High-resolution pollen-inferred paleoclimate and fire records from the southern boreal forest/aspen parkland ecotone in Saskatchewan, Canada

Jeannine-Marie St. Jacques, Catherine Hart, Mary Vetter, David J. Sauchyn and John H. McAndrews

Prairie Adaptation Research Collaborative
University of Regina
3 Sites:

North Flat Lake
AD 115-1885

Lake L03 AD 1430-2003

Lake L02 AD 1811-2003

Photo: Melissa Ranelli
North Flat Lake Pollen Relative Abundances
North Flat L. pollen ordination

Pinaus dominated

Picea dominated

Betula dominated
“Prairie-southern boreal” subset of Whitmore et al. (2005) paired pollen-climate dataset

217 sites
41 pollen taxa
Prairie-southern boreal subset can be used to infer effective moisture

(following methodology of St. Jacques et al., 2008)

25% total pollen variability explained by effective moisture
North Flat Lake Effective Moisture Reconstruction

WA-PLS 2 used ($r^2 = 0.71$).

Corroborated by Humboldt Lake, SK, diatom-inferred salinity record (Laird et al., 2003).

Manito Lake, SK, suggests cold 1st millennium (Ginn and Last, in prep.).

Prairie Effective Moisture Gradient

Important gradient (Hogg, 1994)
Lake L03 Pollen Relative Abundances
Fire: major disturbance in the boreal forest

L03 pollen taxa ordination

Mature successional taxa

Early successional taxa

PCA Axis 1 lambda = 49.1%

PCA Axis 2 lambda = 19.9%

Photo: Melissa Ranelli
Lake L03 Pollen Relative Abundances: A Fire Record

Fire frequency less early Little Ice Age?
Lake L02 Pollen Relative Abundances:
Historical fires and increasing temperatures

Actual changes due to absolute declines in *Betula* and *Alnus*. 
Conclusions:

- **North Flat Lake** pollen-climate transfer function analysis shows a very arid first millennium AD, a moist MCA, and a drier LIA.

- **Lake L03** shows a more active fire regime in the late LIA (AD 1662-1890), than in the early LIA (AD 1430-1661).

- The most recent century stands out as distinct in both Lake L02 and L03, with taxa changes consistent with drying and fire suppression.

- Interpretable changes are detectable in late Holocene, high-resolution pollen records from the boreal forest and aspen parkland. Their analysis is greatly aided by ordination and transfer function statistics.
Acknowledgements

• Cornelius Budd, Carman Dodge and Vincent Biamonte of the Forest Inventory and Resource Analysis Unit of the Saskatchewan Ministry of the Environment for their help in obtaining forestry data.

• Melissa Ranelli, Antoine Beriault and Jeremy Pittman.

• Funding for this project was provided by the Sustainable Forest Management Network and Prince Albert Model Forest.