

NASA Carbon Monitoring System (CMS) **Multi-State Working Group Quarterly Meeting Report**

Friday, February 7, 2020

Meeting Focus: “Scaling Up the High-Resolution Carbon Monitoring and Modeling Products to the Northeast U.S.: Discussion of Climate Action Plans, Current Carbon Monitoring Strategy, and Carbon Monitoring Needs and Interest for Stakeholders in the States of New Hampshire, and Maine”

27 Participants: **Edil Sepulveda Carlo**, SSAI/NASA GSFC; **George Hurtt**, UMD; **Maddie Guy**, UMD; **Jarlath O’Neil-Dunne**, UVT; **Andrew Lister**, USFS; **Elliott Campbell**, MD DNR; **Rachel Lamb**, UMD; **Shannon Kennedy**, UMD; **Sabrina Delgado Arias**, SSAI/NASA GSFC; **Chris Skoglund**, NH DES; **Nathan Robbins**, ME DEP; **Hong-Hanh Chu**, MA EOEEA; **Robert O’Connor**, MA EOEEA; **Daniel Warner**, DE Geological Survey; **Dena Gonsalves**, RI DEM; **John Callahan**, Univ of DE; **Cary Lynch**, CT DEEP; **Kurt Gaertner**, MA EOEEA; **Margaret Valis**, NY DEC; **Mark Biddle**, DE DNREC; **Shawn Lehman**, PA DCNR; **Rachel Soobitsky**, Chesapeake Conservancy; **Don Strebel**, Versar, Inc.; **Teresa Moore**, VPC; **Tom Chi**, Investor; Stakeholder at NY DEC; Louis (not identified)

I. Executive Summary

On February 7th, 2020, CMS scientists and invited stakeholders participated in the first Multi-State Working Group Quarterly Meeting of 2020. The objectives of the Multi-State Working Group Quarterly Meeting were:

- Provide stakeholders with the opportunity to discuss updates of policies, programs, and initiatives that could benefit from CMS carbon data products
- Determine how CMS can contribute science to inform policy
- Provide state officials with ideas on applications of the CMS data products in their respective states

Following an introduction and overview of the CMS data products produced by this team, as well as lessons learned discussion from the Maryland Department of Natural Resources and a brief overview of an upcoming CMS project workshop, state representatives from New Hampshire, and Maine were asked to discuss their respective state’s climate action plans, current carbon monitoring strategy, and carbon monitoring needs and interests. Key takeaways from the states’ presentations were:

- An interest of the state of New Hampshire in reducing forested land conversion rates, using wood for energy, and in maintaining an economically and ecologically sustainable working forest, amongst other actions.
- There is a particular interest of the state on sustainably managed forests because they provide a broad range of ecosystem services to New Hampshire, including: carbon

sequestration and storage; biomass for a variety of forest products; ecological functions; and various recreational opportunities.

- A need to update the NH Forest and Wood Use Carbon Model from 2009.
- The main goal of the state of Maine now is to achieve state carbon neutrality by 2045.
- The state of Maine has a priority information need on improved monitoring of key indicators, and greater integration of remote sensing technologies.

Information learned from this meeting was used to continue updating a multi-state forest carbon science/policy summary table, appended at the end of this report. This draft table presents a summary of each state's policy framework, goal, science (land), and science needs (land), and will be updated as we continue to receive more information from northeastern states. These discussions will be continued through additional telecons planned for the rest of the year, as well as a regional in-person workshop now planned for Spring 2021, to which participants of this call are encouraged to attend. A peer-reviewed publication summarizing input from the states is also planned and currently in preparation.

II. Welcome and Introduction

Edil Sepulveda Carlo, CMS Applications Coordinator at NASA Goddard Space Flight Center, gave a welcome and introduced participants to the objectives of the Multi State Working Group, as well as presented the goals and discussion topics and questions for this meeting. The Multi-State Working Group is comprised of NASA Carbon Monitoring System scientists and carbon data end users from the northeastern United States. The working group was originally created at the 2016 NASA-CMS & USFS Applications Workshop & Tutorial held at Newtown Square, Pennsylvania as the Tri-State Working Group.

The overarching goal of the Multi-State Working Group is to share stakeholder perspectives and needs and relevant scientific advances for forest carbon monitoring and modeling. The working group provides a focused opportunity to continue and expand discussions on lessons learned, identify common needs and solutions, and make progress in incorporating science into policy and decision making. The objectives of the Multi-State WG Quarterly Meetings are the following:

- Provide stakeholders with the opportunity to discuss updates of policies, programs, and initiatives that could benefit from CMS carbon data products
- Determine how CMS can contribute science to inform policy
- Keep awareness of CMS updates

The focus of this meeting was to provide a science overview and updates of the new products being developed for eleven northeastern states of the Regional Greenhouse Gas Initiative plus region (RGGI+), highlight lessons learned from stakeholders in Maryland currently using CMS data products, learn more and understand the objectives of the Regional Workshop on Integrating Technical Assistance with Policy Action, and provide the opportunity for state officials from New Hampshire and Maine to discuss climate change action plans and policies, as well as mandates and greenhouse gas reduction goals in their state. The expected outcome of this meeting was to

provide new stakeholders from the northeastern United States with ideas on how to use the CMS data products for different applications in their states.

III. Science Progress, Updates and Plans from NASA CMS Science Team

CMS scientists George Hurtt (PI, University of Maryland), Jarlath O’Neil-Dunne (University of Vermont), and Andrew Lister (US Forest Service) provided an overview of the CMS science and data products. The new multi-state project (Hurtt CMS-2016) aims to increase accuracy of high spatial resolution forest carbon monitoring and planning in the eleven state RGGI+ region, as well as develop a national prototype using data from the NASA Global Ecosystem Dynamics Investigation (GEDI) mission [<https://science.nasa.gov/missions/gedi>]. The eleven state RGGI+ region consists of Maryland, Pennsylvania, Delaware, New York, Vermont, Massachusetts, New Jersey, Connecticut, Rhode Island, New Hampshire, and Maine.

The following products are being developed for the 11 Mid-Atlantic and Northeastern states: 0.5 and 1m canopy cover maps (1km canopy cover at national level); 1m canopy height maps; 30m aboveground biomass/carbon maps with uncertainty; and 90m ecosystem modeling based maps of future carbon sequestration potential, gap to carbon sequestration potential, and timescale to achieve carbon sequestration potential.

The USDA Forest Service is interested in the operational use of high-resolution carbon maps for monitoring purposes. Their interests include: identifying baseline carbon density at point locations using modeled carbon estimates; developing training data of carbon versus temporal profile indices; and developing machine learning models to estimate carbon loss at points based on temporal profile perturbations. Andrew Lister from the USDA Forest Service Northern Research Station indicated that CMS maps can help fill in holes where there are no plots, improve estimates for smaller geographic areas, and provide high quality information for other resource management tasks.

Elliott Campbell (Maryland Department of Natural Resources) presented an overview of how DNR has successfully implemented CMS data products into their workflow through close collaboration with the CMS team. CMS data are being used to inform the state’s Greenhouse Gas Reduction Act, which mandates the development of a plan to reduce statewide emissions by 40% by 2030 and includes the land/forestry sector.

Finally, Shannon Kennedy from the University of Maryland gave an overview of the upcoming Regional Workshop on Integrating Technical Assistance with Policy Action: A focus on state-based carbon monitoring systems. The two-day workshop is expected to result in actionable solutions and a path forward to integrate high-resolution carbon monitoring and modeling into state-level climate mitigation activities and capacity-building policies. The workshop has been postponed to Spring 2021.

IV. Joint Quarterly Presentations: Discussion of Climate Action Plans, Current Carbon Monitoring Strategy, and Carbon Monitoring Needs and Interests from NH and ME

A. “NH 2019 Climate Action Plan & Forestry Model”

Chris Skoglund, Climate & Energy Program Manager at the New Hampshire Department of Environmental Services gave an overview of the state’s climate strategy and the role of forests in their climate action plans. A Climate Policy Task Force was established through Executive Order 2007-3 in December 2007, which established the quantified greenhouse gas emission reduction goals for the state at 20% below 1990 levels by 2025, and at 80% below 1990 levels by 2050. One of the essential strategies to achieve those goals is to protect the natural resources of the state to maintain the amount of carbon sequestered.

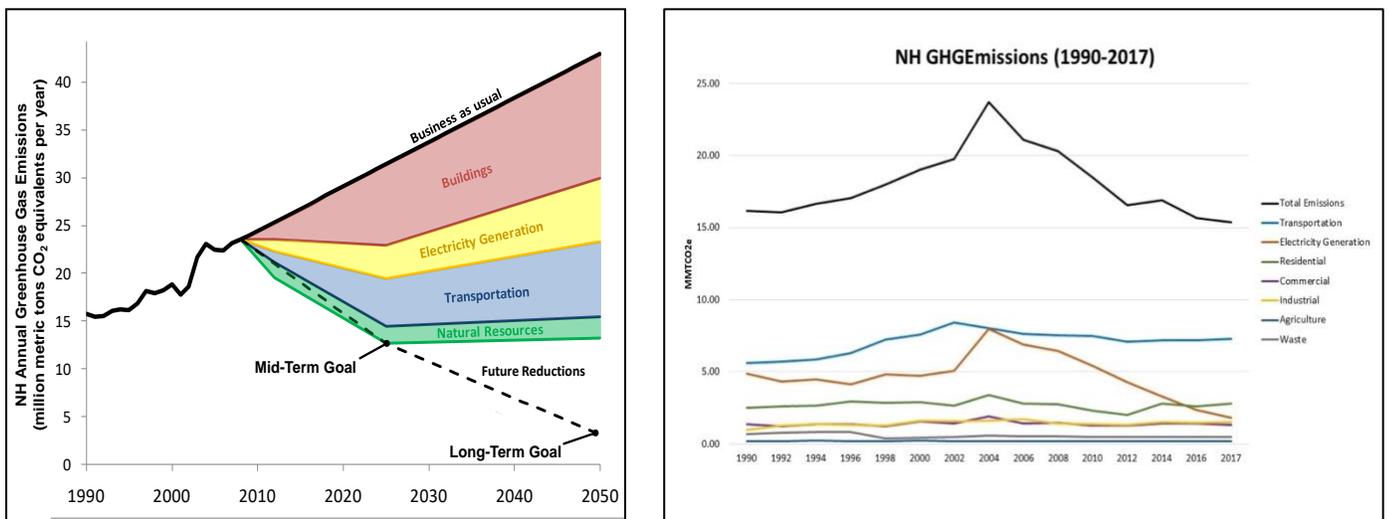


Figure 1: New Hampshire Emission Reductions – Proposed vs. Actual (Source: Chris Skoglund, NH DES)

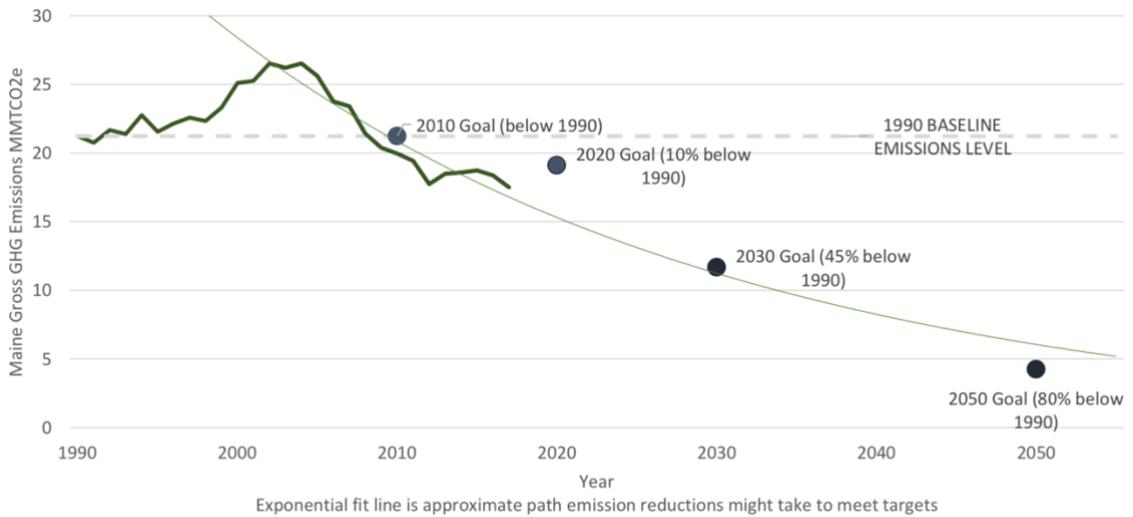
According to their data as seen in Figure 1, the Greenhouse Gas Emissions on the state have fallen below baselines in the transition to natural gas, however, other energy use has remained consistent. In their emission reduction modeling for economic benefits and avoided emission reductions, the integrated forestry and wood use plan was easy to implement without enormous up-front costs, and the natural resources gain was an additional benefit.

Regarding New Hampshire forest carbon monitoring and modeling, Chris Skoglund made reference to a NH Forest and Wood Use Carbon Model from 2009, of which CMS Science Team Lead and PI for this project, George Hurtt, is a co-author. This model hasn’t been updated since 2009. There is interest from the state in reducing forested land conversion rates, using wood for energy, and in maintaining an economically and ecologically sustainable working forest, amongst other actions.

There is a particular interest of the state on sustainably managed forests because they provide a broad range of ecosystem services to New Hampshire, which include: carbon sequestration and storage; biomass for a variety of forest products; ecological functions; and various recreational opportunities. The state would like to develop mechanisms to fully value forest ecosystem services and to compensate landowners for the maintenance of those services as well as develop alternative and stable funding mechanisms to support the protection of working forests.

B. “Climate Planning in Maine and Opportunities in Our Natural and Working Lands”

Nathan Robbins, Climate Change Specialist at the Climate and Adaptation Program of the Commissioner’s Office of Maine Department of Environmental Protection gave an overview of the state’s climate strategy and the role of forests in their climate action plans. The Maine Climate Council asked for a new Climate Action Plan in 2019 to mitigate, prepare, and adapt to climate change. The Maine DEP is tasked with reporting on gross and net in future biennial GHG reports. The main goal of the state of Maine now is to achieve state carbon neutrality by 2045.



Maine Gross GHG emissions 1990-2017 (MMTCO₂e)

Figure 2: Maine Gross GHG emissions 1990-2017 (MMTCO₂e) (Source: Maine DEP 8th Biennial Report on Progress Toward GHG Reduction Goals 1/2020; from Nathan Robbins, ME DEP)

Forests in Maine cover 83% of the state’s surface area. They annually sequester more than 60% of the state’s emissions. According to the simplified carbon budget of Maine, the state’s land-base currently stores more than 2 billion tons of carbon, primarily (~75%) in forest soils. The aboveground biomass is 60% of grown emissions, however, if longer lived forest products were gross emissions would be closer to 75%. Nathan provided the following information as priority data needs of the state:

- Improved monitoring of key indicators
- Greater integration of remote sensing technologies
- Complete a full environmental cycle analysis for forest and forestry products
- Evaluate alternative suite of forest management strategies at a landscape-level
- Integrated modelling (e.g. degree that soils can be included)
- Atmospheric Chemistry for full accounting of CO₂, CH₄, N₂O and other GHGs (e.g. from Maine's forests, shrublands, wetlands, estuaries, etc.)

V. Discussion & Next Steps

The CMS team is planning the postponed regional workshop for Spring 2021. The team is also continuing to develop a multi-state forest carbon science/policy table. A draft version of this table is appended to this report. Currently, the team is drafting a peer-reviewed paper on the input and data presented by the 11 RGGI+ states during Multi-State Working Group telecons. This paper will be discussed further during upcoming telecons in 2020.

VI. Appendix

Multi-State Forest Carbon Science/Policy Table

The intent of this table is to provide an overview of each state's policy framework, climate mitigation goal, science (land), and science needs (land). This draft table is being developed in partnership between CMS scientists and state representatives/stakeholders and will be continually updated as the CMS team learns more information about each state.

State Name	Climate Mitigation Policy Framework	Emission Reduction Goals	Current Source of Forest Carbon Science	Stated Needs for Forest Carbon Science
Maryland	Greenhouse Gas Emissions Reduction Act (2009, updated 2016)	40% below 2006 levels by 2030	NASA-CMS Products NASA-USDA-DOE Study MDNR RAS Field Study MD Forest Service EPA SIT WRI-USCA Analysis	Annual carbon flux monitoring
Pennsylvania	Pennsylvania Climate Change Act (2008) Executive Order 1 (2019)	26% below 2005 levels by 2025, 80% below 2005 levels by 2050	USFS Technical Reports State Continuous Forest Field Inventory None noted in Climate Plan	Carbon sequestration potential; canopy change for monitoring; LiDAR applications

Delaware	Executive Order 41 (2013)	30% below 2008 levels by 2030	USFS FIA Data DE Forest Service Analysis	Annual carbon flux monitoring
New York	Executive Order 24 (2009) Climate Leadership and Community Protection Act (2019)	40% below 1990 levels by 2030, 85% below 1990 levels by 2050, and net zero emissions by 2050 or as soon as practicable	USFS Technical Report USFS FIA Data	High-resolution estimates of forest carbon; biogenic emissions
Vermont	Vermont Statue, 30 V.S.A. § 578 (2005) Under2MOU (2015)	50% below 1990 levels by 2028, 80 to 95% below 1990 levels by 2050	USFS FIA Data	Annual flux monitoring, high resolution/higher confidence forest carbon sequestration estimates
Massachusetts	The Global Warming Solutions Act (2008)	25% below 1990 levels by 2020, 80% below 1990 levels by 2050, and net zero emissions by 2050	Harvard Forest Field Studies MassGIS Analysis State Continuous Forest Inventory USFS FIA Data, USFS Reports Literature Values	Enhanced LiDAR capabilities to improve estimates of urban tree/forest carbon
Connecticut	CT Global Warming Solutions Act (2008) Executive Order 46 (2015) An Act Concerning Climate Change Planning and Resiliency (2018) Executive Order 3 (2019)	10% below 1990 levels by 2020 45% below 2001 levels by 2030, 80% below 2001 levels by 2050	Literature Values	More reliable LULUCF data

Rhode Island	Resilient Rhode Island Act (2014)	10% below 1990 levels by 2020, 45% below 1990 levels by 2035, 80% below 1990 levels by 2050	USFS Forest Carbon Budget model Grey Literature Values	More reliable land carbon data, fully understand mitigation potential of urban forests
New Jersey	Global Warming Response Act (2007, updated 2019) Clean Energy Act (2018) Executive Order 89 (2019) Executive Order 100 (2020)	At or below 1990 levels by 2020, 80% below 2006 levels by 2050	EPA SIT NCASI Carbon Online Tool USFS FIA Data Default IPCC Estimates	Improved estimates of land carbon flux, soil carbon data, and improved monitoring, measurement and verification methods
New Hampshire	Executive Order 3 (2007)	20% below 1990 levels by 2025, 80% below 1990 levels by 2050	EPA SIT USFS FIA Data Hubbard Brook and Bartlett Forest Field Studies Integrated forest model	Improved valuation of forest ecosystem services, inclusive of forest carbon estimates
Maine	Act to Provide Leadership in Addressing the Threat of Climate Change (2003) Executive Order 10 (2019)	10% below 1990 levels by 2020 45% below 1990 levels by 2030, 80% below 1990 levels by 2050, and carbon neutrality by 2045	USFS FIA Data USFS ForGATE Tool	Integration of remote sensing, improved forest monitoring, and integrated modeling