Assessing carbon and ecosystem footprints of forest management scenarios for California's timberlands over 40 years of growth, management and disturbances

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Carbon and Ecosystem Footprints – complements or competitors?

- California imports around 80% of its wood needs – forestry is a hobby
- California has ~8 million acres of productive private conifer timberlands vs ~8 million acres of federal timberlands and ~4 million acres of forested park and wilderness area (3 radically different models)
- Canadian Forest Service "The system boundaries of the analysis included forest management (FM), HWPs and bioenergy, and emissions displaced in the energy and product sectors." (Smyth et al. 2014)
- California – land of diverse system boundaries
  - Air Resources Board (AB 32) – forest management, some HWPs, no bioenergy, no displacement
  - California Energy Commission – bioenergy
  - California Board of Forestry – forest management, HWPs, bioenergy
  - California Dept. of Fish and Wildlife – fish and wildlife
  - California Governor's office – international recognition

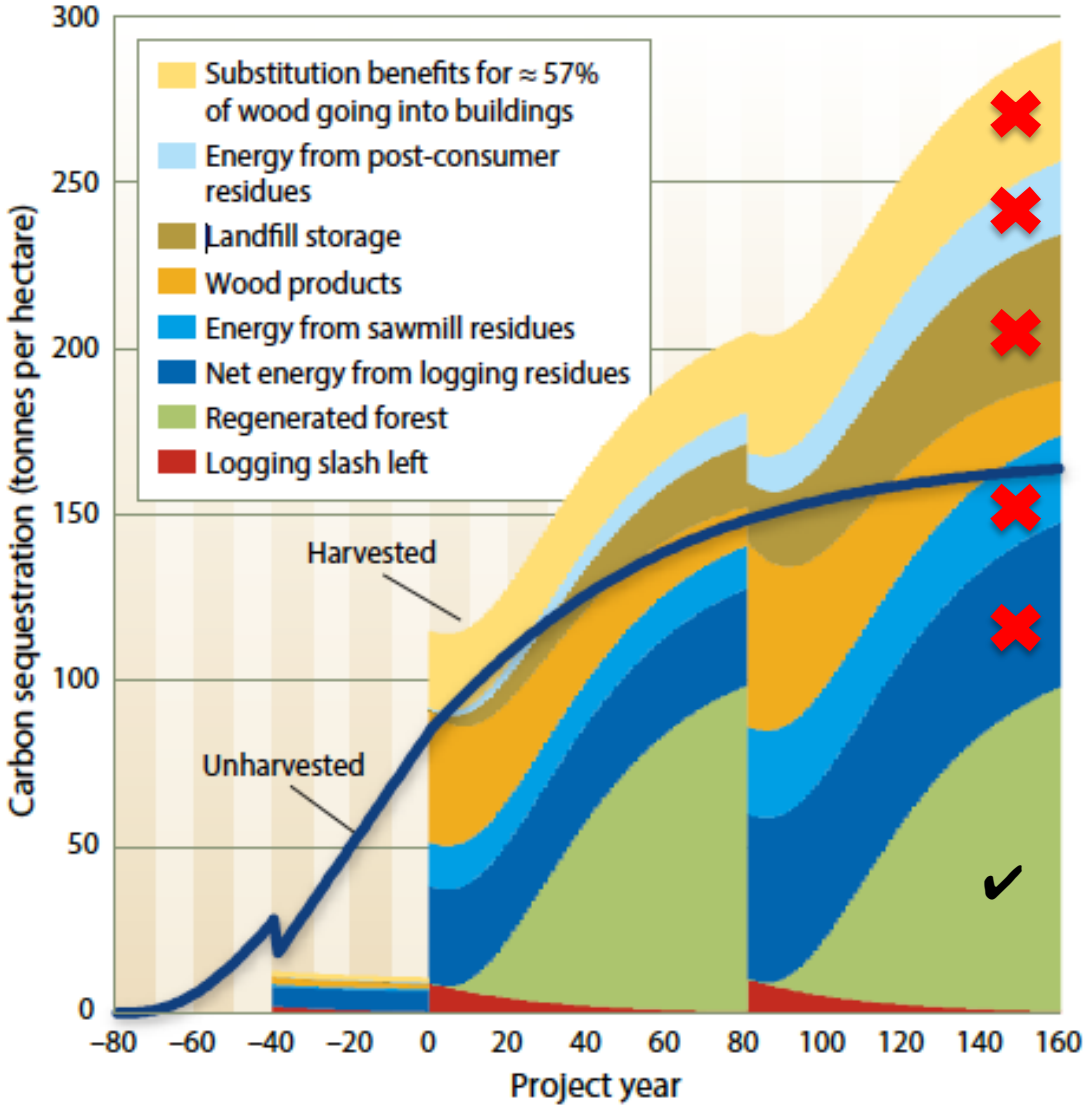


Fig. 1. Sequestration benefits over time from 1 hectare of a mixed-conifer forest under two scenarios: unharvested (or let-grow), and even-aged harvest and regeneration with 75% of slash (logging residues) used for energy at a harvest at year 0. The life cycle includes the 80 years since the forest started from seedlings as well as two cycles of harvesting and replanting.

✔ Similar accounting

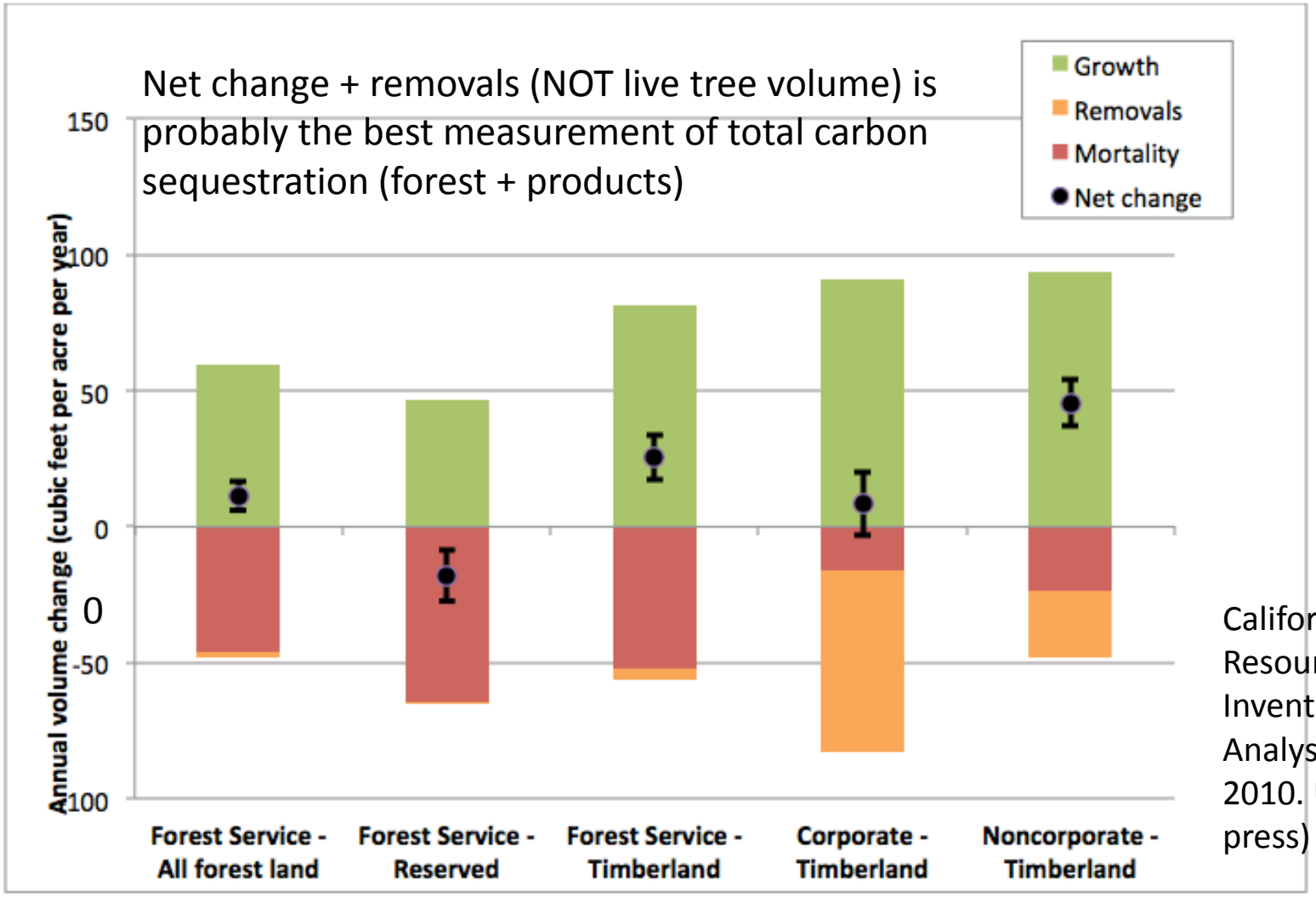
✖ Uncounted benefits in ARB/CAR Offset Protocol

A simple forest growth plus efficient product utilization estimate of total climate benefits
(Stewart and Sharma 2015) at californiaagriculture.ucanr.org

But we need more than cartoons of forests to capture large disturbances and forestry diversity across the state

Carbon Flux to Products and the Atmosphere on Different Ownerships in the 2014 King Fire

FIA remeasurements by California ownerships shows the allocation of tree carbon created by a decade of sunshine



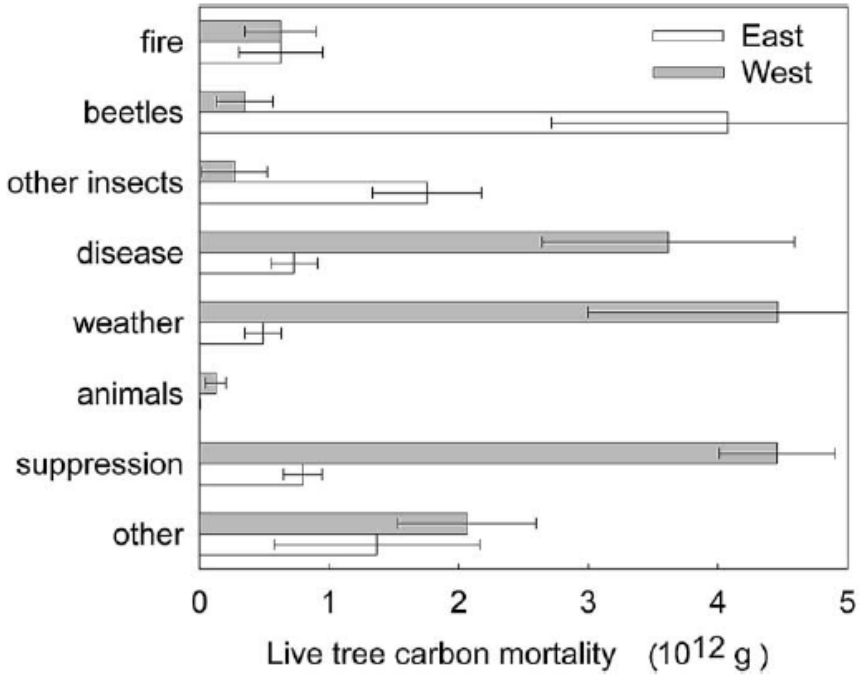
California's Forest Resources: Forest Inventory and Analysis, 2001-2010. USFS FIA (in press)

Figure 34 – Combined average annual change in volume (cubic feet) growth, removals and mortality per

Sources of mortality on private timberlands in OR

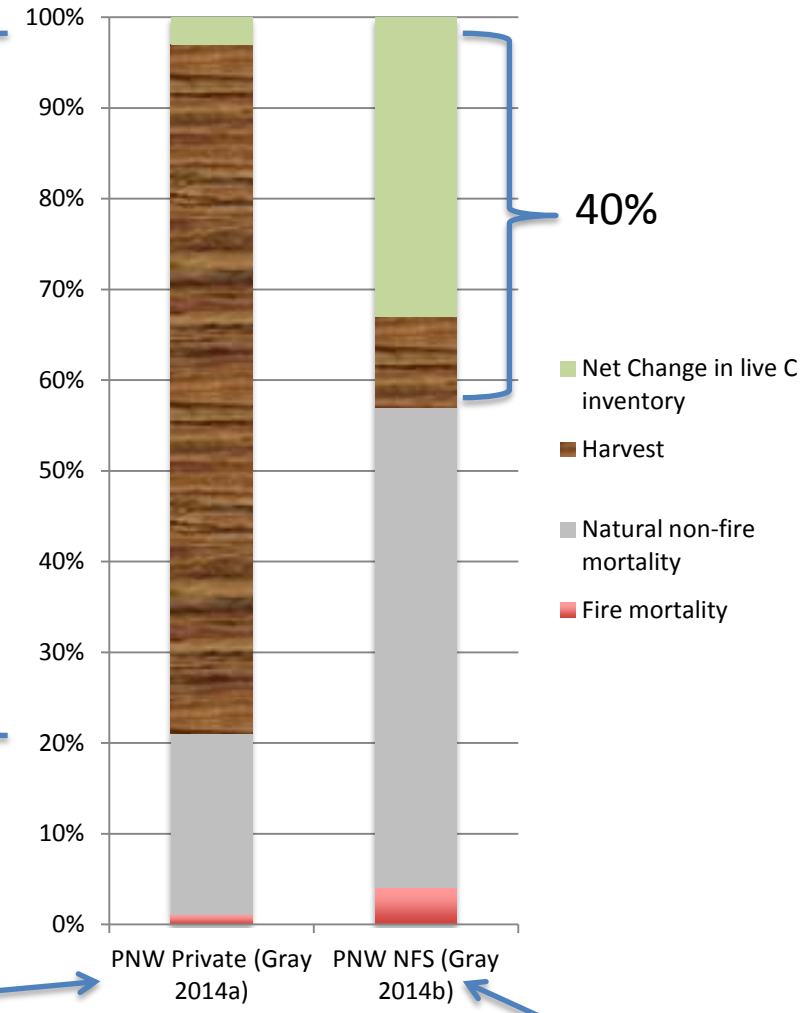
'Forest Health' is more than just fire risk reduction

Private forest lands in PNW allocate more to products, less to mortality than National Forest timberlands



80%

Allocation of gross growth in PNW



Gray AN, Whittier TR, Azuma DL. 2014a. Estimation of Aboveground Forest Carbon Flux in Oregon: Adding Components of Change to Stock-Difference Assessments. Forest Science 60: 317-326.

Gray AN, Whittier TR. 2014b. Carbon stocks and changes on Pacific Northwest national forests and the role of disturbance, management, and growth. Forest Ecology and Management 328: 167-178.

Need biofuels – but what feedstocks are sustainable and globally beneficial?

- California law requires a reduction in the carbon intensity of transportation fuels by 20% by 2020 (CA is anti-corn ethanol)
- USFS timberlands and private timberlands are increasingly regulated under the assumption that keeping more inventory always provides more environmental benefits.
- But how to explain sustainability and global benefits to diverse clientele?
- Need a scenario tool that can grow and manage our diverse current forest and get a view of how new scenarios could work

Want a method to cover ownerships, treatments, and time

BioSum 5

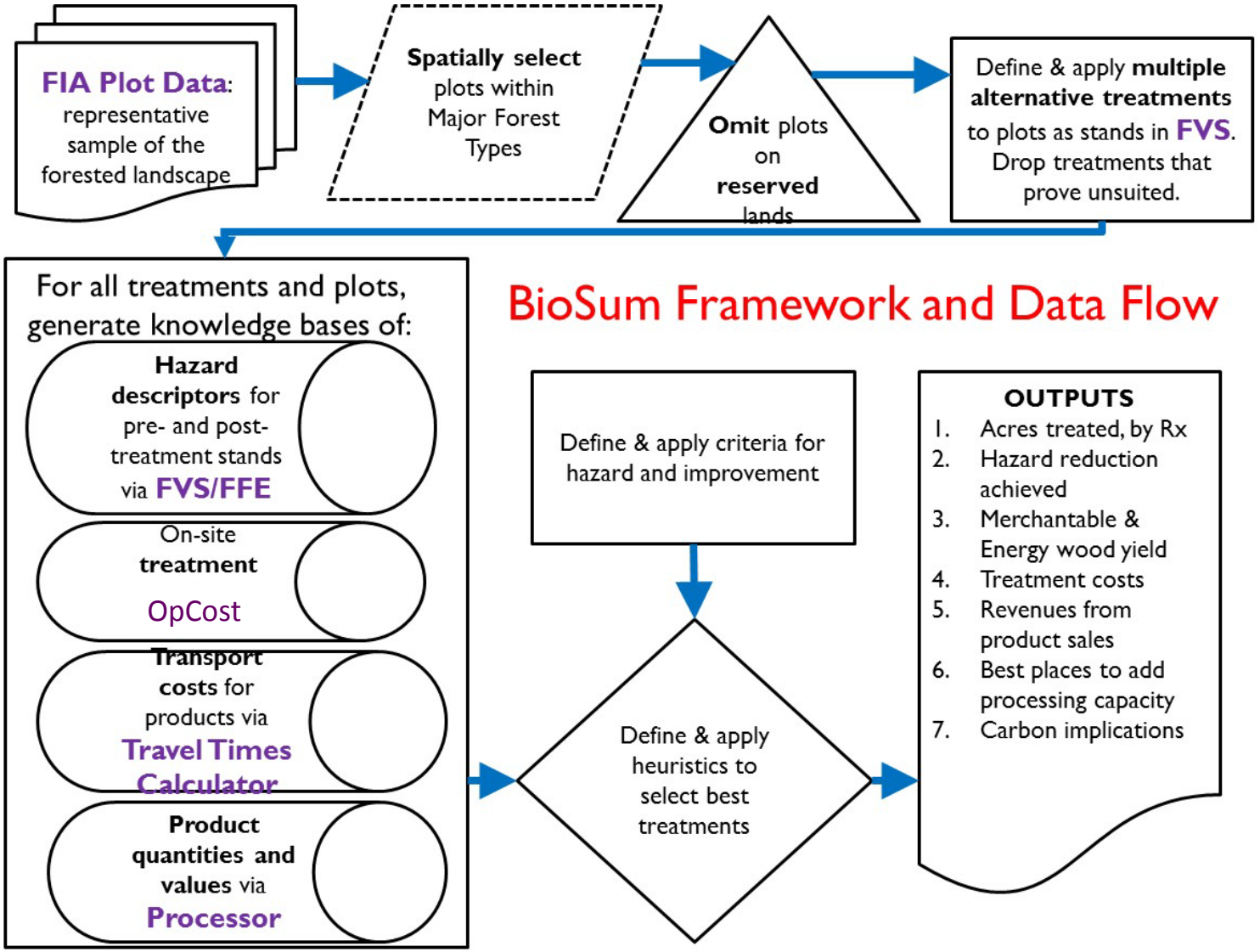
- Simulates 4 decades of growth response to treatments,
- Allows for multiple treatments,
- Can consider state of forest, and economic activity, at multiple time points,
- Links to open-source/transparent R-based FVS/OpCost,
- Includes complete user guide and technical documentation

BioSum Version Comparison

	1	2 - 4	5
Components			
Inventory Data	x	x	x
FVS-FFE	x	x	x
Custom GIS tools	x	x	x
STHARVEST	x		
FRCS		x	
OpCost			x
Coding			
AWK & Perl scripts	x		
C# & VBA		x	x
Added Features			
User defined tmt effectiveness		x	x
Multiple treatments			x
Multiple growth cycles			x
User guide			x

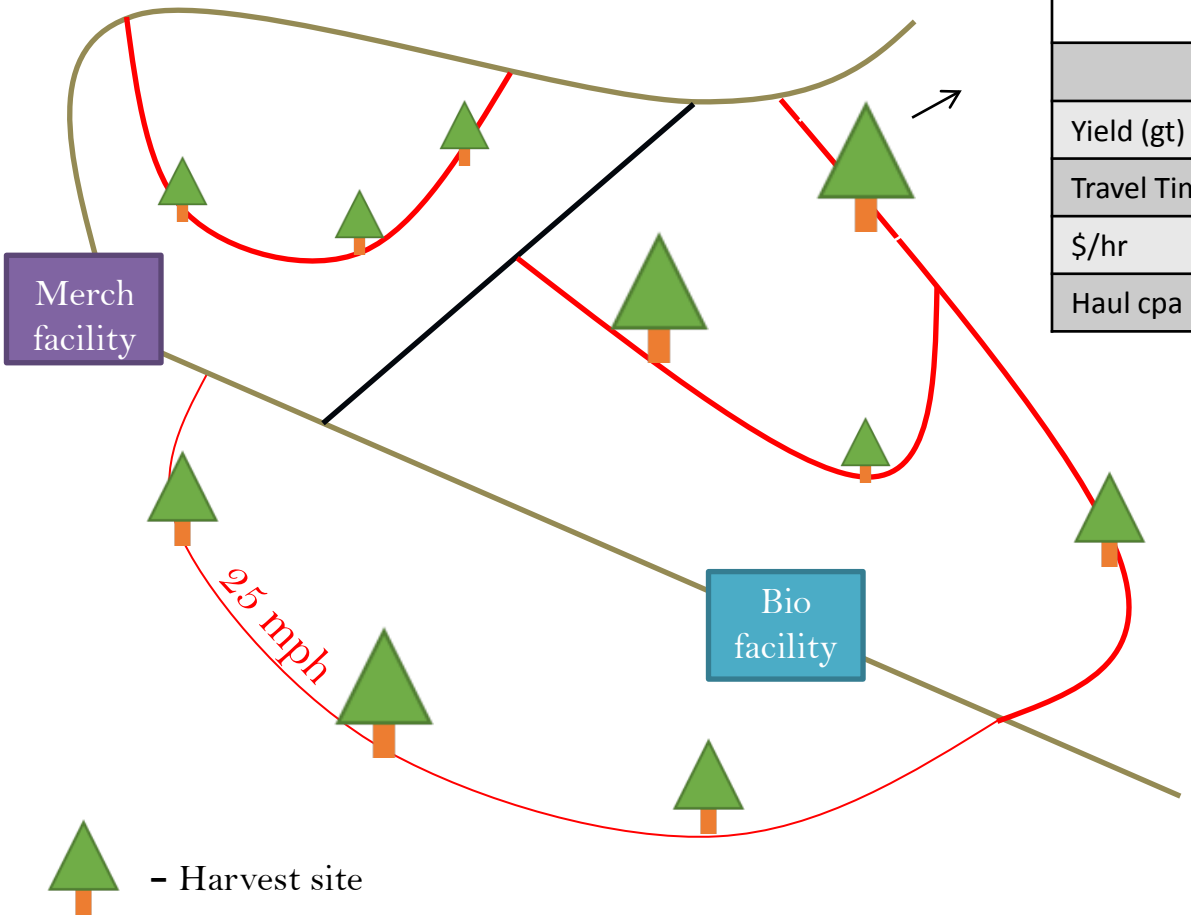
Jeremy Fried, Larry Potts, Sara Loreno

BioSum WorkFlow



BioSum Spatial Representation

aul cost per acre = yield (gt) * travel time * truck and driver cost per gt hour



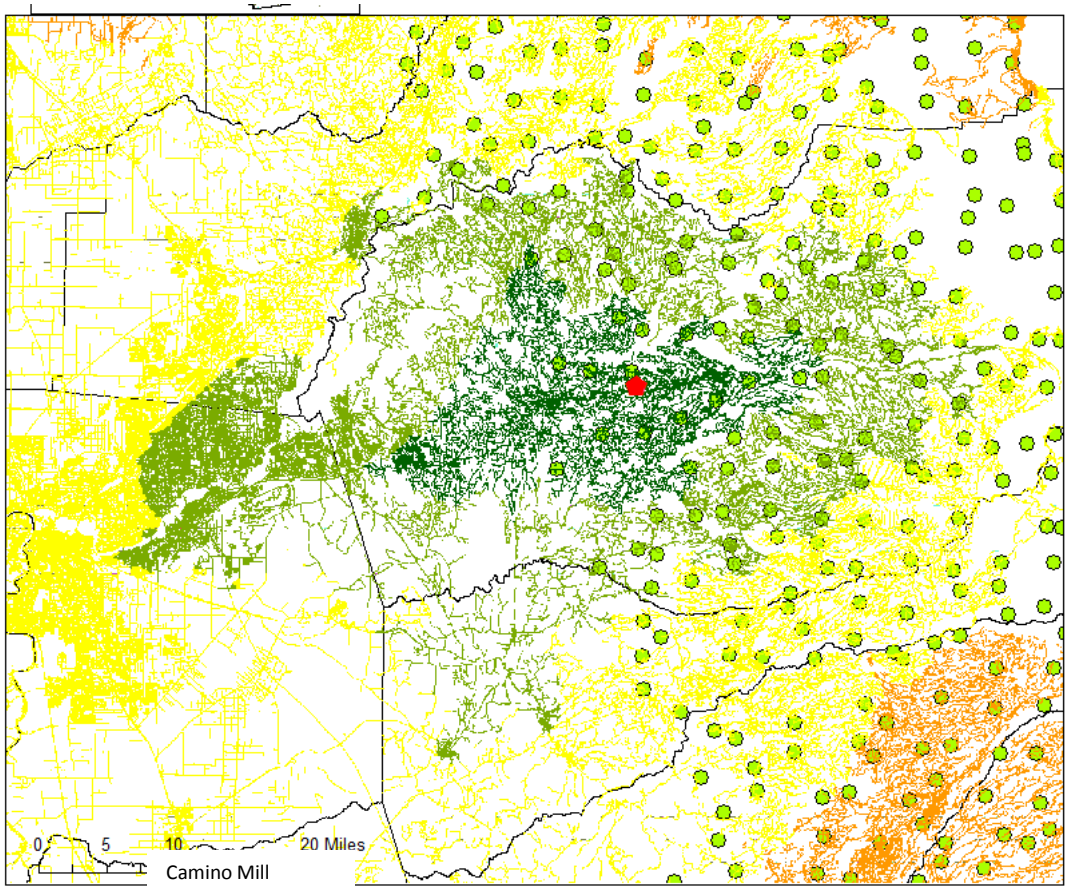
	Package 1		Package 2	
	Merch	Chip	Merch	Chip
Yield (gt)	33	15	11	4
Travel Time	1.2	.6	1.2	.6
$/hr	7	7	7	7
Haul cpa	277	63	92	17

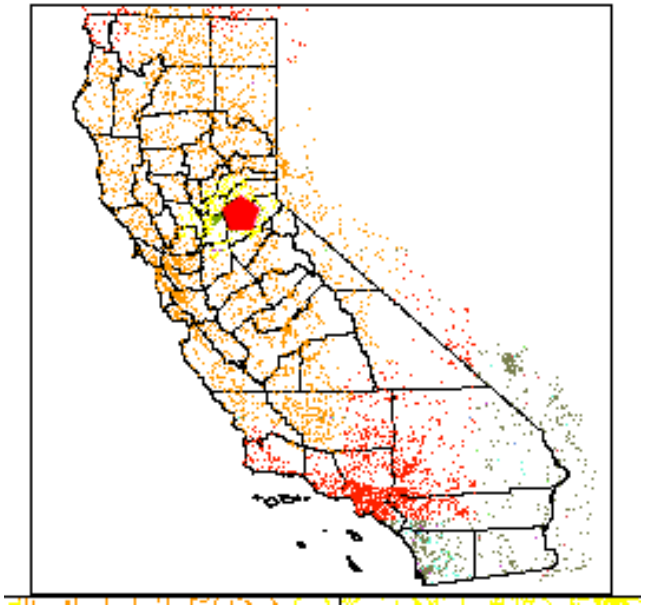
Total Haul Cost Per Acre

Package 1 – $340

Package 2 – $109

- Travel Time Map for Lumber Mill in Camino, CA



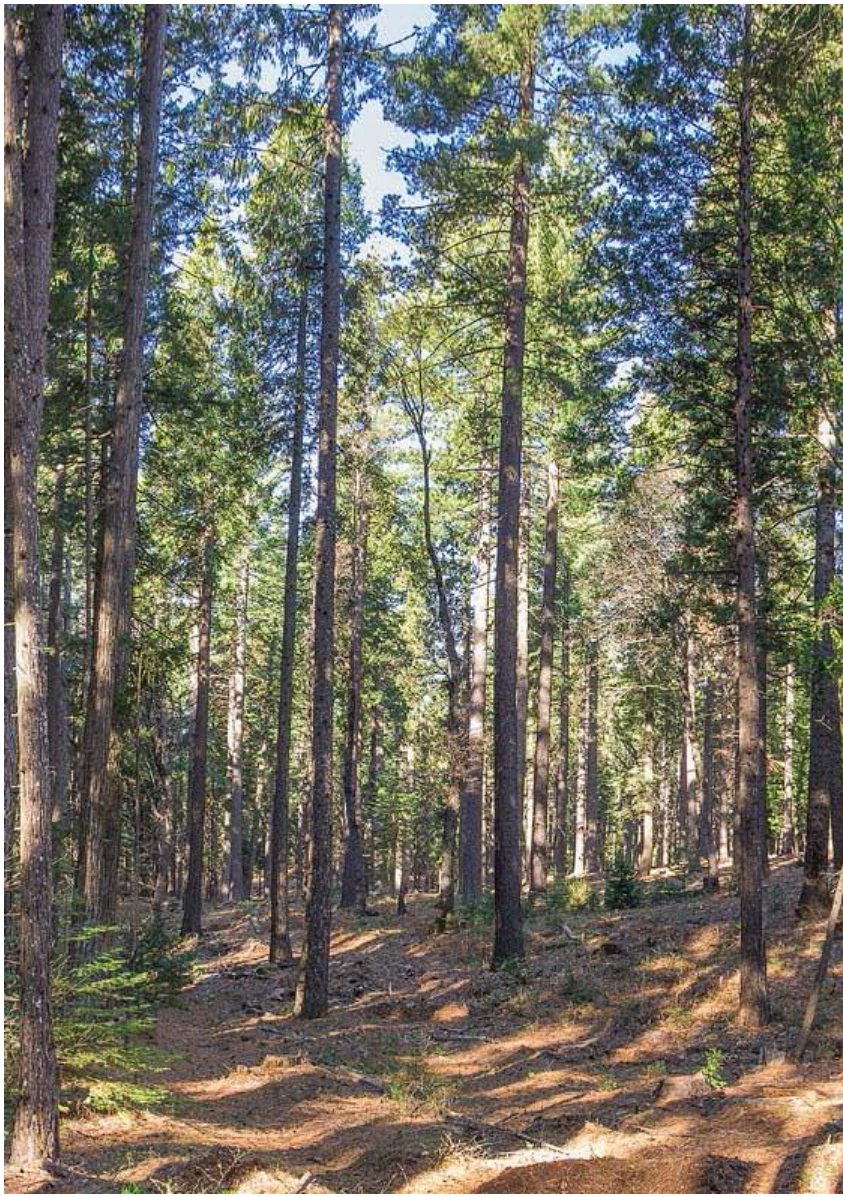


Not optimization but articulating social goals and looking at outcomes

- More big trees (forever)
- Reduce fire risks
- Funding to do the work

Explore some runs that compare Dense and Thinned Stands

Densely Stock Stands to Thinned Stands



40 year simulations (food for thought for policy discussions)

- **Apply CA Forest Practices Act commercial thin in Douglas fir dominated forests – residual BA > 115, treat fuels, ~20 yr re-entry**
- Test how raising Federal lands diameter cap from 30” to 36” would affect outputs and final status
- Only 16-18% of Federal lands and 8-9% of Private lands with > 115 BA are treatable with a (+) Net Rev. requirement
- Increasing cap to 36” leads to 26% more acres treated, 24% more output, BUT 1% more high-volume acres after 40 years
- **Reduce fire risk in mixed ownerships of Mixed Conifer forests – only cut smaller trees OR do risky prescribed burns**
- Thinning from below gives slightly better fire risk protection but generates less revenue than thinning evenly across diameter distribution
- But using prescribed fire after harvest is 3x as effective as just ‘lop and scatter’ -

Concluding Thought: Simulation and scenario tools will not necessarily find the optimal solution but are valuable to highlight potential tradeoffs to decision makers