Title: Supporting the National Fire Plan with Maps And Digital Data Layers Derived From FIA and FHM Plot Observations

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Although not the responsibility of the funding program, the late date at which the FY 2002 funds were made available greatly inhibited progress. Because the FIA program of the North Central Research Station is inherently a production effort, compensation must be made for program personnel time diverted from that effort to projects such as this one. Until compensatory funds became available, only preliminary work could be accomplished. Thus, this report documents that preliminary work and production work completed since funds became available.

PRELIMINARY WORK: Preliminary work consisted of investigation of techniques for mapping down woody materials and fuels using available information from Phase 2 FIA plots, forest/non-forest maps, basic geographic information. Two mapping techniques were investigated, kriging and k-Nearest Neighbors (k-NN).

Kriging is a data interpolation technique that creates a smooth surface from discrete, geographically disparate data points. One disadvantage of kriging is that, for example, data from adjacent forest and non-forest plots are smoothly interpolated geographically between the plots without regard to the fragmented patterns of land cover between the plots. Thus, even though the forest land cover, and hence forest fuels, may abruptly end in much closer proximity to the forest plot than to the non-forest plot, the interpolation only gradually reduces the fuel estimates as the distance from the forest plot increases. Investigations to compensate for this phenomenon focused primarily on using a forest/non-forest map or mask to "zero out" the forest fuel estimates on lands with no forest cover. Results for maps of coarse down woody material for the states for which the North Central Research Station FIA program has responsibility are shown in Figure 1. Although sophisticated modifications of the kriging technique may compensate for this disadvantage, our primary interest for this project is the k-NN technique.

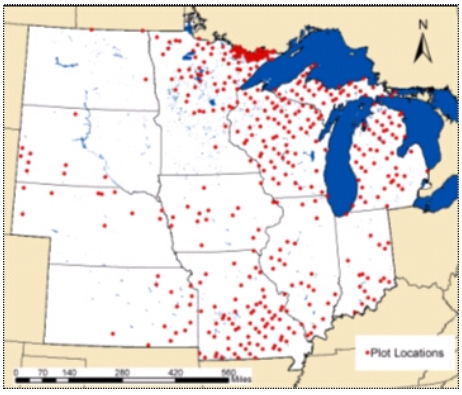

Figure 1a. FIA Phase 3 plot locations.

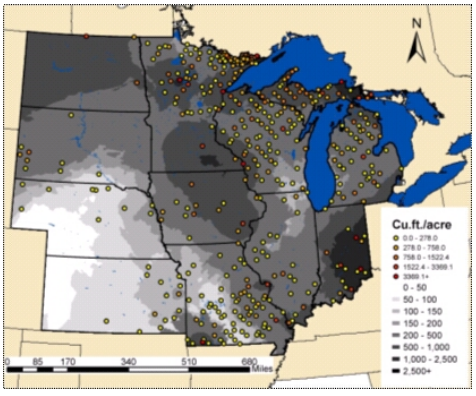

Figure 1b. Kriged map.

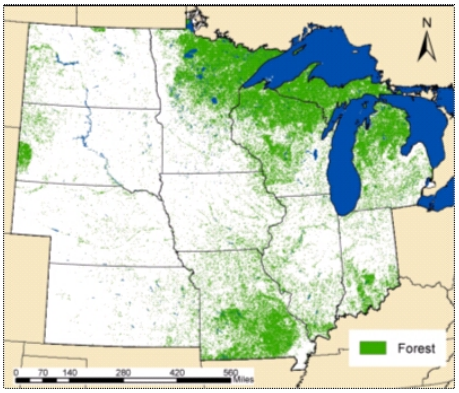

Figure 1c. Forest.non-forest map. removed.

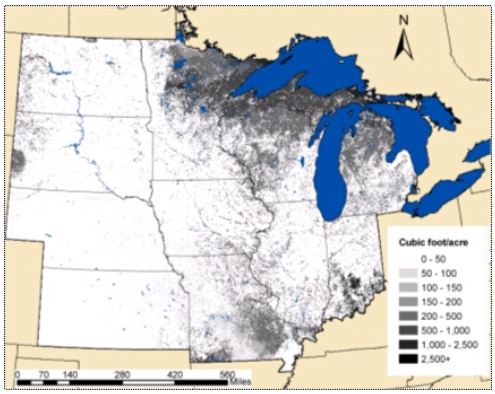

Figure 1d. Kriged map, non-forest

The k-NN technique produces predictions for discrete mapping units that are linear combinations of observations for k other discrete mapping units that are similar with respect to a selection of desirable attributes. Because one of those attributes can be forest cover, the k-NN technique can be used directly to predict forest fuels for only those mapping units that are known or independently predicted to have forest cover. Thus, the kriging disadvantage of predicting non-zero levels of forest fuels for non-forest land in proximity to forest land is avoided. However, to properly use the k-NN technique for this application, the array of variable values for the potential similarity criteria must be assembled for each mapping unit. This is the most time consuming task associated with k-NN prediction; it is the task for which funding to compensate for the diversion of time of program personnel was requested; and it is the task that suffered most from the delay in funds becoming available. However, investigations of the k-NN technique were conducted for Bailey's eco-province 212 (northern portions of MN, WI, and MI) using only latitude and longitude (i.e., geographic proximity) as similarity criteria. Results for two implementations of the k-NN technique for this eco-province using the same plot information as used with the kriging approach are shown in Figure 2. Much more precise maps are expected as a more complete array of variables that can be used for similarity criteria becomes available.

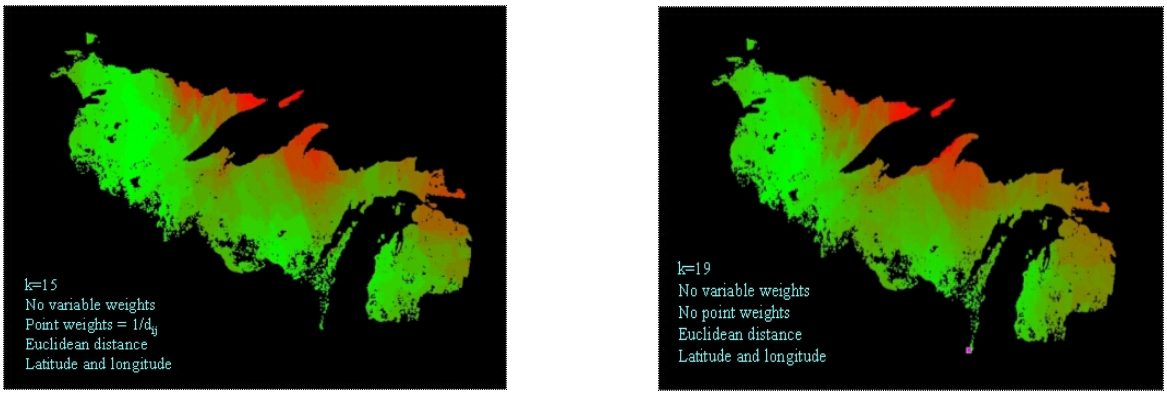

Figure 2. k-NN predictions of forest fuels for Bailey's eco-province 212 (green indicates less amounts of fuels while red indicates greater amounts of fuels).

Finally, because of the sparse population of FIA Phase 3 plots (i.e., one plot per approximately 96,000 acres), we have also been investigating construction of models to be used to predict the Phase 3 fuel components from the suite of Phase 2 measurements that are also obtained on every Phase 3 plots. If successful, we would then be able to predict Phase 3 fuel components for every Phase 2 plot, this increasing the density of fuel component information by factor of 16 to one plot per approximately 6,000 acres. Our preliminary analyses indicate that these models reduce the residual error in k-NN predictions by a sufficient amount to now move this effort into the production phase.

PRODUCTION WORK: Production work since funds became available have focused on assembling values for relevant variables that can be used as k-NN similarity criteria for eco-provinces in the North Central FIA region. In addition to observations for components of down woody materials for an increasing number of FIA Phase 3 plots throughout the North Central FIA region, an array of digital data layers have been assembled and include the following: (1) distance road, (2) distance to water, (3) aspect, (4) elevation, (5) digital elevation, (6) fragmentation indices, (7) forest/non-forest classification, (8) Anderson Level 2 land cover classification, (9) ownership, (10) eco-province, and (11) probability of soil characteristics such as hydric soils and well or poorly drained soils.

Although progress on this project has not been as substantial as anticipated, the circumstances inhibiting progress were beyond the abilities of either the project or the Forest Health Monitoring program to control.

We respectfully request that second year's funding in the amount of $37,125 be made available.

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