Quantifying and growing Maryland's agricultural soil carbon sink

Active state-led project with the U.S. Climate Alliance (2022-2023)

Updating the Maryland's Greenhouse Gas Inventory

Climate action plans clarify the ambition needed to reach a particular greenhouse gas (GHG) reduction goal, while GHG Inventories serve as a mechanism for assessment to determine if the state is on or off the plan. In this sense, one goal should be to have every sector from the state's GHG reduction plan reflected in the state's inventory, including all categories of natural carbon sequestration. Ideally, implementation of planned activities to grow these carbon sinks will show up in the inventory; however, annual changes in net carbon fluxes are impacted by a full range of natural and human activities and require careful accounting. Attention to the entire sector can help the state and other partners identify factors that should be considered for further policy intervention. Ideal attributes of a cropland monitoring approach for Maryland's GHG Inventory include:

- Ability to provide a baseline assessment of agricultural soil carbon fluxes in 2006;
- Ability to track spatially-explicit changes in cropland area over time;
- Access to regularly updated land-use and emissions data for ongoing inventory updates;
- Annual cropland carbon fluxes that are spatially-resolved with attention to variations across space and over time;
- Annual cropland carbon fluxes that are inclusive of annual implementation of agricultural practices (NCRS management practice codes and irrigation/non-irrigation delineation);
- Consistent accounting with the state's climate plan such that there is an ability to detect or characterize the impact of planned practice implementation within an annual inventory context; and
- Coupled modeling of nitrogen and carbon cycling, even as net agricultural soil carbon fluxes and other agricultural emissions are separately reported within the inventory.

In 2021, the Maryland Commission on Climate Change recommended that the state include agricultural soil carbon fluxes within the 2023 GHG Inventory[1] based on the best available science. In response, Maryland Department of the Environment (MDE) moved to include state-level estimates of agricultural soil carbon fluxes, newly made available by the EPA in 2022, within the 2020 GHG Inventory.[2] In partnership with the Maryland Department of Agriculture, MDE also developed a grant proposal to the U.S. Climate Alliance (USCA) to improve this statewide estimate for 2023 using state specific data. Work under this awarded USCA Technical Assistance Grant began in Fall 2022.

[1] Information about the Maryland 2020 Greenhouse Gas Inventory can be found on MDE's website at mde.maryland.gov/programs/air/climatechange/pages/greenhousegasinventory.aspx.

[2] Full methodological details of the U.S. EPA method for estimating state-level agricultural soil carbon stocks and fluxes can be found on their national GHG inventory website at epa.gov/ghgemissions/methodology-report-inventory-us-greenhouse-gas-emissions-and-sinks-state-1990-2020.

Current EPA Approach

Agricultural soil carbon fluxes within the state's 2020 GHG inventory are derived from the EPA State Inventory Tool. While these statewide estimates offer a first order assessment using federal datasets of cropland extent and biogeochemical modeling of carbon and nitrogen, cropland management activity data, drawn from the U.S. Department of Agriculture's Natural Resources Conservation Service Conservation Effects and Assessment Project, is currently sample-based and extrapolated from 2002 to 2006 levels with the aid of additional datasets.[3] Given that Maryland's conservation practice activities do not appear to be well integrated into current inventory methodologies, it is important that the State seek out new tools and methodologies that can better capture the contributions of Maryland farmers and further orient implemented Greenhouse Gas Reduction Act and Maryland Healthy Soils Program activities against background soil carbon fluxes. This additional information could also be used by Maryland to iterate programs and policy to incentivize additional conservation practices that best realize remaining carbon sequestration potential on cropland.

Current USCA Project Goals

Maryland farmers have long demonstrated leadership on implementing climate friendly practices, such as cover cropping, in support of the Chesapeake Bay Program goals. MDA and MDE have already utilized an early version of the U.S. Department of Agriculture (USDA) and Colorado State University's CarbOn Management & Emissions Tool (COMET) Planner tool to provide an initial GHG sequestration estimate of projected practice implementation for the 2030 Greenhouse Gas Reduction Act (GGRA) Plan.[4] COMET, and its underlying modeling framework, is a widely accepted tool that has had more than a decade of iteration and support from the USDA.

Building from this investment, MDE and MDA are working with contractors from Sierra View Solutions to directly integrate state-specific data within COMET Farm[5], utilizing its underlying biogeochemical model to 1) generate historical annual agricultural soil carbon fluxes across all cropland area in the state (2006-2021), 2) develop a method to quantify annual fluxes for future state inventories, and 3) consider future fluxes under a range of planning scenarios for ongoing Best Management Practice implementation towards future GHG goals. This work will ensure we can accurately capture the additional carbon contributions of Maryland farmers against the broader agricultural soil carbon landscape.

Project Contact

Questions about this project can be directed to Dr. Rachel Lamb, MDE's Natural Carbon Sequestration Administrator (rachel.lamb@maryland.gov).

[3] EPA SIT User's Guide, epa.gov/system/files/documents/2022-03/land-use-change-and-forestry-users-guide.pdf
[4] Please see Appendix K of the Maryland 2030 GRRA Plan (mde.maryland.gov/GGRA) for more information about the state's previous use of COMET Planner (comet-planner.com).
[5] More information on COMET Farm is available from the USDA (comet-farm.com).