CONIFER REGENERATION AND DROUGHT: A CONTRC SOUTHERN LIMIT OF THE WESTERN CANADIAN BORI

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Previous analyses indicate that the distribution of coniferous boreal forest in the Prairie Provinces is generally restricted to areas with moist climates (mean annual precipitation greater than mean potential evapotranspiration). However, at least two different mechanisms could explain this relationship. First, the dry climates found in the regions south of the boreal forest may exert a direct restriction on conifer distribution, by inhibiting seedling establishment and survival. Alternatively, dry climates may have indirectly limited conifer distribution prior to European settlement, by producing a high fire frequency that prevented conifers from reaching a seed-bearing age.

The objective of this study was to examine direct influences of climatic moisture regimes on conifer regeneration in Saskatchewan. Because conifers are naturally absent from the drier climate zones, plantations and shelterbelts of mature conifers were used as study sites. A total of 100 sites were selected along 5 transects, each extending southward from the boreal forest, across the aspen parkland, to the semi-arid grasslands. Most sites were abandoned farmsteads, and white spruce (Picea glauca) was the most commonly encountered species. At each site, a survey of spontaneously regenerating conifer seedlings was conducted.

A semi-quantitative Regeneration Index (RI) was used to quantify the success of seedling establishment. The index was based on seedling abundance as a percentage of the number of mature, cone-bearing conifers (to a maximum of 100 mature conifers) as follows: RI=0, 0%; RI=1, 1-9%; RI=2, 10-29%; RI=3, 30-100%; and RI=4, >100%. (i.e., for RI=4, there were more than 100 seedlings or seedlings were more numerous than mature conifers).

Regeneration from planted white spruce was greatest in the southern boreal forest (mean and SE of Regeneration Index = 3.1 ± 0.3, N=25 sites) and in the northern portion of the aspen parkland (RI=2.8 ± 0.3, N=25). However, in the southern aspen parkland, white spruce regeneration was significantly reduced (RI=1.8 ± 0.3, N=25), while in the semi-arid grassland region, regeneration was negligible (RI=0.3 ± 0.1, N=25). Colorado spruce (Picea pungens) and Scots pine (Pinus sylvestris) showed similar decreases in regeneration in the southern aspen parkland and grassland regions.

The results indicate that even in the absence of frequent fires and other disturbances, conifer stands would probably be incapable of perpetuating themselves under the dry climatic regimes presently found in the southern aspen parkland and grassland. The negative effect of drought on seedling survival seems the most likely explanation. However, the good regeneration encountered at some of the northern aspen parkland locations suggests that fire regimes in the past may have prevented conifers from occupying the southern portion of their potential distribution in certain areas of Saskatchewan.

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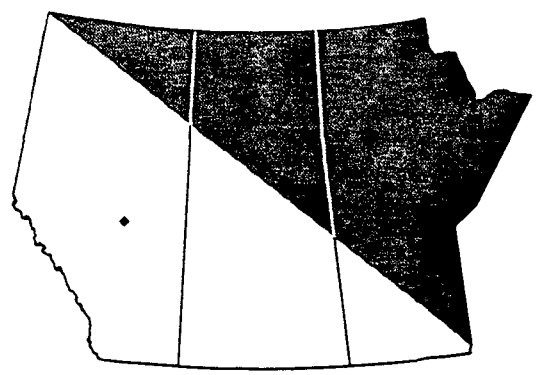

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