Earth Systems Ecology Lab

Resolution	Treatment	AllData	stratified75	stratified50	stratified25	Targeted
100 m	Thin and burn	2074	1659	2959	906	3189
	Burn only	16939	17082	15626	16188	18313
	All treatments	19013	18741	18585	17094	21502
500 m	Thin and burn	450	175	1025	0	1675
	Burn only	20750	19525	18075	16525	21975
	All treatments	21200	19700	19100	16525	23650

Table: Area treated in hectares by treatment type for each of the initial communities layers. The initial communities layers were developed using all available data, a stratified sampling using 75%, 50%, or 25% of available data, and a targeted data set, which focused on field sampling locations within the study area as a function of vegetation type and topographic conditions and included the same number of plots as the 25% sample. The layers were developed at 100 m and resampled to 500 m to evaluate the influence of resolution on error.

Stratified sampling reduces field data needed for reliable forest models

Western US forests face rising high-severity fire risk due to warming, aridification, and past fire exclusion, motivating increased investment in forest management. The high cost of treatments and the vast areas needing work require efficient allocation of resources. Forest landscape models can help scale up analysis and support management, but underlying uncertainties can limit their utility. We focused on uncertainty in the initial forest conditions input layer and quantified the error in that layer to determine how much field data are needed to produce outputs suitable for informing management.

Using the Santa Fe fireshed as a case study, we compared initial forest layers produced using varying dataset sizes and found that using a stratified sampling design representing the entire fireshed by morphology and forest type, attributes used to produce the initial forest layer, significantly reduces the number of plots needed to stabilize the error due to the underlying dataset. Resampling model outputs to a coarser resolution also reduced the error while maintaining key information.

When comparing treatment location maps produced as a function of the probability of high-severity wildfire, we found that treatment map produced using 25% of the dataset, with sampling targeted to capture forest cover type and topographic position (Targeted), compared well to the treatment map produced using the entire dataset (AllData). The Targeted approach did result in more of the landscape being identified for treatment relative to the AllData layer, but coarsening the data to 500 m reduced differences in the locations identified for treatment. Designing a sampling scheme to minimize error in characterizing landscape conditions combined with a forest landscape model can help provide managers a characterization of how disturbance and climate will effect the landscape over time and how management can alter the effects.

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Management Implications

- Stratified sampling enables a significant reduction in sampling intensity while maintaining similar error to forest model layers developed using four times as much data, yielding a similar distribution of modeled high-severity fire risk.
- Resampling model outputs to a coarser resolution reduces errors while remaining informative to managers by identifying landscape locations where they can focus field assessments of fuels conditions.
- Forest landscape models can be useful operational tools aiding managers in the decision making process and enabling to scale up planning efforts when model data layers approximate actual conditions and include an estimate of the error associated with the vegetation layer.

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Contact Information

Matthew Hurteau: mhurteau@unm.edu

Hagar Hecht: hhecht@unm.edu

www.hurteaulab.org