

## ZERO-INFLATED METHODS FOR ESTIMATING PERCENT CANOPY COVER IN MONTANA LYNX HABITAT USING LANDSAT 5 AND 8 IMAGERY

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### ABSTRACT:

The Canada lynx (*Lynx canadensis*) was listed as a federally threatened species in 2000. The US Forest Service (USFS) manages a large portion of lynx habitat in northwestern Montana and requires an accurate portrayal of lynx habitat based on the best available science and data. The desired habitat map will help focus recovery actions for lynx in locations of greatest importance, while potentially allowing more management flexibility in areas no longer considered lynx habitat. In order to identify forest types that are favored by the lynx, we utilized several Landsat images and mapped five coniferous tree species, focusing on subalpine fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*). Our study area required four Landsat scenes to cover its spatial extent. Scenes were acquired for three different dates: July and September 2011 (Landsat 5) and July 2013 (Landsat 8). The images for each date were radiometrically corrected to a master scene, mosaicked, and masked to the study area boundary. Over 1200 field data points were collected during the summer of 2013 by USFS field crews. Using the field data and the Landsat data, we designed, tested, and finalized a novel approach to percent canopy classification: zero-inflated random forest (RF) and support vector machine (SVM) statistical models. In most cases the zero-inflated SVM model performed the best. The results demonstrated that our new zero-inflated models were able to map percent canopy cover by species with fairly high accuracy (RMSEs of 10-18%). They also demonstrated that the extent and quantity of the 2013 field data collection and the new Landsat 8 data (with higher radiometric resolution) strengthened the mapping process.