The State of the Northeastern Forest Carbon Cycle: High-Resolution Carbon Accounting for the Regional Forest Sector

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Project abstract

Ten Northeast and Mid-Atlantic states have joined in the Regional Greenhouse Gas Initiative to develop strategies and policies for reducing greenhouse gas emissions and mitigating their carbon impacts. These include New York, Vermont, New Hampshire, and Maine. NSRC researchers will develop and report a spatially and temporally explicit carbon budget for the forest sector of the northeastern states that is comprehensive of the major components.

Researchers will build on current inventory-based carbon estimation methods by integrating state-of-the-art remote sensing data and techniques for wall-to-wall mapping of forest biomass dynamics at high spatial and temporal resolution. This approach improves estimation accuracy and precision for all of the major carbon pools and transfers in the forest-sector carbon budget of the northeastern states, including soil storage, aquatic export, harvest removals, and the fate of wood products. Finally, they will reconcile and translate the scientific budget with the key policy questions including the current and potential forest-sector carbon offsets to regional- and state-level fossil fuel emissions. The overall result will be a comprehensive estimate of the average annual net forest carbon sink, which will be compared to state-level emissions data to calculate the offset provided by forest carbon uptake.

Progress in 2021

The two goals for this project are to (1) develop a carbon accounting framework for the NSRC forest sector, and (2) disseminate this as policy-relevant information that meets the GHG emissions reporting requirements of stakeholders. Important progress has been made in project year 1 with respect to laying the groundwork for each of these components.

We are developing a “bookkeeping” approach for the regional carbon accounting based on remote sensing to estimate initial forest carbon and track changes. The initial (2018) forest biomass has been mapped at 30m resolution over the full domain using models of LiDAR and Landsat time-series metrics. Landsat-based change detection has been used to map forest disturbance across the full domain from 1985-2018, and we are near to completing the update to 2020.

Over the past year, we have worked closely with project collaborator Stacy Knapp (Maine Department of Environmental Protection) to design a stakeholder GHG emissions reporting system that draws from a policy-translation of our scientific-based forest carbon budget accounting. While we work on the “version 2” high-resolution carbon accounting framework for this project, Maine DEP will use our “first-order” estimates from the initial version of the state budget for their 2022 GHG emissions reporting requirements. Based on this collaboration, Ms. Knapp is also serving as a stakeholder participant with the NASA Carbon Monitoring System science team.

Problems or changes

Although the simple bookkeeping method has the advantage of being a straightforward and well-developed approach to regional carbon accounting, there are a number of issues that can (and do) arise in the details. We have been working through many of these in the first project year, including addressing data gaps, scale mismatches, and accounting decisions. A new aspect that we added early on is to develop and verify the mechanics of the accounting framework and associated remote sensing data processing at a “test site”. We are currently working on the end-to-end development of our workflow as applied to the

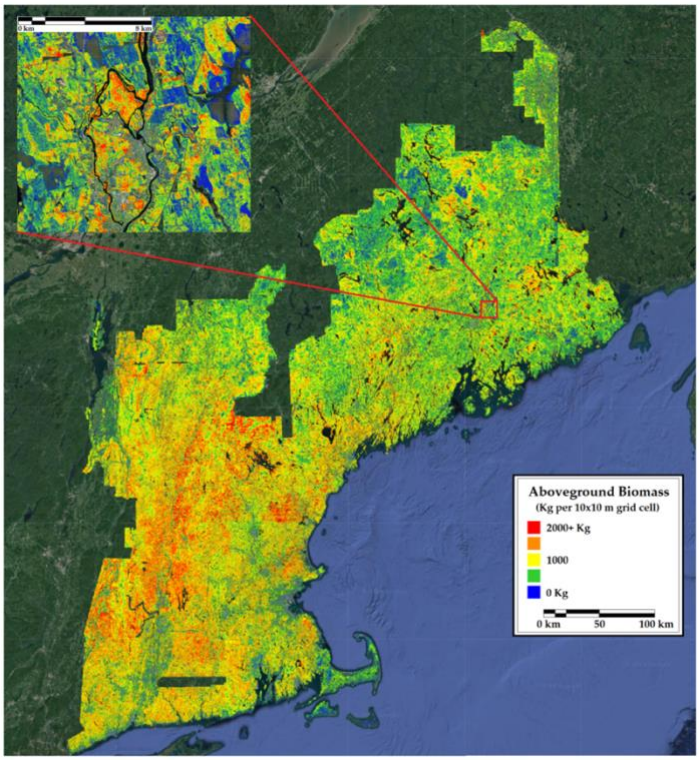
forest properties owned by the University of Maine. Here, we have partnered with the UMaine's Office of Sustainability to report the University Forest Carbon within the campus carbon footprint and climate mitigation assessments.

Collaboration with Forest Service

We hold quarterly meetings with our USFS collaborator, Chris Woodall, to discuss project progress specifically and to discuss more generally the alignment of our work with broader goals of the USFS in carbon management and climate mitigation initiatives. In turn, Dr. Woodall is providing guidance on federal priorities for managed lands GHG reporting, particularly where our project can contribute to methodological testing and advancement with respect to incorporating state-of-the-art remote sensing tools within forest carbon accounting models. We plan to continue these meetings through project year 2 and beyond.

Plans for 2022

With the foundation built for each, we plan to make progress on the quantification of the contemporary carbon budgets at the University Forest test site and the larger NSRC region as a whole. We will use the Landsat-based methods to update the forest carbon estimates to year 2020 at 30m resolution across the full NSRC domain. By the end of the year, we will have updated the Landsat change-detection to incorporate disturbances and report the associated carbon fluxes for the 2020 to 2022 time period. In parallel to monitoring forest carbon changes with the remote sensing component, we will build the model "plug-in" that will account for the fate and eventual emissions of the harvested wood products. We will continue to work closely with Maine DEP to co-develop the emissions accounting framework, and the forest and products carbon budget for 2020-22 will be included in the 2023 state GHG emissions report.



A 10 m resolution forest inventory map of aboveground biomass in New England with a 12 km inset of a representative portion of the region. Figure from Ayrey et al. 2021 Remote Sensing.