

# Beyond Biomass to Carbon Fluxes: Application and Evaluation of A Comprehensive Forest Carbon Monitoring System



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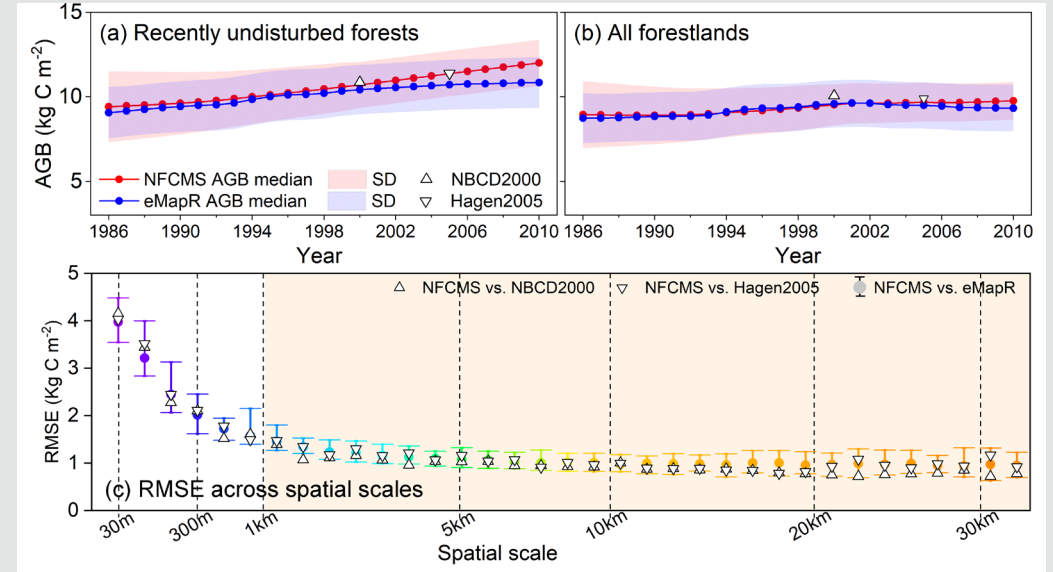
**Background:** We developed a National Forest Carbon Monitoring System (NFCMS) framework to estimate forest carbon stocks and fluxes by combining information from satellite data on forest biomass and disturbance, field data from the FIA program, and a carbon cycle model.

**Analysis:** This paper evaluates the framework's forest AGB with comparison to other data products. It also demonstrates the framework's application for carbon balance assessments.

**Results:**

- Biomass estimates agree well with evaluation datasets, especially at > 1 km<sup>2</sup> spatial scales despite their substantial differences in methodologies.
- Pacific Northwest (PNW) forests acted as a stable net sink for atmospheric CO<sub>2</sub> (18.5 Tg C yr<sup>-1</sup>) within forestlands.
- However, regional carbon balance is significantly perturbed by harvesting removals, which equal 75% of annual NEP, and also by CO<sub>2</sub> emission from severe fires.

**Significance:** This study demonstrates the potential of the NFCMS framework to serve as a candidate monitoring, reporting and verification (MRV) system to capture the highly dynamic nature of the forest carbon fluxes within local patches and their contribution to regional-scale carbon emissions and removals in exchange with the atmosphere.



AGB estimates from NFCMS and evaluation datasets for (a) recently undisturbed forests and for (b) all forestlands in the PNW region, and (c) their RMSEs across spatial scales

Annual net ecosystem productivity (NEP), harvest removals and emissions, fire emissions, net biome productivity (NBP), net atmosphere in the PNW forests.

