ABSTRACT

California has a pressing need to measure and manage forest carbon. Fusion of satellite-based data with plot-level information provides a promising means to measure forest biomass at relevant spatial and temporal scales. Key questions remain regarding accuracy and feasibility. Over a century of fire suppression complicates managing forest carbon in California's dry forests. Live tree biomass is at risk of loss due to wildfire. Here, we evaluated the performance of an emerging technology using Landsat imagery, forest inventory data, and gradient nearest neighbor imputation (referred to as LT-GNN) to measure annual aboveground live tree biomass (AGB) across multiple spatial scales. We also developed a means to quantify the trade-off between biomass storage and stability for fire-prone forests. We relied on two independent estimates of AGB to evaluate LT-GNN results: local assessments calculated from field-data and airborne light detection, and county estimates calculated from Forest Inventory and Assessment plot results. We also used repeated measurements conducted in Forest Inventory and Analysis plots to quantify the ability of LT-GNN to detect trends in AGB. Finally, we extended a field experiment at Blodgett Forest Research Station in Georgetown, California to gain insights into biomass dynamics of fire-prone forests. LT-GNN is a promising method to monitor live tree biomass. Its success at interpolating county-level tree biomass suggests an application-ready means to track annual biomass at a policy-relevant scale. However, improvements are needed to track change under stable conditions. At finer scales applications must be pursued with more caution. In particular, LTGNN did not accurately predict AGB in an old-growth redwood forest. At Blodgett, we quantified the trade-off between biomass storage and stability. Fuel treatments did lower the overall biomass stored, but more biomass survived fire compared to the untreated forest. However, trade-off between biomass storage and stability critically depends on the probability of fire occurring in these stands.

HIGHLIGHTS

• The LandTrendr-Gradient Nearest Neighbor system is a promising means to monitor live tree biomass in California’s forest.
• The success of this approach at interpolating county-level tree biomass suggests an application-ready means to track annual biomass at a policy-relevant scale.

• However, improvements need to be made in LT-GNN’s ability to track change under stable conditions and to capture AGB in high-biomass forests.

• We presented a framework for evaluating the trade-off between biomass storage and stability in fire-prone forest and applied it to a well-studied Sierran mixed conifer forest.

• Fuel treatments lowered the overall biomass stored but more of this biomass survived a fire compared to the untreated forest.

• We proposed the term "stable aboveground biomass" to describe the fraction of live tree biomass on a site that is capable of surviving a problem wildfire.

ACCESS
For access to the full report, please email Susan.wilhelm@energy.ca.gov

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