EFFECTS OF SUBSOILING ON WOODY ROOTS OF JEFFREY PINES ON TWO DIFFERENT SOIL TYPES

William J. Otrosina and Shi-Jean S. Sung

Institute of Tree Root Biology, United States Department of Agriculture, Forest Service, 320 Green Street, Athens, GA 30602

This study was initiated to determine the long term effects of subsoiling to alleviated soil compaction due to use of mechanized harvesting equipment in forest stands. Two stands having a predominance of 90 to 110 years old Jeffrey pines (*Pinus jeffreyi* Grev. & Balf.) were selected for this investigation. Each stand was located on the Milford Ranger District of the Plumas National Forest on the eastern slope of the Sierra Nevada mountains of northeastern California. One stand has a volcanically derived soil and the other stand has a granitic soil. In 1992, prior to precommercial thinning by mechanical shearing equipment, 12 permanent 1.0 ha plots were established in each stand. Four treatments performed after thinning were assigned at random to each plot. The treatments were: 1) subsoil the entire plot to a depth of 70 cm; 2) subsoil skid trails only; 3) no subsoiling; and 4) no thinning, no subsoiling treatment. Each treatment was replicated three times in each stand and all plots in both sites were subjected to a controlled burn during the spring of 1993.

Root excavations and biochemical studies were conducted during July and October of 1994 and June, 1995. Stem cambial sucrose synthase (SS), PPi-phosphofructokinase (PPi-PFK), and ATP-PFK activities were analyzed on selected trees on both study sites. Also, observations on ectomycorrhizae, woody root damage, and rooting configuration were made relative to subsoiling treatments on the two different soil types. Sucrose synthase activity from cambial tissues sampled in July was slightly lower in trees that had been lightly scorched from the controlled burn, as compared to those not scorched. ATP-phosphofructokinase activity was as active as that of PPi-PFK in July. In loblolly pine (*P. taeda* L.), ATP-PFK activity is significantly less than PPi-PFK during the active growing season. October and June SS activity was low compared to the July samples, indicating an apparent window of about 3 to 4 months of active growth between these months at this location. Activity of ATP-PFK remained at an average of 194 nmol/min.mg protein for all three sampling periods. In June, SS activity was also assayed in lateral root samples and no activity was detected.

Apparent woody root damage from the fire was observed in July and October on lateral roots that were within 6 cm of the soil surface. During June of 1995, excavations of roots were performed one meter from selected trees to a depth of 1.2 m on plots from treatments 1, 3, and 4. Lateral roots dieback was associated with degree of stand diturbance. No subsoiling, no thinning treatment had the least dieback and the subsoiling plots had the most lateral root dieback. Simply thinning the plot resulted in only moderate lateral root dieback. No new mycorrhizae or fine root growth was observed in either site, regardless of treatment. There were fewer lateral roots per m^2 in the volcanic soil site versus the granitically derived soil site. Long term observations will be necessary to evaluate effects of subsoiling on health of these stands.