

# CENTRE FOR ENHANCED FOREST MANAGEMENT



## ADVANCES IN FORESTRY RESEARCH

DEPARTMENT OF RENEWABLE RESOURCES

EFM RESEARCH NOTE 01/2008



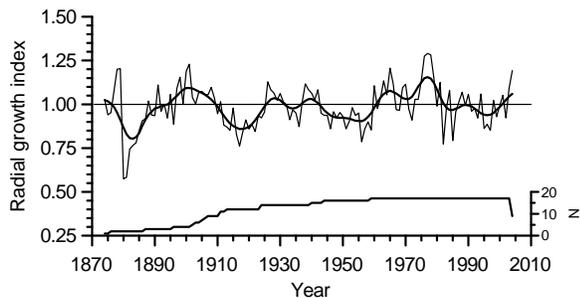
### Climate and the growth of lodgepole pine in Alberta

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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.

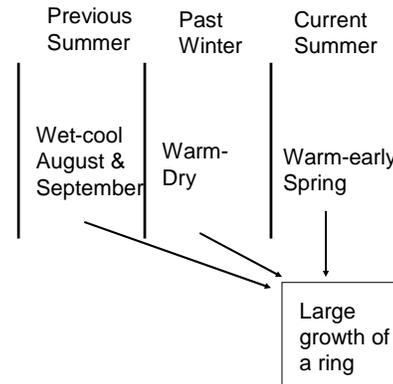
**Results:** There was considerable variation in ring growth across all of the stands over the last 100 years.



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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