

Innovative wood products for carbon-beneficial forest management in California



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Yale Seminar on Bioenergy from Forests

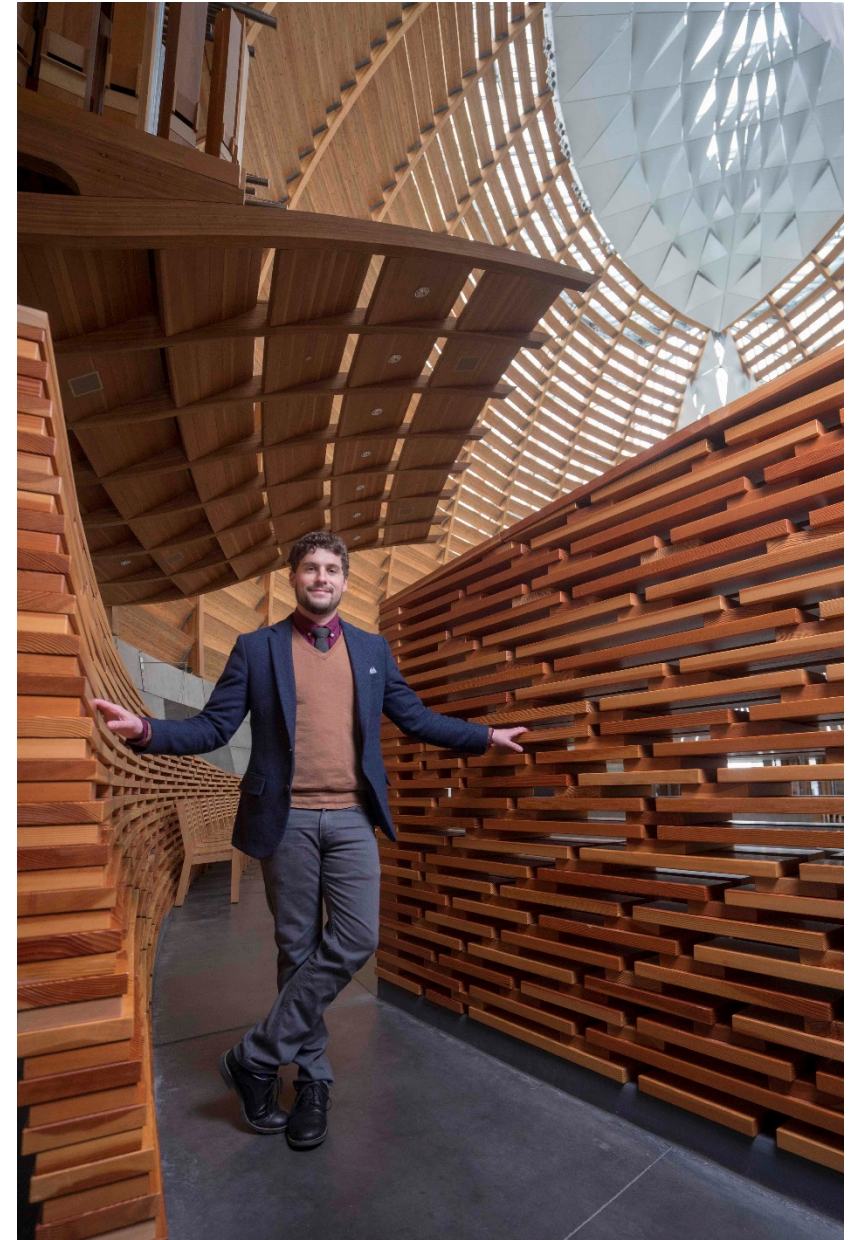
March 29, 2022

About Me

Assistant Professor of Cooperative Extension
University of California, Berkeley

Academic research focuses on engineered biomass & bioenergy systems that remove CO₂ from the atmosphere

Outreach and extension focuses on assisting technology developers and policymakers to develop new biomass markets in California



The Problem

“Climate change has created a new reality in the State of California. It’s not a question of ‘if’ wildfire will strike, but ‘when.’ Our recent, terrifying history bears that out”

Gov. Gavin
Newsom, 2019

Climate change

- How does California reduce current climate change impacts, or ***adapt*** to climate change?
- How does California reduce future emissions, or ***mitigate*** climate change?

A Solution?

Innovative wood products



Electricity



Building materials



Mass timber

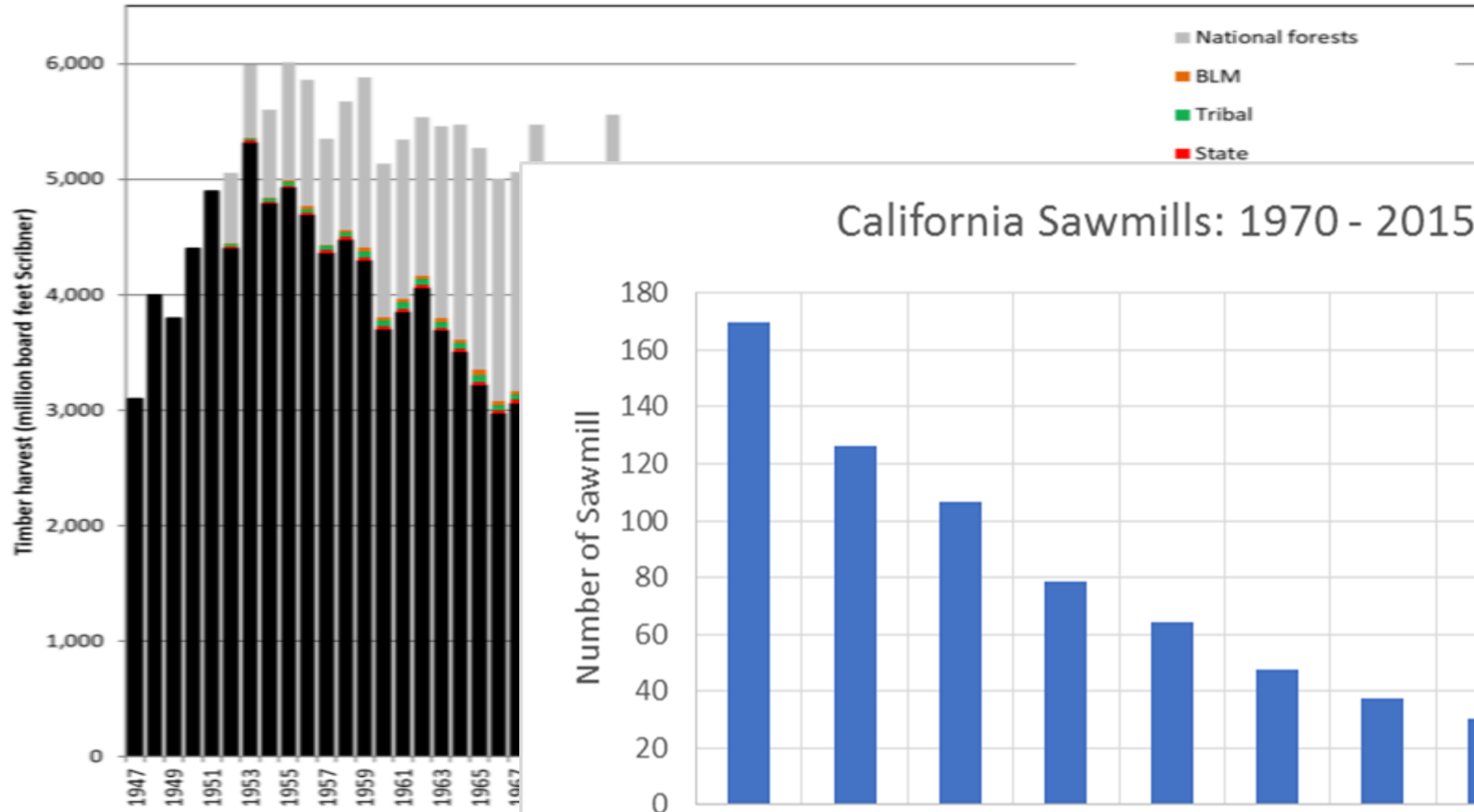


Transportation fuels

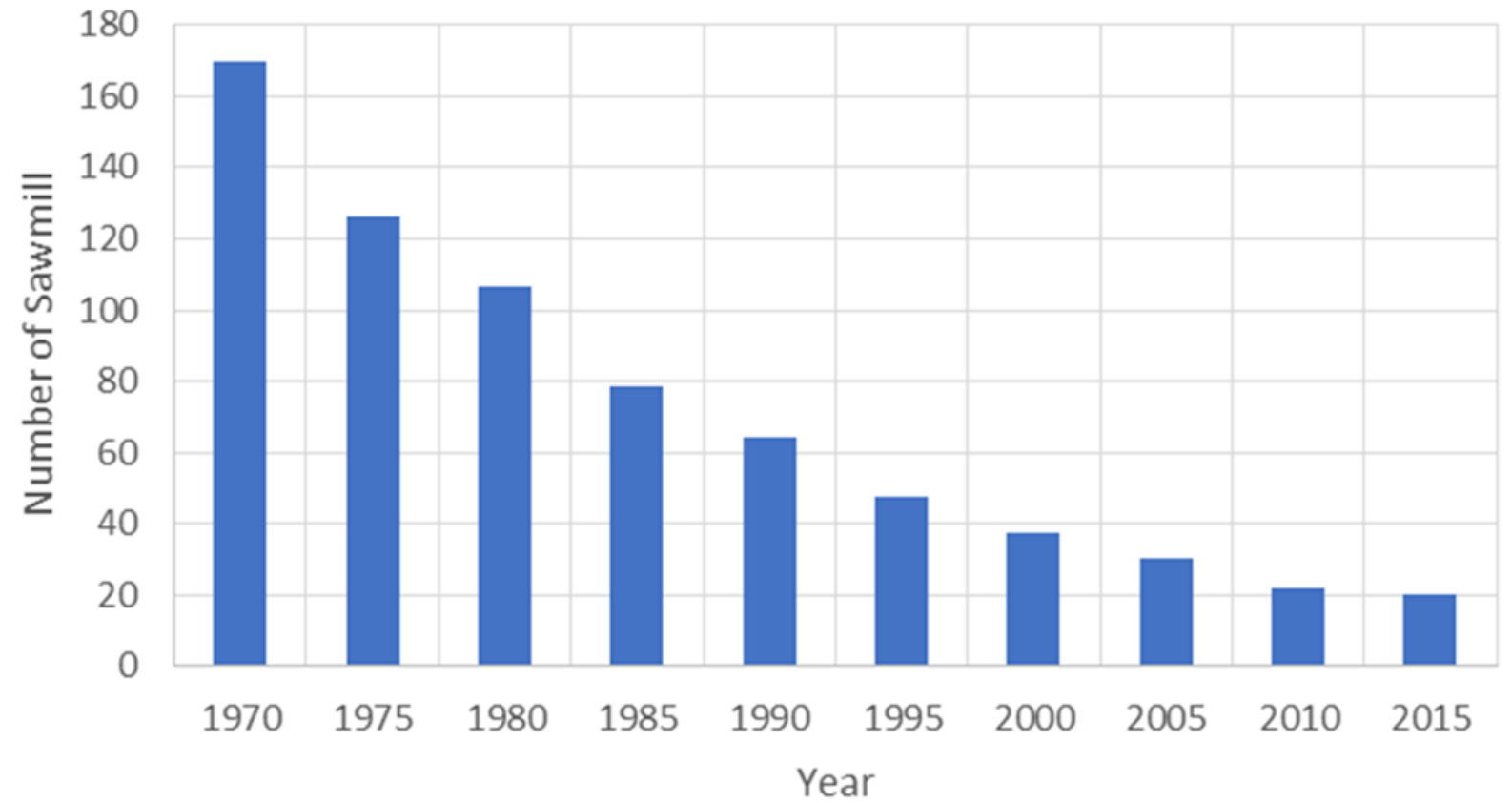


Forest restoration requires use of prescribed fire or mechanical vegetation removal (thinning)

- Thinned trees are piled and burned or left to decay
- Merchantable trees are used to produce **houses, furniture, and paper**



California Sawmills: 1970 - 2015



Joint Institute for Wood Products Innovation

2020 Review of Wood Products

There are *numerous innovative products* with sufficient commercial and technical readiness, and potential market size, to justify increased public and private investments in their development

The most promising classes of innovative wood products identified by the Institute at this time include:

- **Mass timber**
- **Liquid and gaseous transportation fuels**



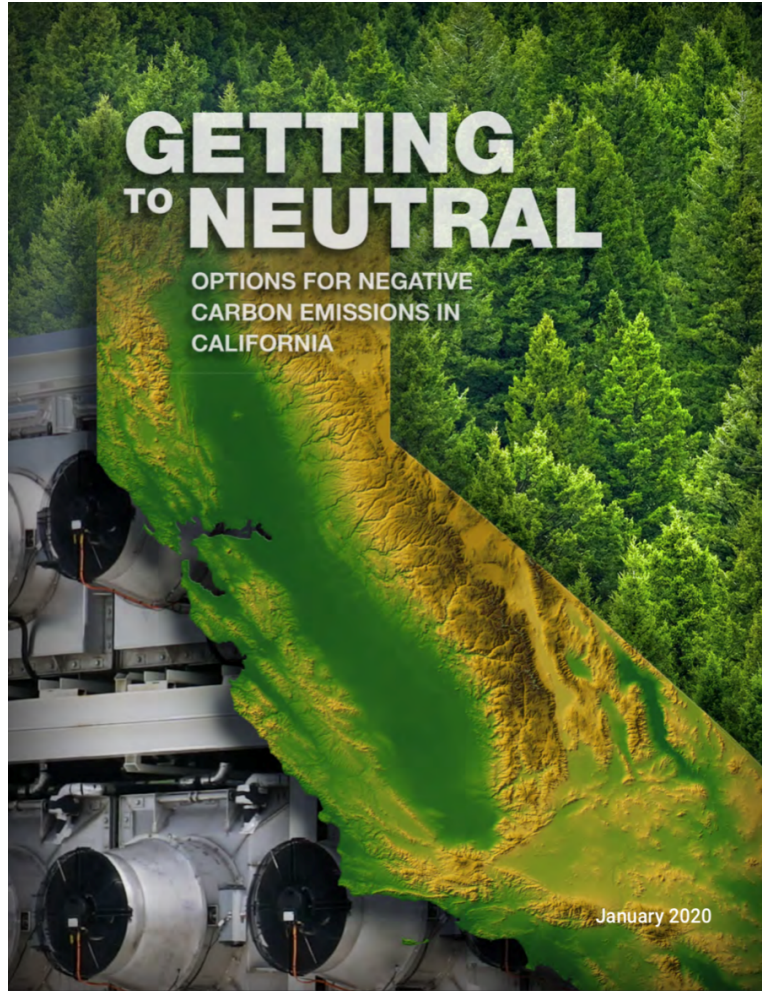
Getting to Neutral? 2045 Carbon Neutrality



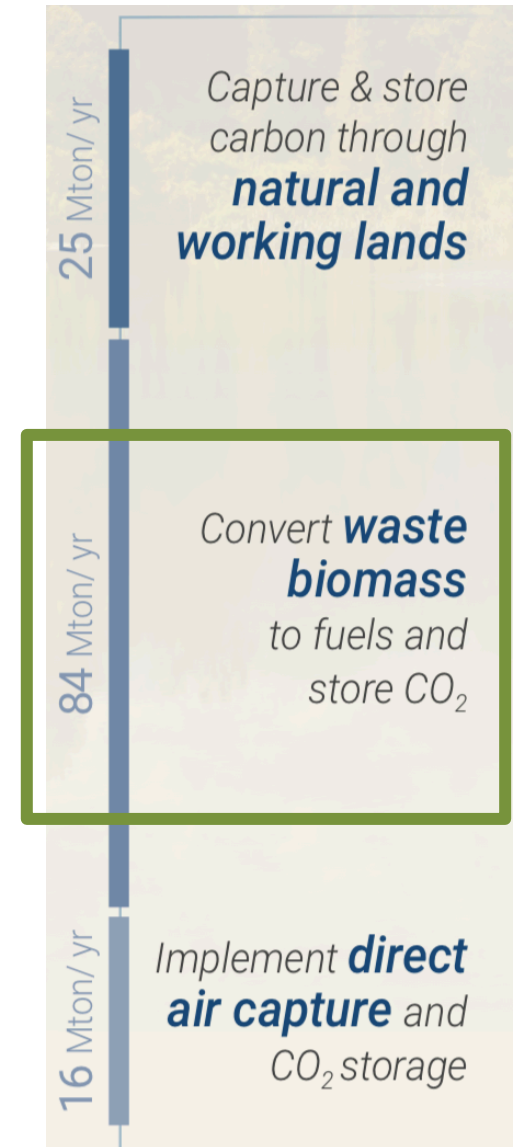
Figure ES-1. Goals of California's emissions plan extrapolated to 2045 (CARB, 2017) with negative emissions estimates from this report.

Getting to Neutral

(Lawrence Livermore National Laboratory, 2020)



Three pillars to reach
125 million tons of
negative emissions



Agreement for Shared Stewardship of California's Forests and Rangelands

(between State of CA & U.S. Forest Service Pacific Southwest Region, 2020)

ACTIONS:

The Parties commit to the following actions to advance shared stewardship opportunities:

1. **Treat One Million Acres per Year:** The Parties will scale up vegetation treatment to one million acres of forest and wildlands annually by 2025, committing to each sustainably treat 500,000 acres per year.

PURPOSE:

This MOU establishes a joint framework to enhance science-based forest and rangeland stewardship in California. The U.S. Forest Service and the State of California commit to maintain and restore healthy forests and rangelands that reduce public safety risks, protect natural and built infrastructure, and enhance ecological habitat and biological diversity. The Parties agree to develop shared tools, coordinated processes, and innovative approaches to increase the pace, scale, and effectiveness of forest and rangeland stewardship in California.

Can innovative wood products help California align its climate change mitigation and adaptation goals?

What **new wood products** can **attract higher prices**, and what California policies can drive their deployment?



What are the **ultimate carbon impacts** of expanded management and new markets?



What impact would new markets have on **forest management** and **fire risk** across the State?



Electricity +/- CCS



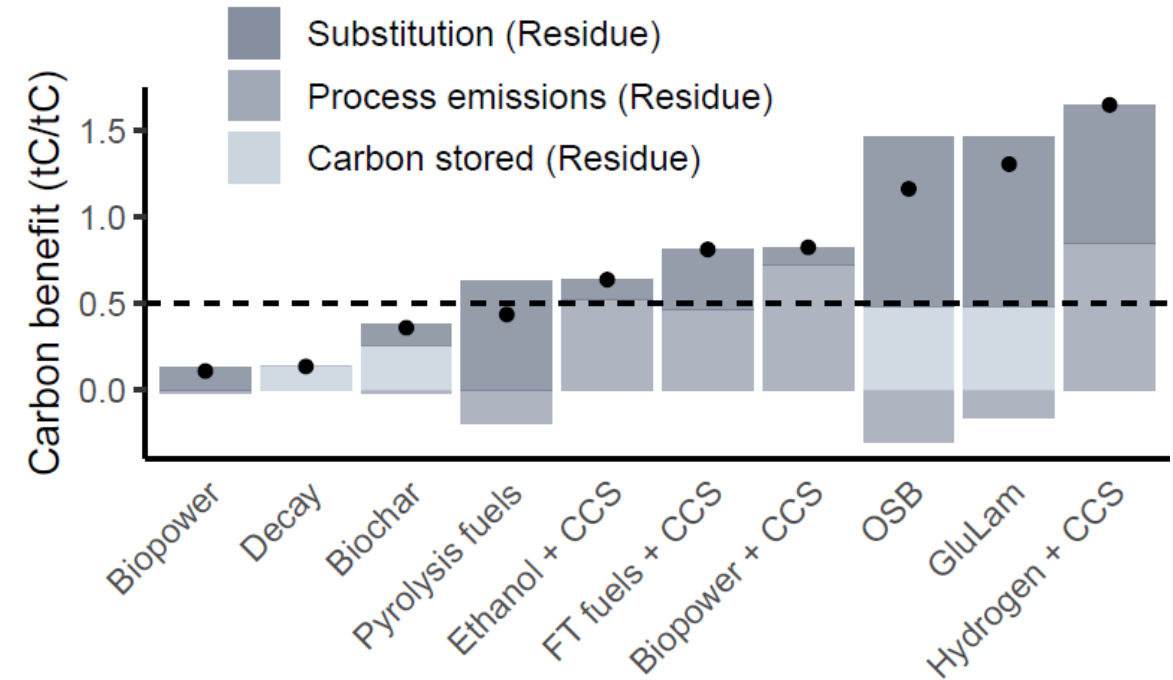
Oriented Strand Board



Ethanol + CCS

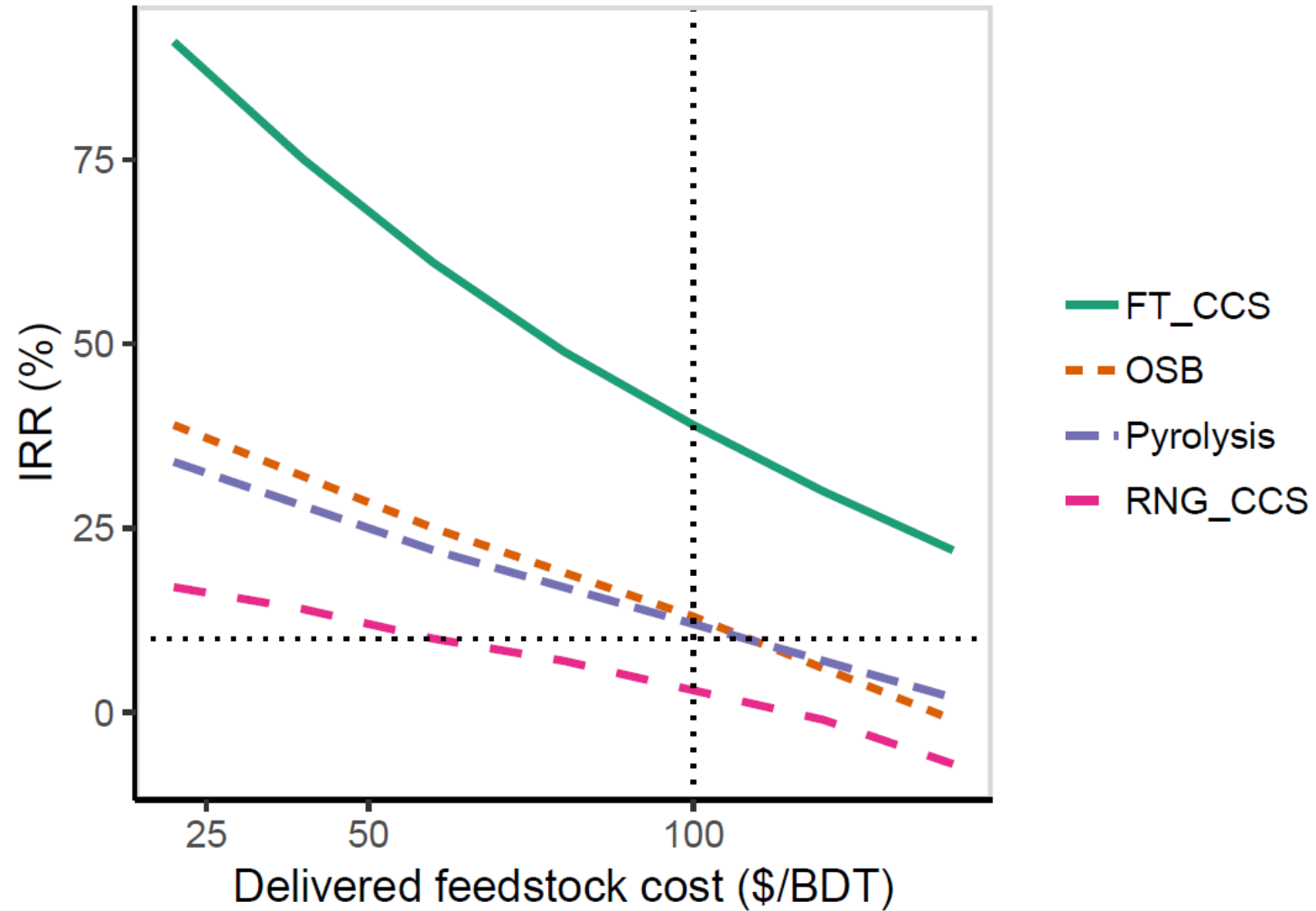


F-T Fuels + CCS

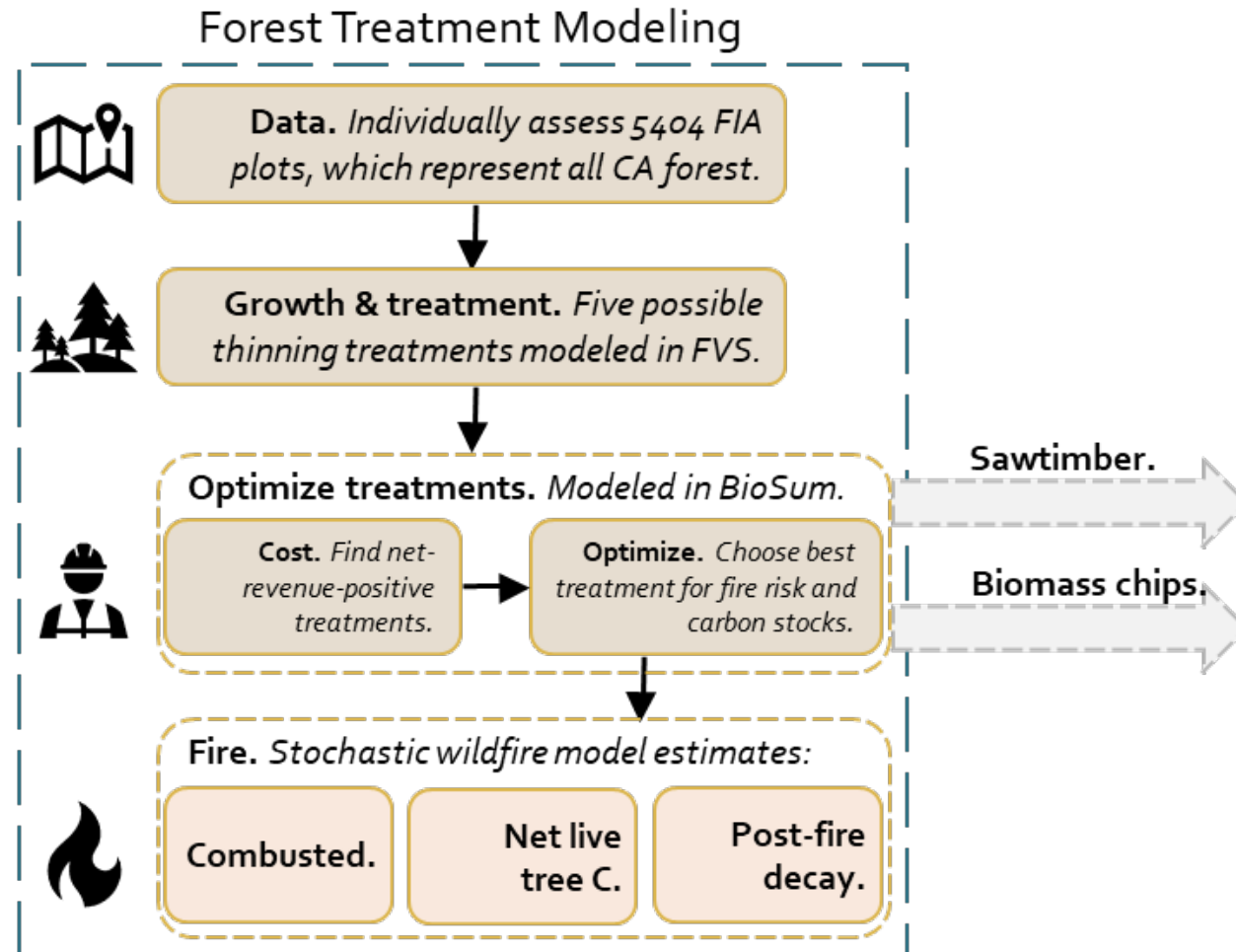


Cabiyo et al. (2021)

Economics of innovative wood products

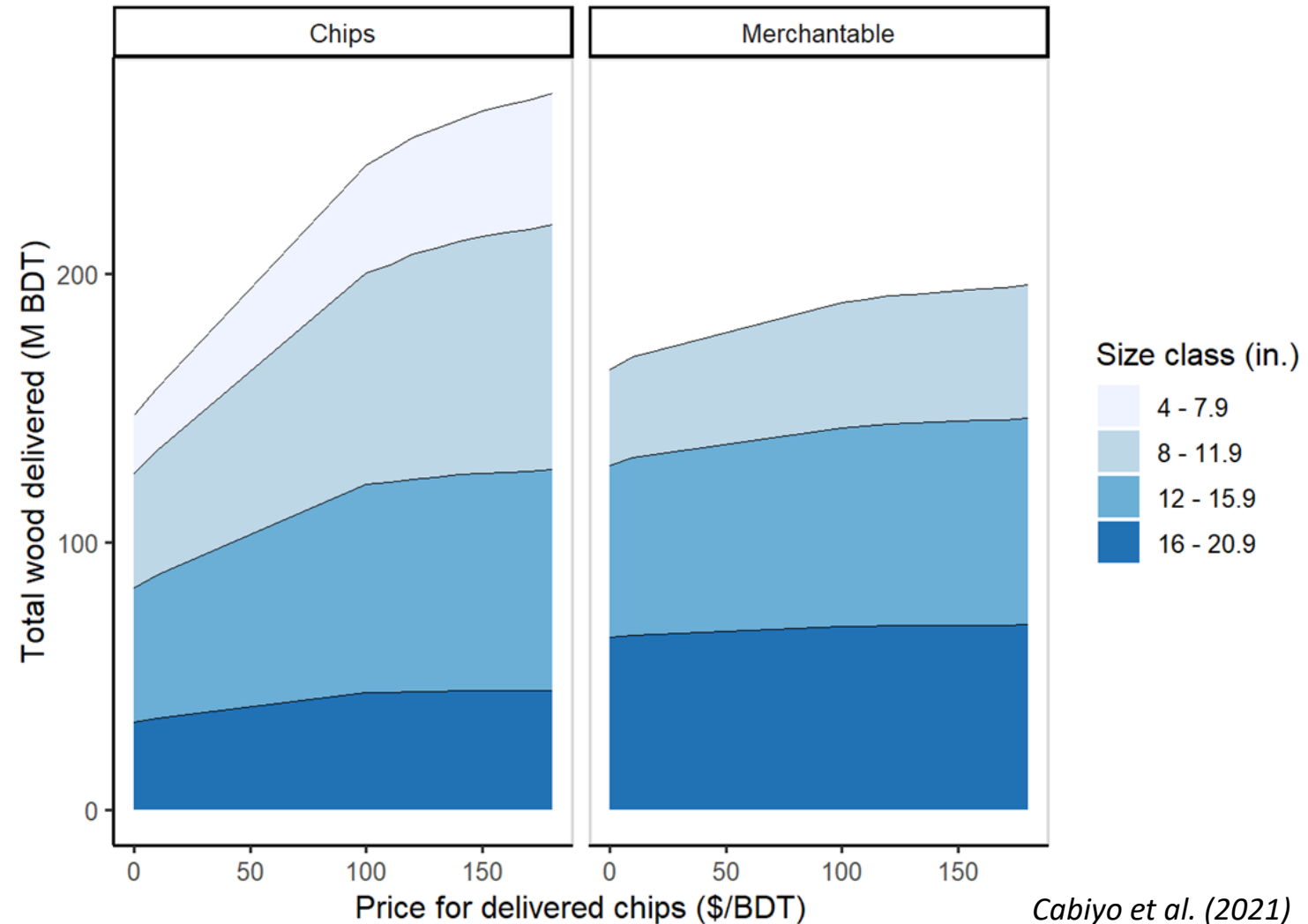


Methods: Forest management and LCA



Results: Biomass Availability

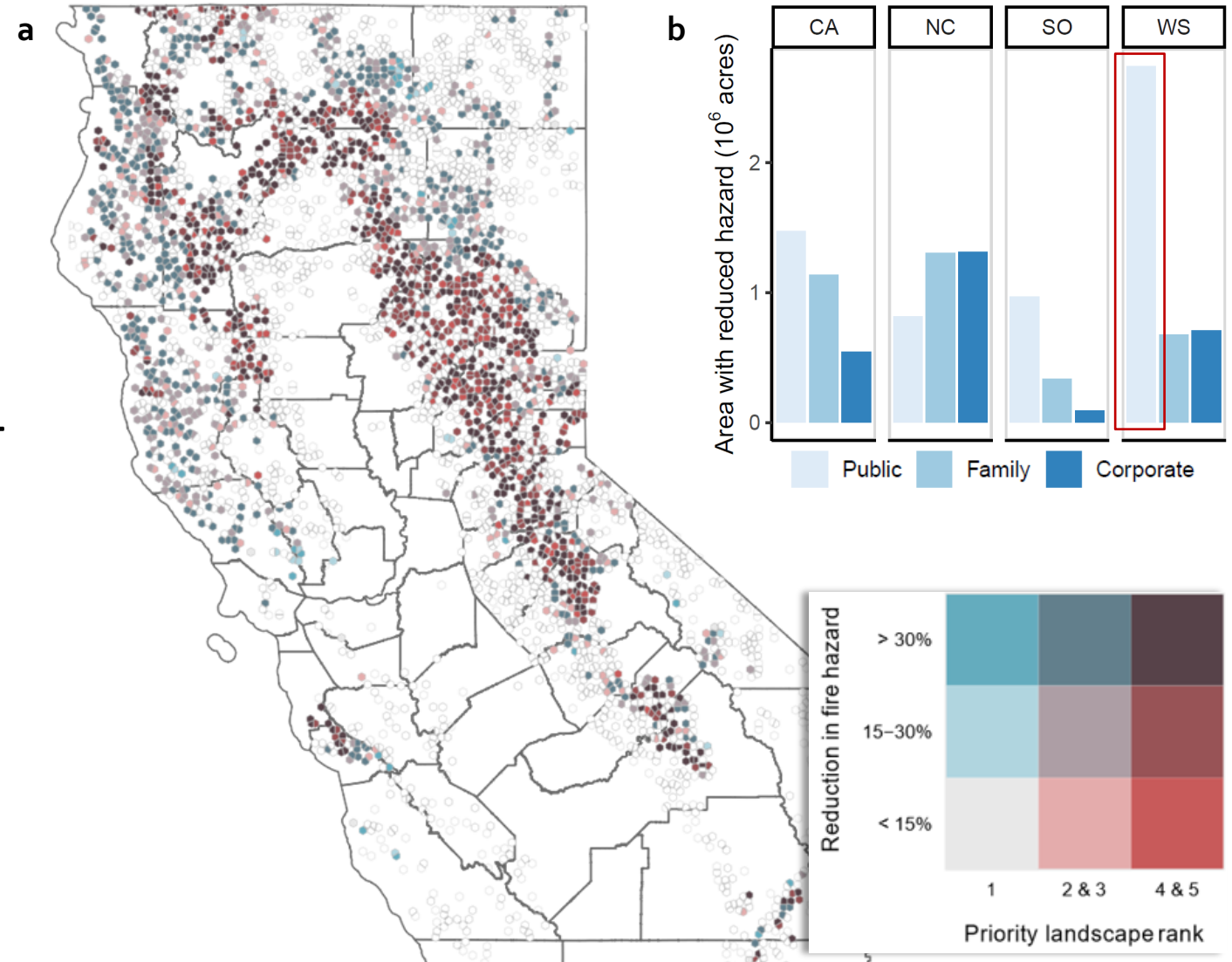
- Delivered chips increase steeply up to \$100/BDT
- High chip prices don't increase harvest of large trees
- Large trees are a critical source of chips (e.g. tops)



Results:

Wildfire hazard reduction

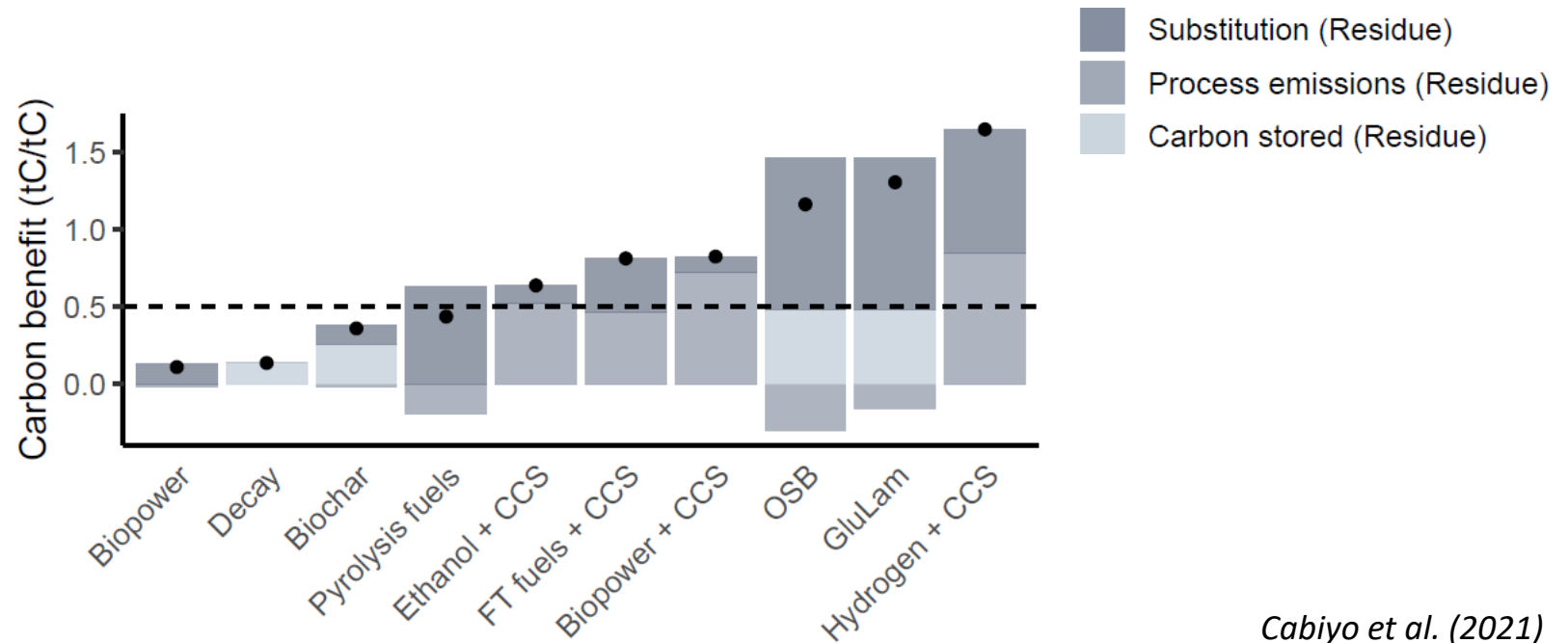
- 12.1 M acres hazard reduced
- 3.1 M acres of potential stand-replacing fire avoided
 - 28% reduction in fire mortality on average
 - 47% on high-priority landscapes (Zones 4 & 5)



Results:

Lifecycle carbon accounting

- 6.5 Mt/CO₂ climate benefit relative to BAU
- 16.4 Mt/CO₂ climate benefit when new sawtimber is used for multi-unit buildings



Conclusions:

- Forest-health-oriented thinning could produce up to **7.3 million (M) bone-dry tonnes (BDT)** of forest residues per year, an eight-fold increase over current levels.
- Increased management and wood use could yield net climate benefits between **6.4-16.9 million tonnes of carbon dioxide equivalent (M tCO₂e) per year** when considering impacts from management, wildfire, carbon storage in products, and displacement of fossil carbon-intensive alternatives over a 40-year period.
- Concurrently, treatment could reduce wildfire hazard on **12.1M acres**, 3.1M of which could experience stand-replacing effects without treatment.

Our results suggest that innovative wood use can support widespread fire hazard mitigation and reduce net-CO₂ emissions in California.

State actions

- Department of Conservation carbon-negative forest biofuels pilot program: \$50 million
- Climate Catalyst Fund: \$74 million
- Air Resources Board Scoping Plan and LCFS revisions
- Woody feedstock aggregation pilot projects



Photo Credit Holzvergaser Güssing.

Dr. Daniel Sanchez
& Dr. Haris Gilani

University of California, Berkeley
February 22, 2022



Available at https://bof.fire.ca.gov/media/mn5gzmxxv/joint-institute-forest-biofuels_final_2022_ada.pdf

Announced Biofuels Facilities in CA



Company	Location	Fuel	Commission Date
Aemetis	Modesto	Aviation Fuel	2023
Yosemite Clean Energy	Butte	Hydrogen & Natural Gas	2024
	Tuolumne	Hydrogen & Natural Gas	2025
	Tulare	Hydrogen & Natural Gas	2026
Mote Hydrogen	Bakersfield	Hydrogen	2024
H-Cycle	Los Angeles	Hydrogen	2026
	Butte	Hydrogen	2026
	Bakersfield	Hydrogen	2026
	Contra Costa	Hydrogen	2024
Kore	Los Angeles	Hydrogen & Natural Gas	2021
	Bakersfield	Hydrogen & Natural Gas	2023
Sierra Energy	Jolon	Diesel	2017

Sources: Esri, HERE, Garmin, USGS, Intermap, INCREMENT P, NRCan, Esri Japan, METI, Esri China (Hong Kong), Esri Korea, Esri (Thailand), NGCC, (c) OpenStreetMap contributors, Swatch

Questions?



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