THE EFFECTS OF PARTIAL CUTTING PRACTICES ON FOREST STAND STRUCTURE IN APPALACHIAN HARDWOOD FORESTS

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Abstract: Eastern hardwood forests originated after catastrophic disturbances around the turn of the century and are currently an even-aged, maturing resource. The increasing value of sawlogs, especially those of particular species and quality, has prompted many forest landowners to increase their harvesting efforts. Most harvesting appears to be economically driven, focusing on sawlog extraction without regard to the future of the residual stand. Partial cutting practices, such as diameter limit cutting, remove the highest quality material and leave inferior species and quality behind. None of these cutting practices are part of any planned silvicultural system and may alter future forest sustainability.

In 1993 a study was initiated on the West Virginia University Forest to compare diameter-limit harvesting practices with a silvicultural regeneration method: the shelterwood method. Harvested areas are 4 ha (10 a) and there are four replications of three treatments: (1) diameter-limit cutting where all merchantable trees > 30 cm (12") dbh were removed, (2) diameter-limit cutting where all merchantable trees > 40 cm (16") dbh were removed, (3) seed cut of the shelterwood method. Stands were 60 years old and harvesting occurred during the fall of 1993 and early spring 1994. Stand characteristics were measured before harvest and so far, for three growing seasons post-harvest.

During the winter of 1995, a 1 ha (2.47 a) block was established near the center of each treatment area. Within each block, the location of each residual stem was mapped and diameter, height, crown area and live crown length were measured using a survey laser. The objective of this part of the study is the long-term monitoring of residual tree growth. Results from the 1 ha mapped blocks (architectural maps) show that the treatments have resulted in very different stand structures. Residual basal area of the shelterwood cut was double (19 m^2/ha) that of the diameter limit cuts and 92% of the shelterwood basal area/crown area was in trees > 21 m (70') tall. Whereas in the diameter-limit harvests approximately 25% of the basal area was in trees between 12.3-21.3 m (41-70') tall and a higher percentage of crown area (35-45%) was found in this canopy layer.

Because the canopy mapping is such a time-consuming process, the canopy maps were used as baseline data for testing the use of geostatistical sampling techniques to predict canopy structure. A 6 m x 6 m grid was established within each 1 ha plot for a total of 289 points. At each point an observer looked straight up through a sighting tube to determine whether or not canopy was present; the observer also looked straight down to detemine if regeneration was present. Semivariograms and kriging were used to model and map the spatial pattern and structure of canopy. Kriged maps showed a higher percentage of the area consisted of "gaps" in the diameter-limit harvests compared to the shelterwood. Kriged maps were compared to architectural maps and the accuracy of predicting presence/ absence of canopy ranged between 54-56%. Seventy-five percent of the error came from incorrectly noting canopy presence in field and 25% came from incorrect gap predictions from the model. In the next phase of the project, the scope and methodology will be modified to minimize these types of errors.

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