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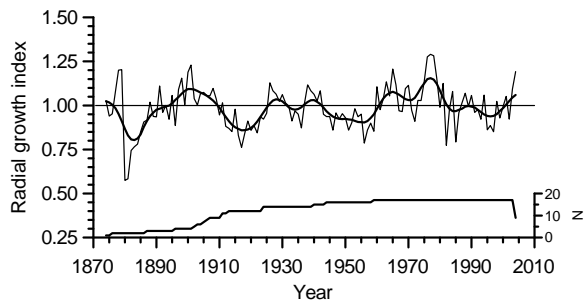
Climate and the growth of lodgepole pine in Alberta

CHHIN S., HOGG, E.H., LIEFFERS, V.J. AND HUANG, S.

Lodgepole pine is the most common tree species in the foothills of the Rocky Mountains and it also plays an important role in the lower-elevation forests of western Alberta. This note reports on tree-ring studies of how lodgepole pine responds to climate.

Methods: We collected cores or cross-sectional stem samples of lodgepole pine trees from 65 stands, spread over four ecoregions of Alberta (Boreal Highlands, Foothills, Cypress Hills and Rocky Mountains). Trees of a range of crown classes were sampled. For each tree and stand, we then measured ring-growth on an annual basis and compared this to weather records modelled for each stand; growth-climate relationships for lodgepole were modelled for each of these regions. Finally, we used the growth-climate relations to model the expected changes in growth under different scenarios of climate change.

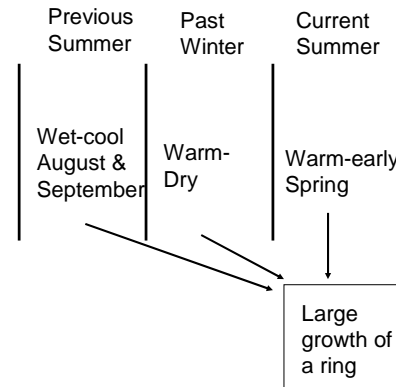
Results: There was considerable variation in ring growth across all of the stands over the last 100 years.



Ring growth of lodgepole pine (low-frequency standardized chronology) of all four ecoregions combined in relation to year. (N is the number of plots contributing to the graph).

Findings:

- 1)The growth of annual rings was related to a complex interaction of weather variables in the current and past year. Growth of this year's annual ring was stimulated by cool-wet late summer of the previous year, a warm-dry winter before and an early and warm spring.
- 2)The largest trees and smaller trees in the stand responded climate in similar ways – therefore, it is OK to sample only dominant trees.
- 3)More southerly sites in the Rocky Mountains had depressed growth in relation to Chinook events.



The best weather to grow a large annual ring in lodgepole pine

4)Predictions of future pine growth were made by linking the growth-climate relationships from tree-rings with climate projections for ecoregions in Alberta. The Boreal Highlands are projected to have a slight increase in growth under future changes in temperature and precipitation. In contrast, growth in the Cypress Hills and the Foothills is projected to decline by >5%.

Implications: The projected changes in growth under the different scenarios for climate change are not large, but even slight changes in growth might have implications for competitive dynamics in forests, *e.g.*, the pine may be outcompeted by species from lower elevations. Secondly, reduction in growth rates may affect the ability of the trees to defend against insects and diseases.

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Further Information:

Chhin, S., Hogg, E.H., Lieffers, V.J. and Huang, S. 2008. Potential effects of climate change on the growth of lodgepole pine in Alberta, Canada. *For Ecol and Manage.* 256: 1692-1703.

Chhin, S., Hogg, E.H., Lieffers, V.J. and Huang, S. 2008. Influences of climate on the radial growth of lodgepole pine in Alberta. *Botany* 86: 167-178.

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Centre for Enhanced Forest Management, Dept. of Renewable Resources, U. of A., Edmonton, AB T6G 2H1

Victor.Lieffers@ualberta.ca

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