Comparing Five Modeling Techniques for Mapping Forest Characteristics in the Interior Western US

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Abstract

Broad-scale maps of forest characteristics are needed throughout the United States for a wide variety of forest land management applications. Inexpensive maps can be produced by modeling forest class and structure variables collected in nationwide forest inventories as functions of satellite-based information. But little work has been directed at comparing modeling techniques to determine which tools are best suited to mapping tasks given multiple objectives and logistical constraints. Consequently, five modeling techniques were compared for mapping forest characteristics in the Interior Western United States. The modeling techniques included linear models (LMs), generalized additive models (GAMs), classification and regression trees (CARTs), multivariate adaptive regression splines (MARS), and artificial neural networks (ANNs). Models were built for two discrete and four continuous forest response variables using a variety of satellite-based predictor variables within each of five ecologically different regions. All techniques proved themselves workable in an automated environment. When their potential mapping ability was explored through simulations, tremendous advantages were seen in use of MARS and ANN for prediction over LMs, GAMs, and CART. However, much smaller differences were seen when using real data. In some instances,a simple linear approach worked virtually as well as the more complex models, while small gains were seen using more complex models in other instances. In real data runs, MARS and GAMS performed (marginally) best for prediction of forest characteristics.