

Influence of canopy treatments on the growth of lowland totara under a regenerating kānuka forest

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Podocarpus totara (totara) and *Prumnopitys taxifolia* (matai) were the dominant emergent trees in pre-human lowland North Canterbury forests. As a result of deforestation, limited seed sources for these species restrict natural regeneration and restoration plantings are required to bring these species back. At Tiromoana Bush, a 410-ha restoration project, seral kānuka (*Kunzea robusta*) forest is widespread but lacks many later canopy angiosperm and emergent podocarp species that would have dominated these forests historically. This is likely because of seed dispersal limitation and reduced light levels due to the dense kānuka canopy. Because totara seedlings are light demanding and unlikely to naturally regenerate under a closed canopy, this study looked at the potential of different canopy treatments that include creating gaps by felling and ringbarking of kānuka to enhance the establishment and growth of totara. Seedling height and survival were measured over six years after establishment. Seedlings under artificial gaps grew significantly taller and faster than those under the closed canopy. Gap creation by felling was most effective in improving light condition and explained the largest amount of the variance in height growth. Gap creation is likely to be an important tool for the return of late-successional woody canopy and emergent species to regenerating kānuka stands both through providing ideal sites for the growth of light demanding species such as totara and through natural establishment of other future canopy trees (angiosperms) into the gaps.