Growth of Douglas-fir, lodgepole pine, and ponderosa pine seedlings underplanted in a partially-cut, dry Douglas-fir stand in south-central British Columbia

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ABSTRACT
The effects of partial cutting on seedling growth of three conifer species were studied at a very dry, hot interior Douglas-fir site near Kamloops, British Columbia. Douglas-fir *(Pseudotsuga menziesii* var. *glauca* (Beissn.) Franco), lodgepole pine (Pious *contorta* Dougl. ex Loud. var. *latifolia* Engelm.), and ponderosa pine *(Pious ponderosa* Dougl. ex. P. & C. Laws.) seedlings were planted in mechanically prepared 50 cm X 50 cm patches under different canopy conditions created by harvesting 60% of the original stand volume. The prepared areas *were* selected to represent canopy closures from open to closed, slopes from 0 to 60%, and all aspects. After six years, survival of Douglas-fir, lodgepole pine and ponderosa pine was 78%, 76% and 70%, respectively. Light level had a strong influence on survival and condition. Growth of all species increased linearly with light, and was greatest for lodgepole pi*ne,* followed by ponderosa pine and Douglas-fir. Multiple regression analysis showed that six-year seedling size was most significantly affected by total light, and only occasionally by aspect, slope, or crown closure. The best models explained 53%, 47% and 42% of the variation in diameter of lodgepole pine, ponderosa pine, and Douglas-fir, respectively. Natural abundance ^{13}C was positively correlated with light and soil moisture availability, reflecting higher photosynthetic capacity of all specks in the wetter, open canopy conditions. Patterns in isotopic discrimination also indicated greater water use efficiency of Douglas-fir and ponderosa pine than lodgepole pine under low light conditions. Underplanting stands thinned to a basal area of less than $15m^2$ per ha offers a solution to regeneration difficulties on hot, dry Interior Douglas-fir sites.
Key words: partial (titling, Douglas-fir, lodgepole pine, ponderosa pine, light, soil moisture, ^{I3}C, growth, survival, Opax Mountain Silvicultural Systems Project