

Environmental factors influencing the Douglas fir invasion of Nothofagus forest.

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Douglas fir (*Pseudotsuga menziesii*) was introduced to New Zealand in 1859 for timber and in the last few decades has been recognised as an invasive species, particularly into grassland. Our aim was to investigate the environmental factors influencing the Douglas fir invasion of a mountain beech (*Nothofagus solandri* var. *cliffortioides*) forest at Cora Lynn, near Arthur's Pass.

Our study site is a mature mountain beech forest which adjoins an 80 ha Douglas fir/Corsican pine plantation. In the first part of the study we remeasured the density of Douglas fir seedlings in three permanent plots established in the native forest in 1989. Secondly, we conducted a root competition and fertilizer addition experiment (consisting of four treatments: control, fertilizer, trenching, and fertilizer + trenching) in 544 naturally occurring Douglas fir seedlings in the native forest. In the last part we established 400 random points in the native forest to measure the distance of the nearest seedling to each point. The light availability at all 544 seedlings and 400 random points was assessed using hemispherical photography (light estimates extracted with the CIMES package).

The fertilizer treatment increased Douglas fir seedling growth significantly, but trenching did not. Light availability had a stronger influence on the growth of seedlings than the fertilizer/trenching treatments, but even so seedlings were common in dark sites with canopy openness as low as 5%. The density of Douglas fir seedlings in the permanent plots has increased 12 fold since 1989, and seedlings were found within 1m radius at 88% of the 400 random points. This shows that Douglas fir is definitely invading the Nothofagus forest, albeit slower than invasion into grassland. We hope to raise attention to the slow but existing process of invasion of the native forest.

Light availability in the understory showed to have more influence on the seedlings' growth than did competition for nutrients. The plants were found in dark sites with canopy openness as low as 5%. Seedlings were found within 1m radius in 88% of the 400 random points, and while the distance to the point increased as the light availability decreased, it does not appear to limit their establishment. We hope to raise attention to Douglas fir's potential to invade native forests in New Zealand before the spread scales, as seen in other conifer species.