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Abstract

Maps of fuel loadings for the North Central region were constructed using Forest Inventory and Analysis (FIA) down woody material observations. These observations were obtained from measurements of FIA Phase 3 plots which focus on a suite of variables related to forest health. Because only two years of Phase 3 plot observations are available, the sampling intensity of one plot per approximately 480,000 acres is only marginally sufficient to form the basis for constructing maps. To compensate, predictive models were constructed for relationships between down woody material observations for Phase 3 plots and the suite of FIA Phase 2 mensurational variables observed on those same Phase 3 plots. Down woody material predictions were then calculated for all Phase 2 plots, not just those with a Phase 3 component. The predictions were used to augment the Phase 3 plot observations, thus forming a better basis for map construction. The accuracy of the maps were compared for the two sets of calibration data, the Phase 3 plot observations alone and the Phase 3 plot observations augmented with the Phase 2 plot model predictions.

Objectives

1. To construct models of the relationships between Phase 3 down wood material observations and the suite of Phase 2 observations.
2. To determine if augmentation of Phase 3 plot observations with Phase 2 plot predictions improves fuel maps.
3. To determine if fuel maps are improved by masking out non-forest areas

Methods and Model Building

Down Woody Material Phase 3 → Phase 2 models

Dependent variables:
 Down Woody Fuel Classes: 1-hour, 10-hour, 100-hour, and 1000-hour

Independent variables:
 Categorical: Eco-province, Forest cover type, Physiographic class, and Stand size class

Continuous: Stand age, Site index, Stand density index, Basal area, Trees per acre, Aspect, Slope, Elevation, and Average stand diameter

Methodology: Multiple linear regression

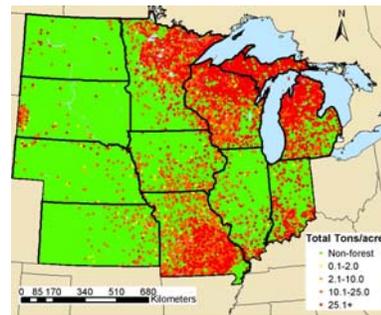
Mapping Procedures

1. Ordinary kriging (exponential model) using total tonnage estimates from Phase 3 plots
2. Ordinary kriging (exponential model) using total tonnage estimates from Phase 2 and Phase 3 plots
3. Mask out non-forest using non-forest classes from National Land Cover Dataset
4. Visually compare maps
5. Compare map-based estimates to estimates from Phase 3 plot observations

FIA Plot Locations

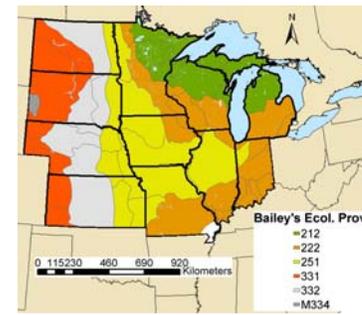


FIA Phase 3 plot locations and fuel estimates



FIA Phase 2 and Phase 3 plot locations and estimates

Map Accuracy Assessment



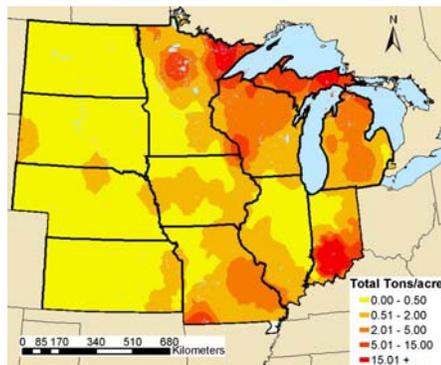
Bailey's Ecological Provinces of North Central States

Mean per acre Phase 3 plot-based and map-based total per acre fuel tonnage estimates for Bailey's Ecological Provinces

| Ecological Province | Phase 3 Observations | | Kriging Interpolation |
|---------------------|----------------------|-----------|-----------------------|
| | Mean | 2 Std Err | Mean |
| 212 | 5.53 | 2.14 | 6.63 |
| 222 | 2.85 | 1.98 | 5.13 |
| 251 | 0.38 | 0.15 | 0.53 |
| 331 | 0.08 | 0.11 | 0.11 |
| 332 | 0.05 | 0.04 | 0.09 |
| M334 | 3.14 | 2.84 | 3.09 |

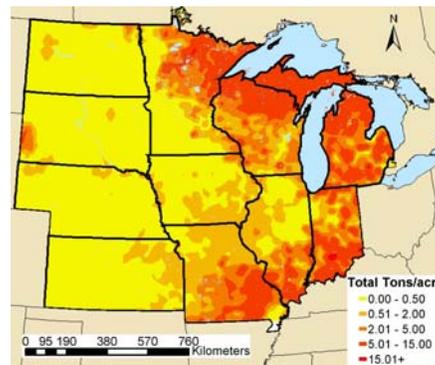
A conservative estimate of the statistical significance of the error in the map-based mean may be obtained by determining if it falls within a 2-standard error interval around the plot-based mean.

Map Based on Phase 3 Plot Obs.

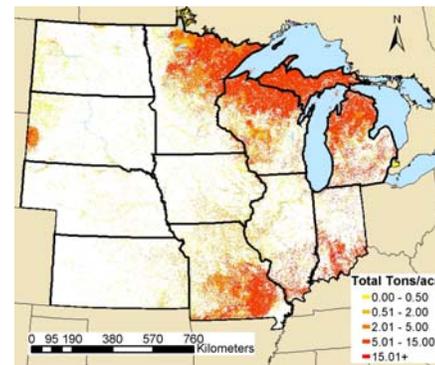


Map constructed using Kriging interpolation of Phase 3 plot observations only

Maps based on Phase 3 Plot Obs. & Phase 2 Plot Preds.



Map constructed using Kriging interpolation of Phase 3 observations and Phase 2 plot predictions



Map obtained by masking out non-forest portions of map constructed using Kriging interpolation of Phase 3 observations and Phase 2 plot predictions

Conclusions

1. Augmenting Phase 3 plot observations with Phase 2 plot predictions improves fuel maps
2. Masking out non-forest portions of the landscape improves fuel maps
3. Map-based mean per acre fuel tonnage estimates are not significantly different than plot-based estimates, suggesting that the map is unbiased at the spatial scale of Bailey's Ecological Provinces (Ecological Province 222 is an exception).
4. These maps and estimates are based on only 40% of the Phase 3 plot data that will eventually be available. Both maps and estimates are expected to improve as this additional data becomes available.