

## Long-term dynamics of vegetation, fire, and climate in the northern boreal forest of Alaska and the Yukon

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The aim is to describe Holocene changes in climate, vegetation and accompanying fire regimes, in order to assess the role of fire in facilitating and/or responding to the observed vegetation changes. At the landscape level and over short time periods, climatic conditions cause variation in the fire regime, which in turn changes vegetation structure and the abundance of various successional stages. Little is known about how the fire regime is related to large-magnitude climate and vegetation changes, such as those that happened earlier in the Holocene, which are of a magnitude similar to that expected from anthropogenic global warming. In eastern Canada, Carcaillet et al. (2001) found evidence that climate change affected fire, which in turn drove vegetation change. However, a high-resolution pollen and charcoal record from Dune Lake in the Alaskan interior shows that a regional shift to black spruce (*Picea mariana*) dominance preceded a change to a more intense fire regime, suggesting that vegetation drove the fire response (Lynch et al. in press).

Three significant shifts in boreal forest vegetation have been recorded in interior Alaska and the Yukon: deciduous to spruce-dominated, white-spruce to black-spruce dominated, and spruce to pine-dominated. In central Alaska, black spruce increased in the mid Holocene (as at Dune Lake) but in the central Yukon, it increased along with white spruce (*Picea glauca*) in the early Holocene. In the southern Yukon, lodgepole pine (*Pinus contorta*) became a dominant species ca 2000-4000 years ago. We are also documenting climate changes based on various proxies derived from the lake sediments (e.g. Abbott et al. 2000). We now have sediment cores from paired lakes in the three regions and sediment and pollen analyses are underway. We plan to reconstruct fire histories from charcoal. In this way, we will develop a series of records of fire, vegetation, and climate across important transitions in the Holocene boreal forest.

Fieldwork in 2002 included collecting new lake cores from the southern Yukon and a reconnaissance in the Brooks Range in collaboration with A. Lloyd and C. Fastie, along a transect from the foothills (mixed black and white spruce) to the latitudinal limits of white spruce. We retrieved exploratory sediment cores from two lakes and recorded bathymetric and catchment features of two further lakes (see Lloyd report).

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## References

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(Two figures included in case they are useful).

# Dune Lake

→ present

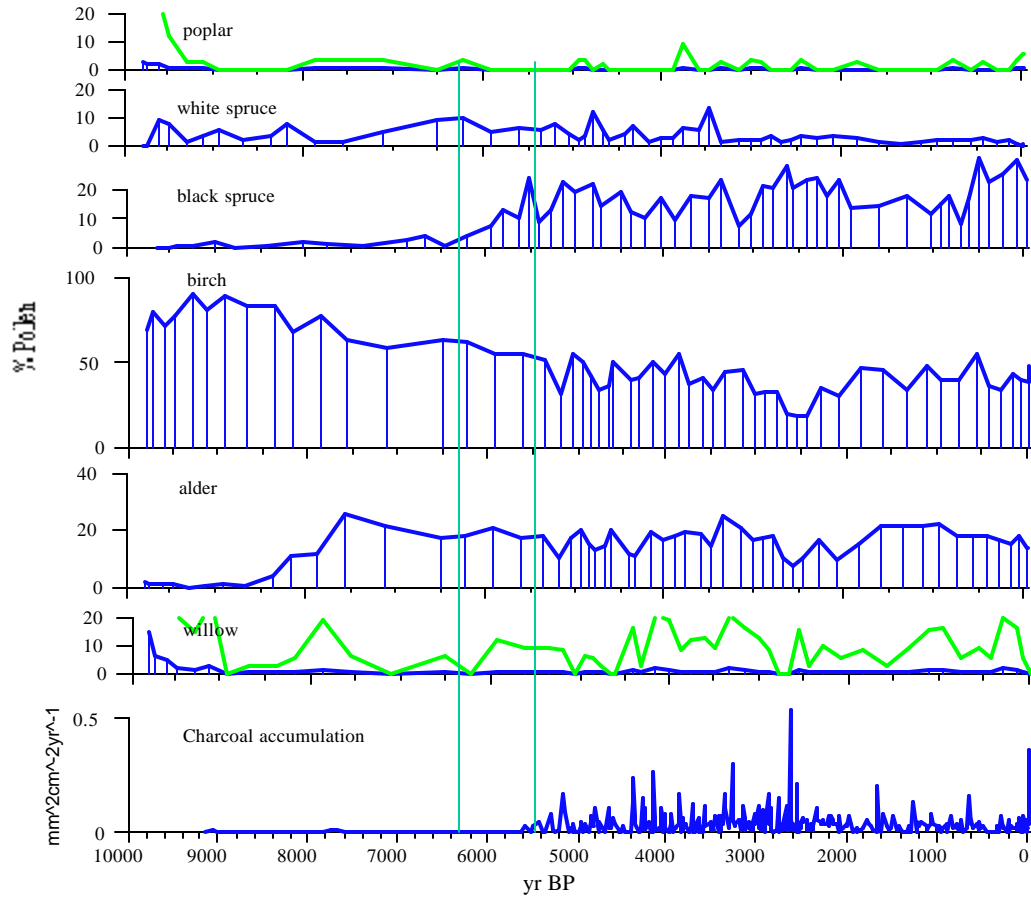


Figure: Dune Lake, major pollen taxa (%) and charcoal influx ( $\text{mm}^{-2} \text{cm}^{-2} \text{yr}^{-1}$ ) for Dune Lake, in calibrated years B.P. After Lynch et al. in press.

Figure: Climate controls fire via dryness and ignition conditions, and vegetation via a set of bioclimatic relationships that affect plant growth and reproduction and hence range limits. In turn, fire and vegetation feed back to climate via their affects on surface properties (albedo, ET, surface roughness, etc.). Fire affects vegetation as a disturbance to the ecosystem, causing succession, and vegetation structure and species morphology and flammability influence the nature of fire.

