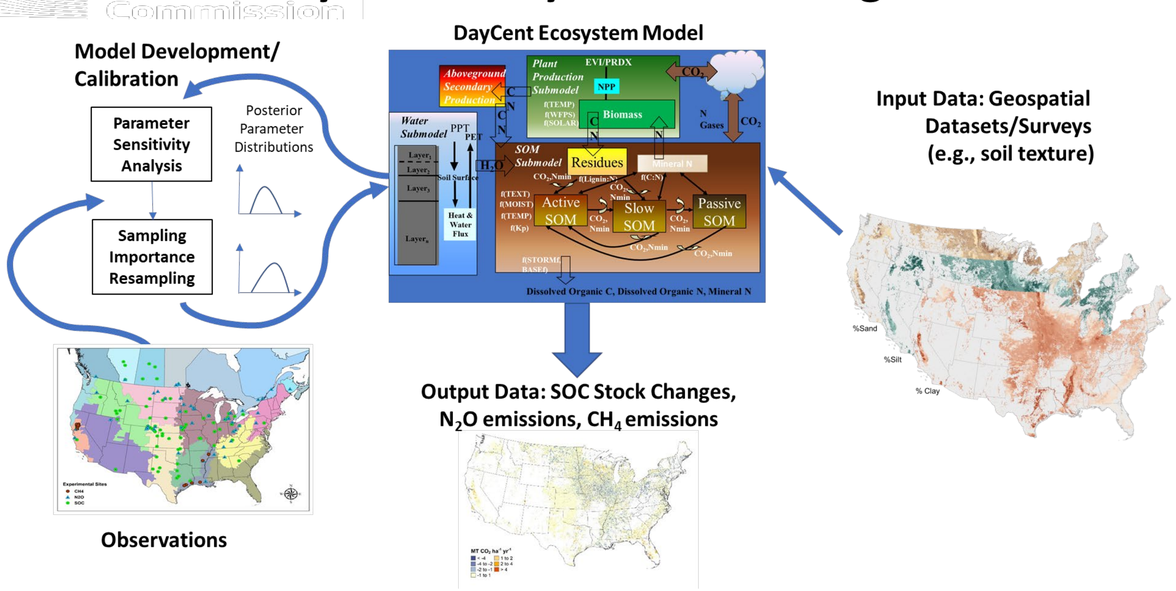
Objective: Use an IPCC Tier 3 method to produce more accurate estimates of soil C stock changes for U.S. croplands and grasslands for reporting to the UNFCCC

- **Tier 3 methods require a country-specific approach with models and/or measurements (IPCC 2006, 2019).**
- **Models must be calibrated and evaluated**
- **Must have sufficient activity data and related environmental data to apply the model across the national domain and assess uncertainty.**
- **The following platform has been developed to apply the DayCent ecosystem model for estimating soil organic C stock changes in mineral soils for the majority of cropland and grasslands in the U.S. (Ogle et al. 2023, Scientific Reports).**

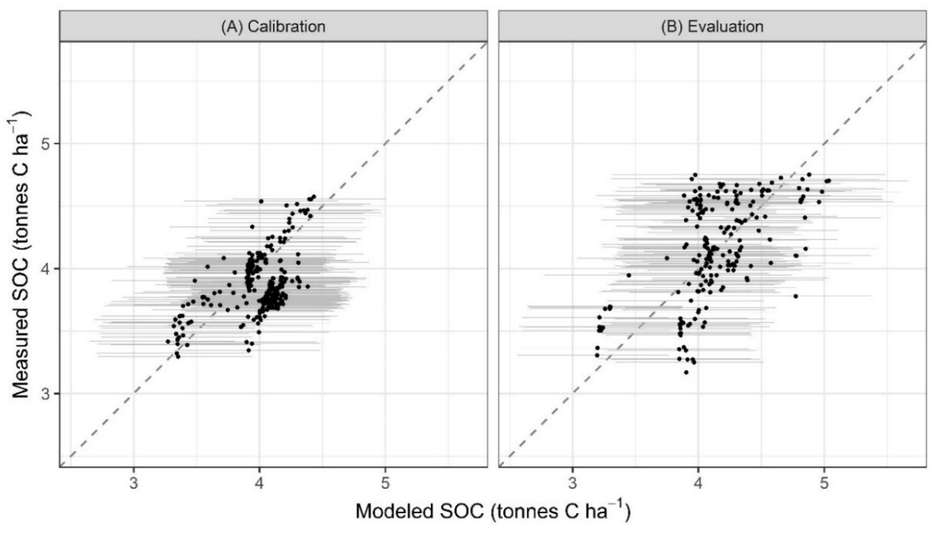
Note: Same platform is also used for estimating agricultural soil N_2O emissions and CH_4 emissions from rice cultivation

Tier 3 DayCent Ecosystem Modeling Platform



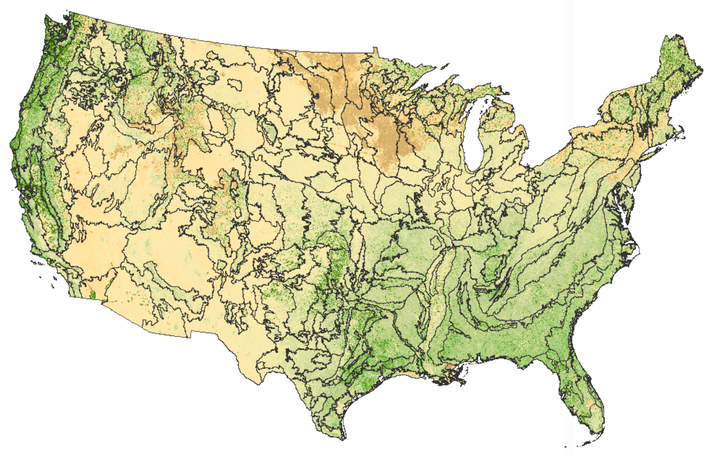
Model Calibration and Evaluation

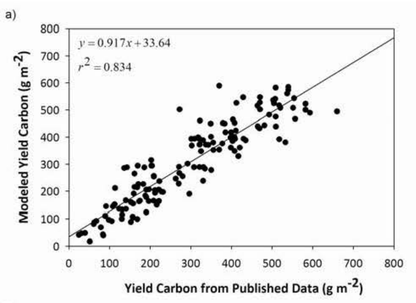
Used Bayesian method to calibrate the model and evaluate results (Gurung et al. 2020, Geoderma)



Remote Sensing Products

Utilize MODIS Enhanced Vegetation Index data to inform simulation of crop/forage production (Potter et al. 2007, Earth Interactions; US-EPA 2024, National Inventory Report)





Part a) presents results of the NASA-CASA algorithm (r^2 = 83%) and part b) presents the results of value for maximum net primary production (r^2 = 64%).

Activity Data

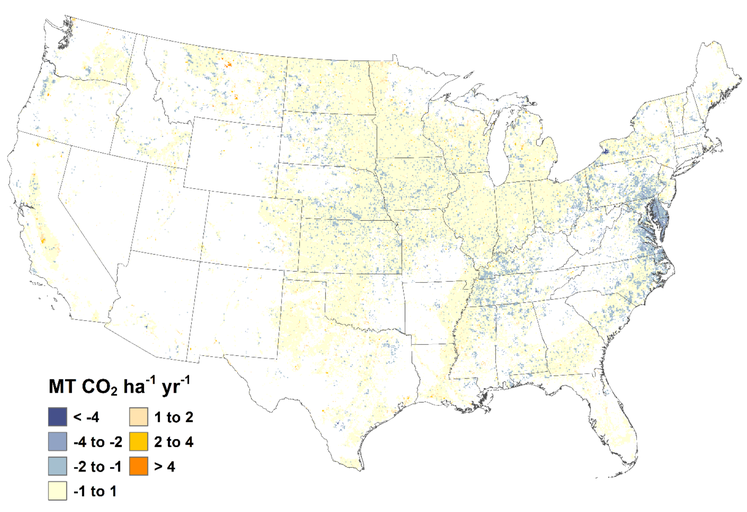
Compiled land use and management data from surveys and remote sensing products to produce a consistent and complete time series using statistics and machine learning methods (EPA 2024, National Inventory Report)

- **Gradient boosting**
- **Linear models**
- **Hot deck imputation**

Reporting Results

Estimates of soil C stock changes, along with 95% confidence intervals are reported to the UNFCCC

Map: SOC Stock changes for croplands In 2020 (Mt CO_2 eq.).
Total National Change: -38.8 Mt CO_2 eq.
95% CI: 6.4 to -81.3 Mt CO_2 eq.



Challenges and Opportunities

Goal: Further reduce uncertainty by overcoming key challenges

- **Challenge: Expand observations of SOC stock changes for calibration and evaluation**
  Opportunity: USDA is implementing a national soil C monitoring network
- **Challenge: Advance models to estimate more accurate results**
  Opportunity: New models are being developed with the latest understanding of soil organic matter dynamics
- **Challenge: Further refine the activity data time series to fill gaps**
  Opportunity: Conduct additional strategic surveys for missing data, and further explore options to use remote sensing products

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