World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:14, No:07, 2020

Inverted Diameter-Limit Thinning: A Promising Alternative for Mixed Populus tremuloides Stands Management

Authors : Ablo Paul Igor Hounzandji, Benoit Lafleur, Annie DesRochers

Abstract : Introduction: Populus tremuloides [Michx] regenerates rapidly and abundantly by root suckering after harvest, creating stands with interconnected stems. Pre-commercial thinning can be used to concentrate growth on fewer stems to reach merchantability faster than un-thinned stands. However, conventional thinning methods are typically designed to reach even spacing between residual stems (1,100 stem ha^{-1}, evenly distributed), which can lead to treated stands consisting of weaker/smaller stems compared to the original stands. Considering the nature of P. tremuloides's regeneration, with large underground biomass of interconnected roots, aiming to keep the most vigorous and largest stems, regardless of their spatial distribution, inverted diameter-limit thinning could be more beneficial to post-thinning stand productivity because it would reduce the imbalance between roots and leaf area caused by thinning. Aims: This study aimed to compare stand and stem productivity of P. tremuloides stands thinned with a conventional thinning treatment (CT; 1,100 stem ha^{-1}, evenly distributed), two levels of inverted diameter-limit thinning (DL1 and DL2, keeping the largest 1100 or 2200 stems ha^{-1}, respectively, regardless of their spatial distribution) and a control unthinned treatment. Because DL treatments can create substantial or frequent gaps in the thinned stands, we also aimed to evaluate the potential of this treatment to recreate mixed conifer-broadleaf stands by fill-planting Picea glauca seedlings. Methods: Three replicate 21 year-old sucker-regenerated aspen stands were thinned in 2010 according to four treatments: CT, DL1, DL2, and un-thinned control. Picea glauca seedlings were underplanted in gaps created by the DL1 and DL2 treatments. Stand productivity per hectare, stem quality (diameter and height, volume $stem^{-1}$) and survival and height growth of fill-planted P. glauca seedlings were measured 8 year post-treatments. Results: Productivity, volume, diameter, and height were better in the treated stands (CT, DL1, and DL2) than in the un-thinned control. Productivity of CT and DL1 stands was similar 4.8 m^3 ha^{-1} $year^{-1}$. At the tree level, diameter and height of the trees in the DL1 treatment were 5% greater than those in the CT treatment. The average volume of trees in the DL1 treatment was 11% higher than the CT treatment. Survival after 8 years of fill planted P. glauca seedlings was 2% greater in the DL1 than in the DL2 treatment. DL1 treatment also produced taller seedlings (+20 cm). Discussion: Results showed that DL treatments were effective in producing post-thinned stands with larger stems without affecting stand productivity. In addition, we showed that these treatments were suitable to introduce slower growing conifer seedlings such as Picea glauca in order to re-create or maintain mixed stands despite the aggressive nature of P. tremuloides sucker regeneration.

Keywords : Aspen, inverted diameter-limit, mixed forest, populus tremuloides, silviculture, thinning
Conference Title : ICSFM 2020 : International Conference on Silviculture and Forest Management
Conference Location : Tokyo, Japan
Conference Dates : July 14-15, 2020