Functional Forests

The Role of California Forests in Achieving Statewide Carbon Neutrality

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BACKGROUND

In 2018, Governor Jerry Brown issued Executive Order B-55-18, pledging California to achieve statewide carbon neutrality by 2045. To achieve this ambitious goal, the State needs to both reduce emissions and remove carbon dioxide (CO_2) from the atmosphere.

California's forests play an important role in carbon storage in the State. However, increasing drought severity and intensity of wildfires threatens the effectiveness of the State's forests as a carbon sink. To ensure that California's forests continue to help offset the state's carbon emissions, State policymakers and land managers will need to prioritize carbon storage in forest management and in climate policy (Liang et al., 2018).

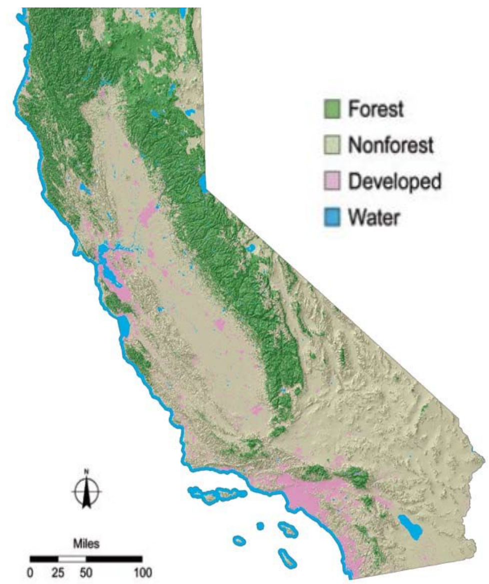


Figure 1. Land type across California.
(USDA, 2020)

OBJECTIVES

1. Identify forest management practices that cost-effectively store carbon.
2. Identify policies to incentivize these forest management practices and support carbon neutrality.

TOOL FOR POLICYMAKERS: MCCs

- We created marginal cost curves (MCCs) for forest management across forest land in California
- These MCCs estimate the **costs** and **carbon consequences** of managing California's forests
- MCCs inform policymakers **which forest management practices to promote** to meet carbon neutrality & provide a **mode of comparison** to other carbon abatement strategies

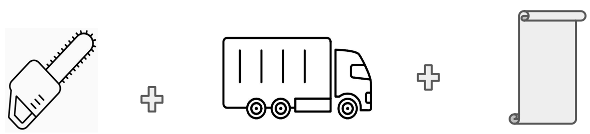
APPROACH

Four Steps to Creating a Marginal Cost Curve

To create our MCC, we used the U.S. Forest Service Biosum model, which simulates the effects of management practices on the the growth of forest land over time. For our project, we estimated the costs of applying 31 different treatments to over 2,000, 5,000 acre plots across California. We then applied a 5% discount rate to determine the present value of costs and carbon implications of each treatment over 30 years.

I Determine Costs

Total cost of each treatment for a given forest plot is the sum of:



Harvesting + **Transportation** + **Permitting**

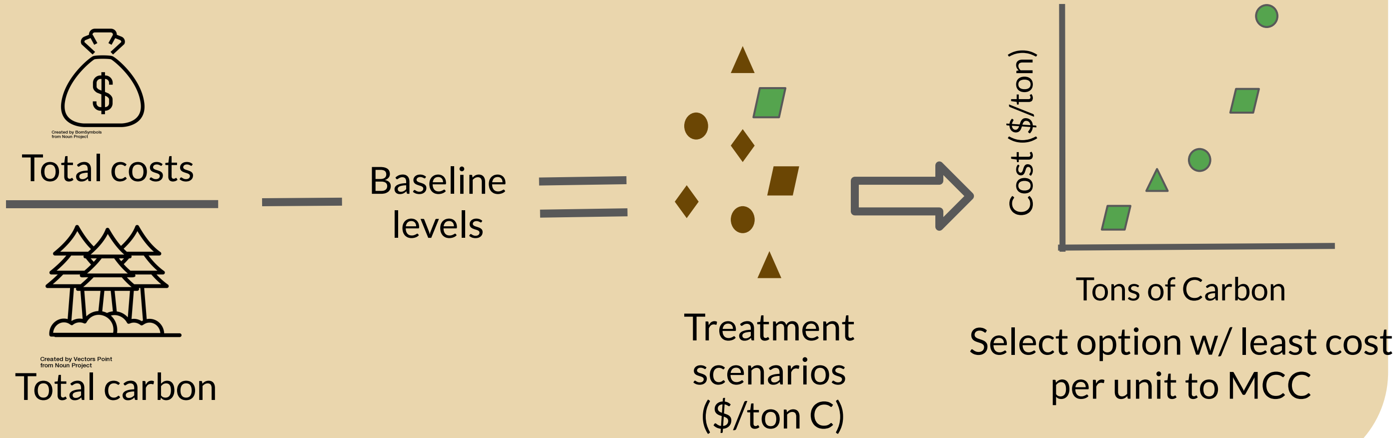
II Model Data

The 31 treatments were applied to each plot to determine its total cost and carbon implication

2,289 plots	31 treatments	>60,000 scenarios
Species Size Health	Grow-only Clear cut Thinning	Total cost Total carbon

MCC Workflow:

Process to Select a Management Strategy for a Single Plot



III Calculate Relative Carbon

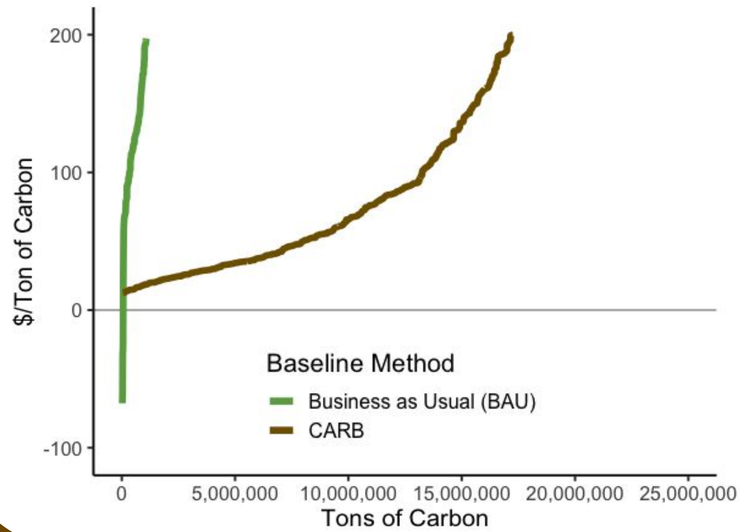
We subtracted a baseline reference point representative of current management from each modeled result. We used two baselines:
(1) Business as Usual (BAU) baseline
(2) Assumed Management baseline based on the California Air Resources Board (CARB) method of granting forest carbon offsets.

IV Select Best Treatments

We selected the treatment for each plot that yielded the **lowest per-unit carbon costs** for our MCC. If no treatments for a plot yielded an increase in carbon relative to the baseline, that plot was not selected. We then **arranged the treatments in order of their cost ($/ton)** to generate the MCC.

MAIN FINDINGS

Baseline matters. Scenarios relative to a CARB baseline stored more carbon at a lower cost than scenarios relative to a BAU baseline.

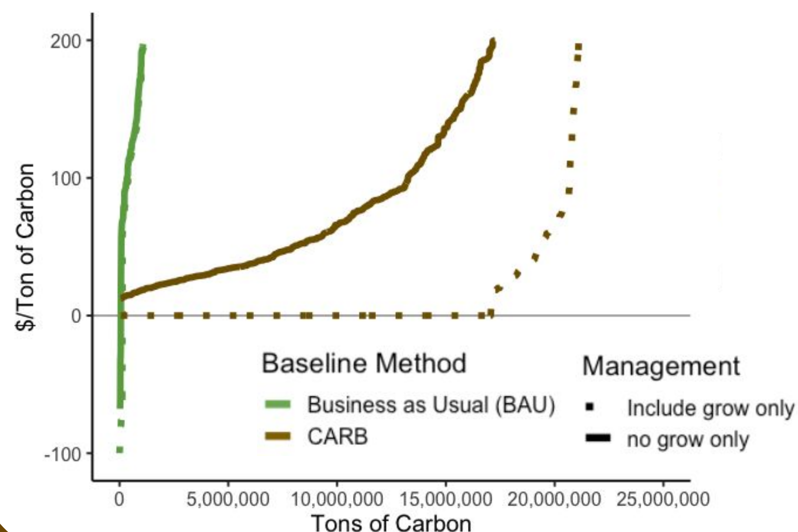


At the current forest offset price ($15/ton of carbon), CA forests can store:

Relative to BAU Baseline
0.06 million tons C

Relative to CARB Baseline
0.42 million tons C

Grow-only management stores the most carbon. Grow-only imposes the least management costs to store the most carbon



If grow-only is included as a treatment option, the State could store 4.5 million more tons of carbon relative to the CARB baseline at a much lower cost

Forest management may be a costly abatement strategy

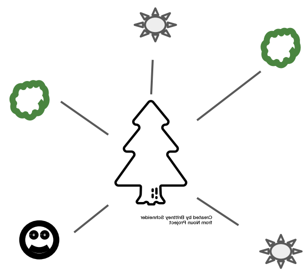
- *Additional* carbon storage through forest management contributes a relatively small amount given a statewide goal to store 15.5 million tons of carbon through forest management per year by 2045.

Management assumptions are important

- The baseline amount of forest carbon that the State chooses is critical to evaluate how much *additional* carbon a treatment could store.

POLICY IMPLICATIONS

We evaluated the State forest carbon offset program and federal conservation incentive programs for their ability to motivate cost-effective forest management for increased carbon storage.



Forest policy should be motivated by co-benefits in addition to carbon sequestration

Co-benefits approach could be modeled on existing federal incentive-based policies

State should consider a statewide forest carbon inventory instead of project-level accounting

RECOMMENDATIONS

1. Incorporate the co-benefits of forest management into climate policy-- managing forests for carbon & other ecosystem services may make it more economically viable.
2. Utilize a statewide forest carbon inventory to measure the increase in carbon storage from forest management projects
3. Compare the MCCs of other industries to the MCC of forest management to design cost-effective climate policy.

LIMITATIONS

Inclusion of Avoided Fire Emissions: Did not include avoided wildfire emissions, which could increase carbon storage.

Relatively Short Time Frame: Do not account for carbon storage that occurs after 32 years.

Incomplete Wood Products Carbon LCA: Carbon substitution benefits from burned bioenergy are not included.

ACKNOWLEDGMENTS

We would like to thank our faculty advisor, Andrew Plantinga; our PhD advisor, Alice Lépissier; and our clients, Daniel Sanchez at the Joint Institute of Wood Products Innovation and Teal Zimring at Galvanize Partners. The team would also like to express gratitude to Jeremy Fried at USFS Pacific Southwest; Bodie Cabiyo at UC Berkeley Energy and Research Group; and William Stewart at UC Cooperative Extension.

REFERENCES

Brown, Edmund G Jr, 2018. Executive Order B-55-18 to Achieve Carbon Neutrality.

Liang, S., Hurteau, M.D., Westerling, A.L., 2018. Large-scale restoration increases carbon stability under projected climate and wildfire regimes. Front. Ecol. Environ. 16, 207–212. https://doi.org/10.1002/fee.1791

The Noun Project, 2020. Darren Barone, Bohdan Burmich, Baboon designs, Deemak Daksina, Justin Blake, Brittney Schneider

California. (n.d.). USFS. Retrieved April 20, 2020, from https://www.fs.fed.us/pnw/rma/fia-topics/state-stats/California/index.php USDA.com

California Department of Forestry. (n.d.). Forest Health Grants. Retrieved April 20, 2020, from https://www.fire.ca.gov/grants/forest-health-grants/