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Simulating Site-Specific Effects of a Changing Climate on Jack Pine Productivity Using a Modified Variant of the CROPLANNER Model

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ABSTRACT

This study evaluated the site-specific effects of projected future climate conditions on the productivity of jack pine (Pinus banksiana Lamb.) plantations over the next 50 years (2011-2061). Climatic parameters as predicted by the Canadian Global Climate Model in association with a regional spatial climatic model, under 3 emissions scenarios (no change (NC), B1 and A2), were used as input values to a biophysical-based site-specific height-age model that was integrated into the CROPLANNER model and associated algorithm. Plantations managed under a basic silvicultural intensity on two site qualities at each of two geographically separated sites (northeastern and northwestern Ontario, Canada) were assessed. The results indicated that the stands situated on low-to-medium quality sites at both locations were largely unaffected by the predicted increase in temperature and precipitation rates. Conversely, however, stands situated on good-to-excellent quality sites grown under the B1 and A2 scenarios experienced consequential declines in stand development rates resulting in decreases in rotational mean sizes, biomass yields, recoverable end-product volumes, and economic worth. In addition to providing a plausible range of site-specific climate change outcomes on jack pine productivity within the central portion of the species range, these results suggest that future predictions that do not account for potential climate changes effects may overes- timate merchantable productivity on the higher site qualities by approximately 15%. As demonstrated, in-corporating biophysical-based site index functions within existing forest productivity models may repre- sent a feasible approach when accounting for climate change effects on yield outcomes of boreal species.

KEYWORDS

B1 and A2 Emission Scenarios; Low-to-Medium and Good-to-Excellent Site Qualities; Basic Silvicultural Intensity Regimes

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