

**Model assisted statistical estimates of forest population and small-area parameters with *k*NN maps of forest conditions**

Raymond L. Czaplewski, Ph.D.  
USDA Forest Service  
Rocky Mountain Research Station  
Interior West Forest Inventory and Analysis Program  
2150 Centre Avenue, Bldg. A  
Fort Collins, CO 80526-1891 USA  
rczaplewski@fs.fed.us

**Abstract:** The non-parametric multivariate  $k$  Nearest Neighbor ( $k$ NN) predictor can use remotely sensed data to produce thematic maps of detailed forest conditions. One major advantage of  $k$ NN is the ability to impute the full vector of field measurements and transformations to each and every remotely sensed pixel in the population. By simply summing imputed values for all pixels, detailed estimates are produced for the entire population. However, these estimates can be biased, and measures of random estimation error are required to describe the reliability of those estimates. This paper presents an application of a best linear unbiased estimator that combines  $k$ NN predictions for pixels with a simple random sample of field data to produce an efficient multivariate estimate and its error covariance matrix. Bayesian techniques are outlined that might extend the method to small-area estimates.