Quantifying and Growing Maryland's Agricultural Soil Carbon Sink

Scientific and Technical Working Group

August 16, 2024

Project Partners

Maryland
Department of
the Environment

UNITED STATES
CLIMATE
ALLIANCE

Agriculture Sector in the GHG Inventory

Animal, manure, fertilizer emissions (CH4, N2O)

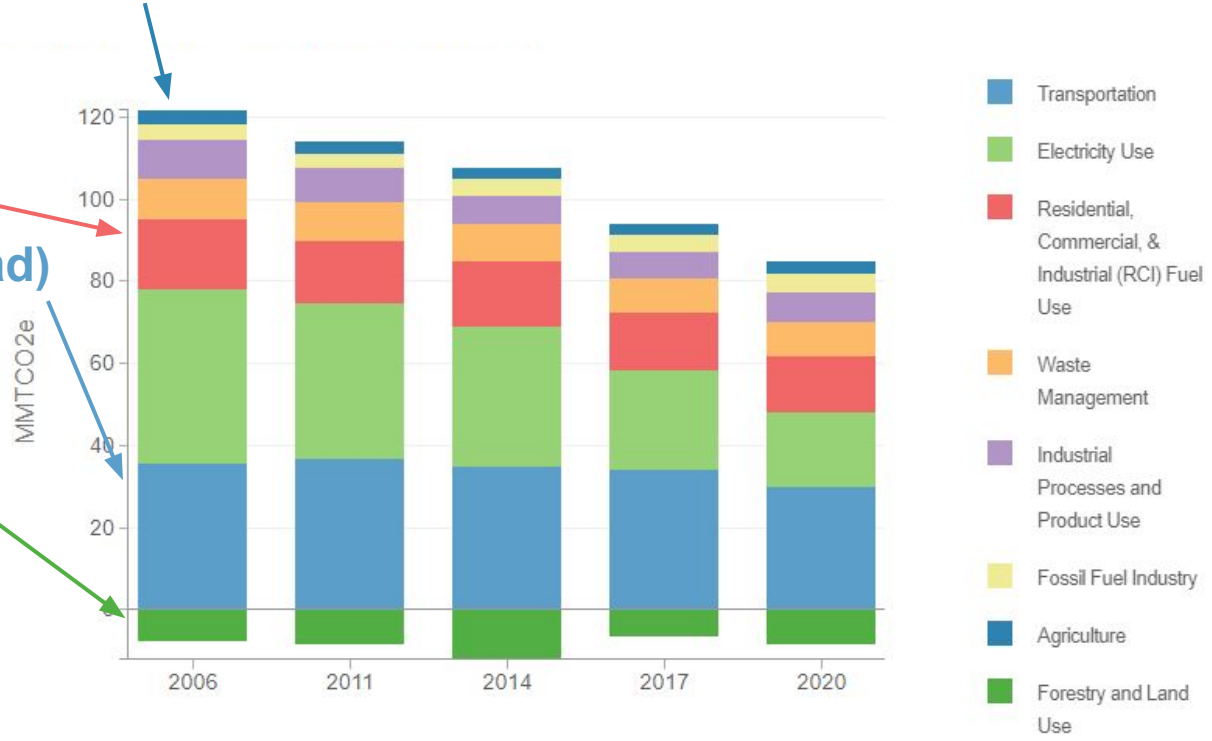
Fuel use emissions (CO2)

in RCI (industrial)

& Transportation (non-road)

Carbon flux in soils

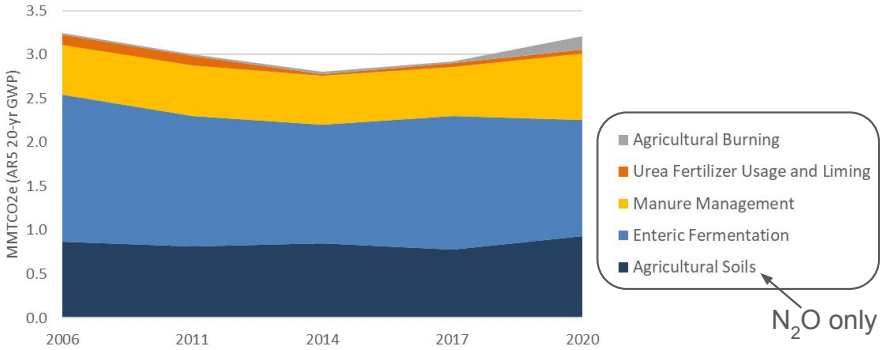
Carbon flux in trees



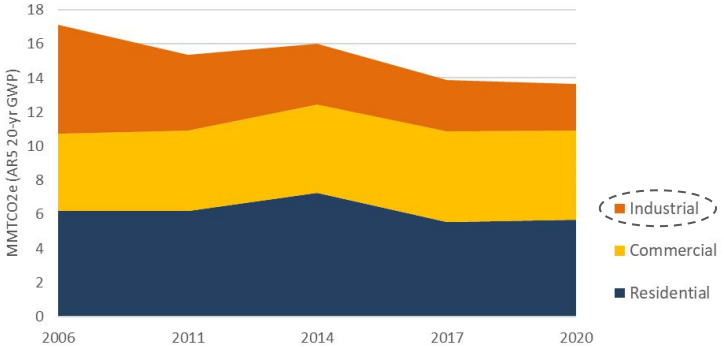
Source: https://mde.maryland.gov/programs/air/ClimateChange/Pages/GreenhouseGasInventory.aspx

Agriculture Sector in the GHG Inventory

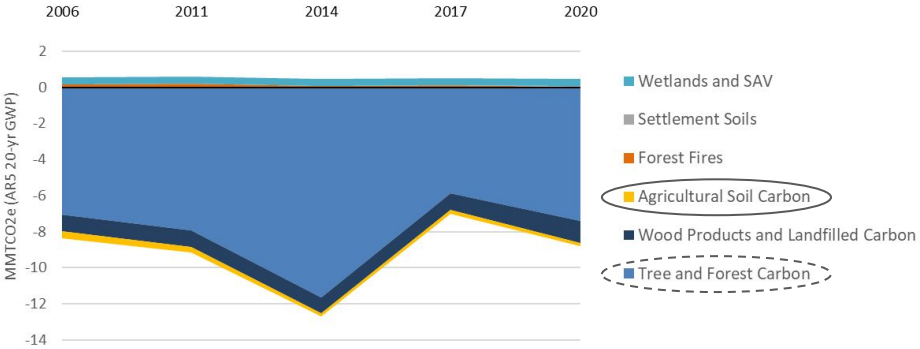
Agriculture (animals, manure, fertilizer)



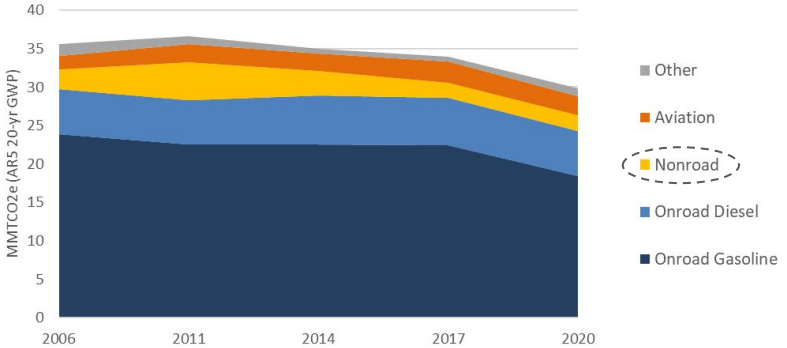
Residential, Commercial, & Industrial Fuel Use



Forestry and Land Use

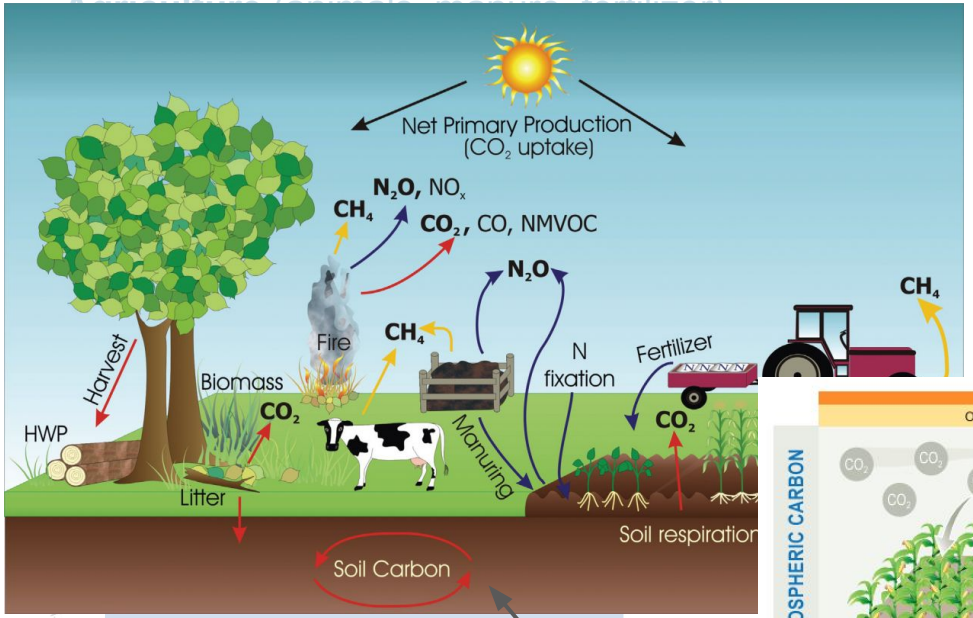


Transportation

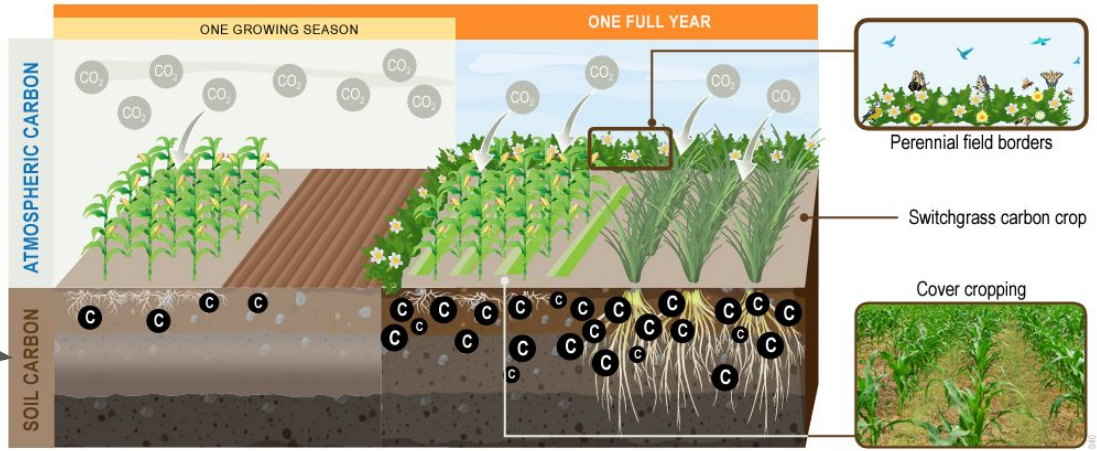


Source: https://mde.maryland.gov/programs/air/ClimateChange/Documents/GGRA PROGRESSS REPORT 2022.pdf

Agriculture Sector in the GHG Inventory



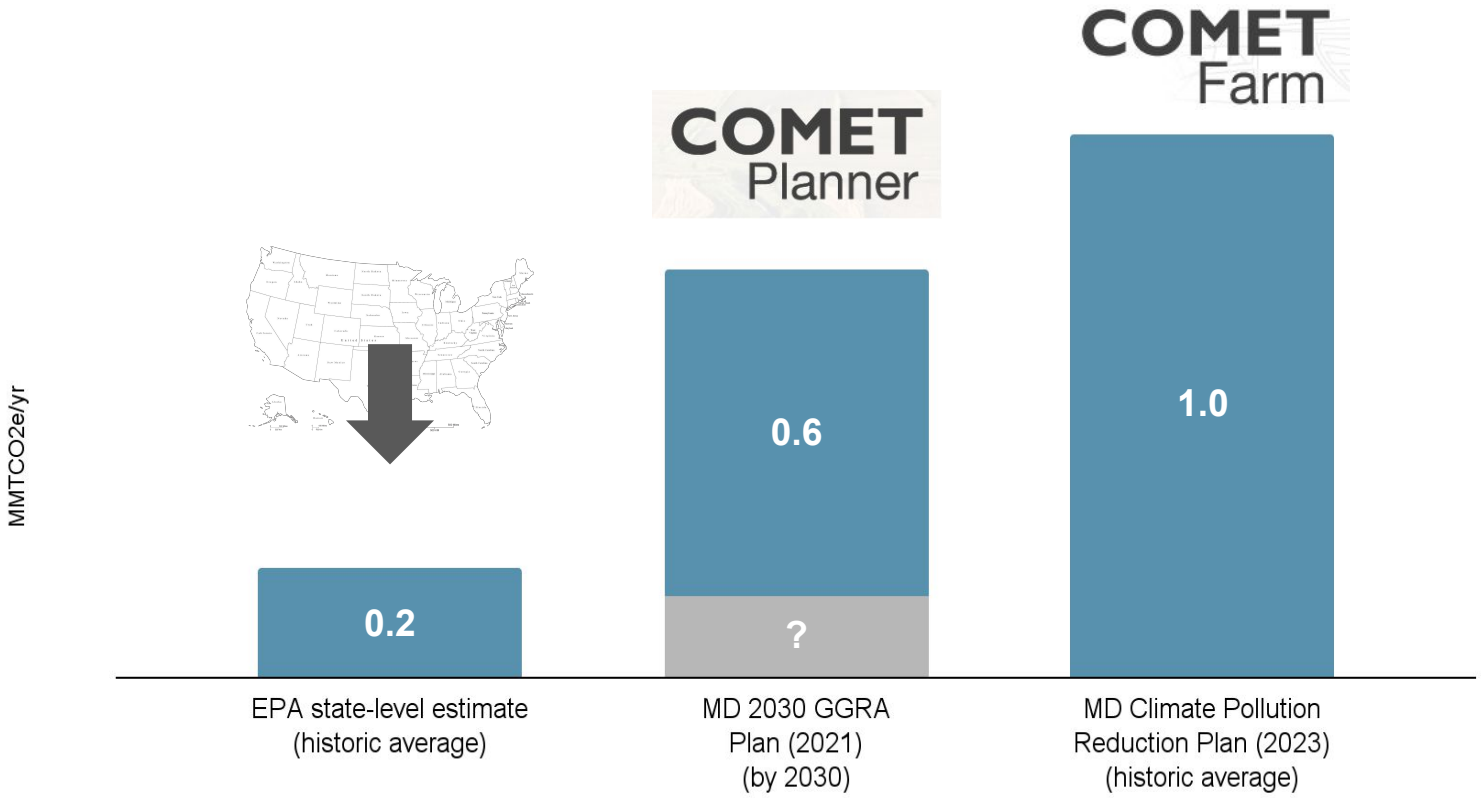
Source: IPCC, 2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 4: Agriculture, Forestry and Other Land Use



Source: Lawrence Livermore National Laboratory, Roads to Removal: Options for Carbon Dioxide Removal in the United States

Source: https://mde.maryland.gov/programs/air/ClimateChange/

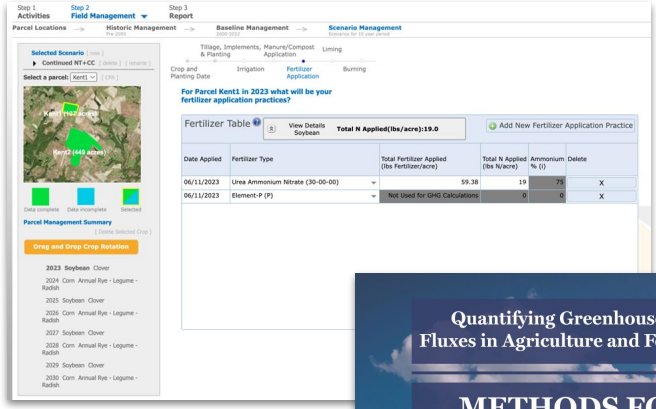
Other/Previous Estimates

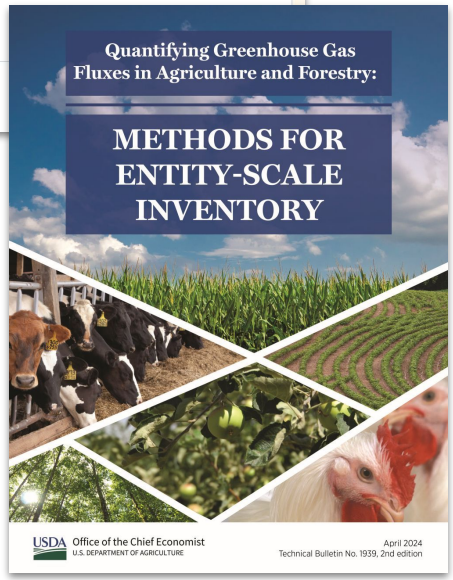


Tools

COMET-Farm

- Developed by Colorado State University and USDA
- A whole farm and ranch carbon and greenhouse gas accounting system
- Guides users through describing farm and ranch management practices, including alternative future management scenarios, to generate a report comparing the carbon changes and greenhouse gas emissions between current management practices and future scenarios.
- Uses the DayCent dynamic model, which is the same model used in the official U.S. National Greenhouse Gas Inventory.
- Implements the peer-reviewed, USDA-sanctioned entity-level inventory methods.





COMET-Planner

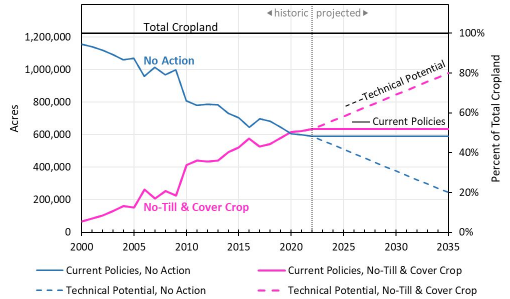
Methodology

Management Scenarios

Sample Fields

Implementation Acres

x

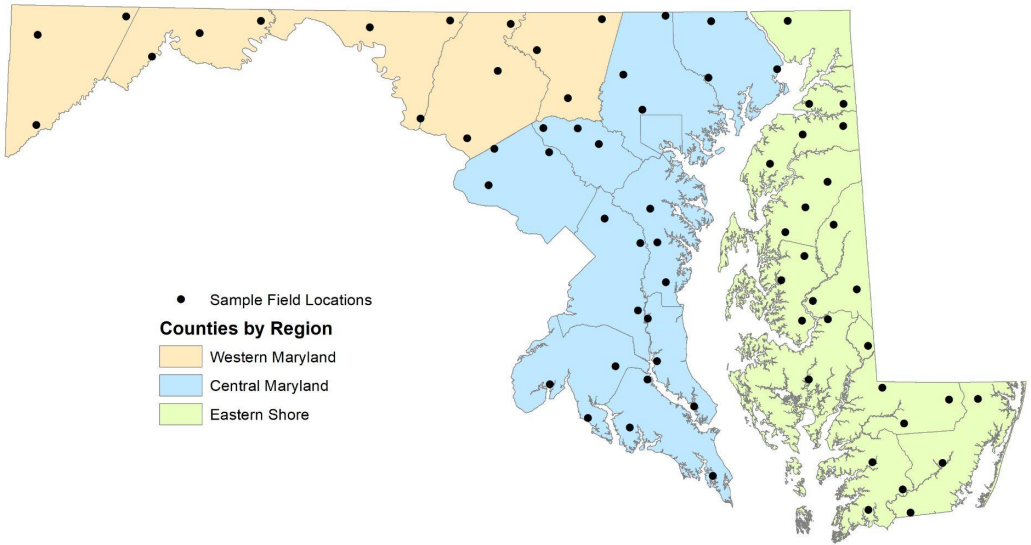


combination of management practices

per county

Methodology

Sample Fields



Methodology

Management Scenarios

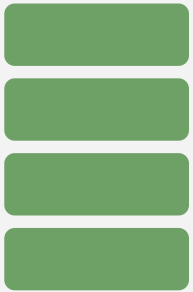


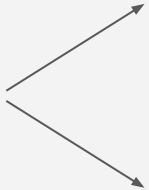
Table 2: Summary of management scenario assumptions

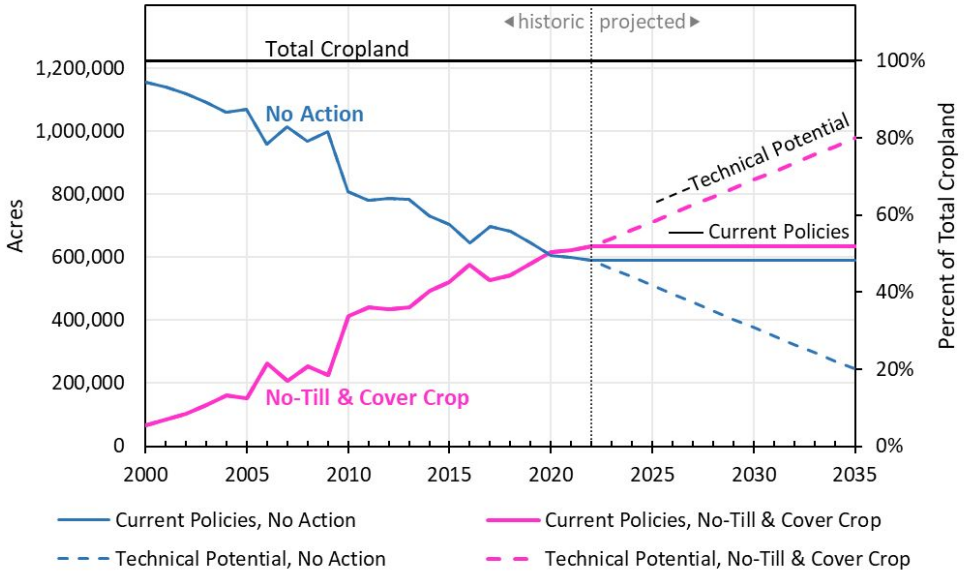
Management Scenario	Region	Tillage Practice	Crop Rotation	Nutrient Inputs
Pre-2000	all	Intensive tillage	Annual crops in rotation	n/a
No Action	Western Maryland	Reduced tillage	Year 1: Corn Silage & Alfalfa Years 2-5: Alfalfa	Dairy slurry, MAP, UAN*
	Central Maryland		Year 1: Corn Year 2: Soybean	MAP, UAN
	Eastern Shore		Year 1: Corn Year 2: Soybean	Poultry litter, MAP, UAN
Cover Crop Addition	Western Maryland	No-till	No Action with cover crop of winter wheat in Year 5	[same as No Action]
	Central Maryland & Eastern Shore		No Action with cover crop of winter wheat	
Cover Crop and Precision Nutrient Management	Western Maryland	[same as Cover Crop Addition]		Increased corn silage yield
	Central Maryland			Increased crop yields
	Eastern Shore			Reduced poultry litter Increased crop yields
Biodiverse Cover Crop and Precision Nutrient Management	all	No-till	No Action with cover crop of annual rye - legume - radish	[same as Cover Crop and Precision Nutrient Management]

* MAP = Monoammonium Phosphate; UAN = Urea Ammonium Nitrate

Methodology

Implementation Acres





Results


Management Scenarios
Sample Fields
x
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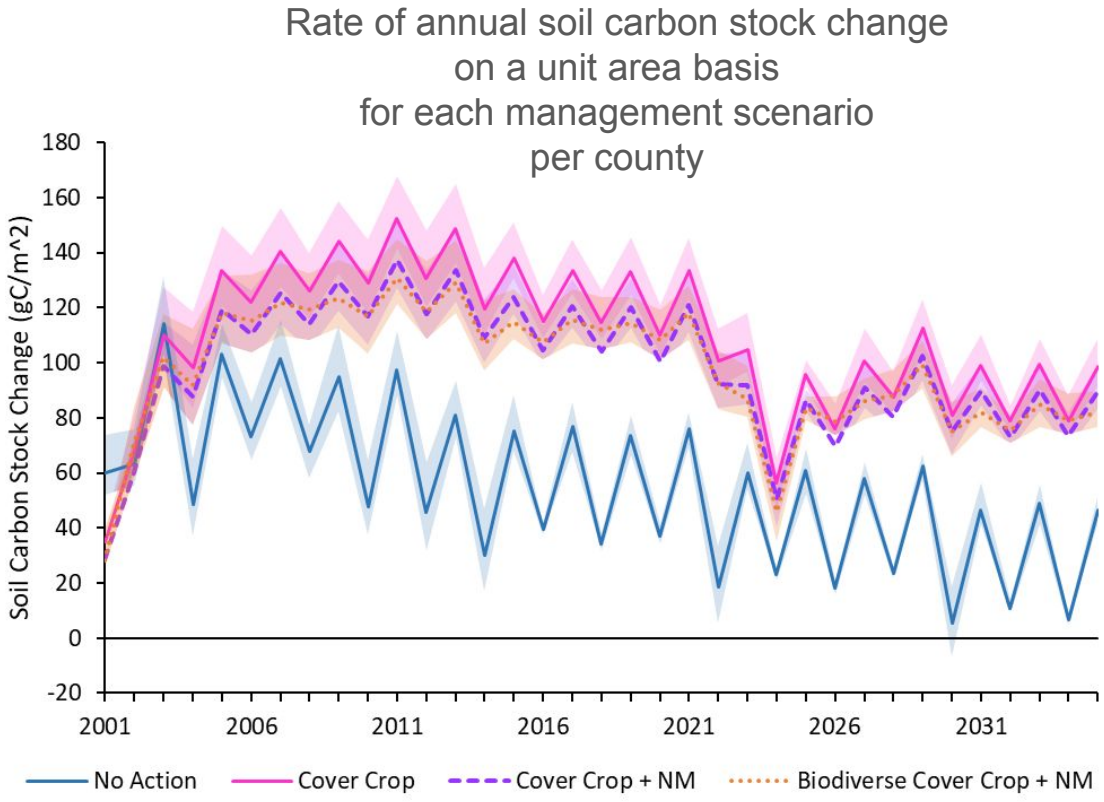
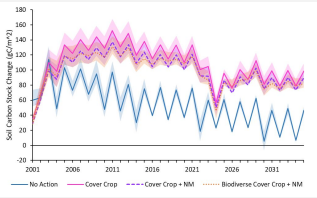

Rate of annual soil carbon stock change
on a unit area basis
for each management scenario
per county
Soil Carbon Stock Change (gC/m^2)
180
160
140
120
100
80
60
40
20
0
-20
2001
2006
2011
2016
2021
2026
2031
No Action
Cover Crop
Cover Crop + NM
Biodiverse Cover Crop + NM

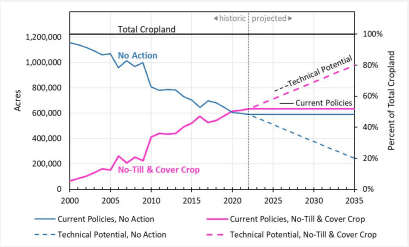
Results

Rate of annual soil carbon stock change on a unit area basis for each management scenario per county



x

Implementation Acres



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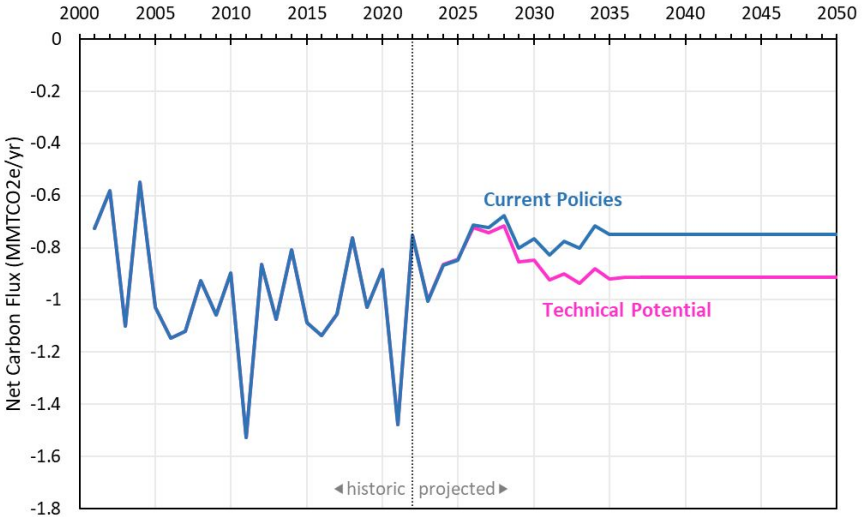
Annual statewide flux of carbon per historical and projected levels of implementation



summed across counties

Conclusions

Benefits

- Leverages state-specific data
- Uses best available peer-reviewed model
- Automated & repeatable
- Temporal resolution
- Spatial resolution

Challenges

- Staff time to refine
- Adapting to COMET-Farm updates

Opportunity

- Continuing current levels of implementation can provide a stable level of annual carbon sequestration
- Expanding practice adoption can increase the annual rate of sequestration by 23%