

AN ASSESSMENT OF HOLOCENE FIRE REGIME CONTROLS IN SOUTHEASTERN BRITISH COLUMBIA, CANADA

Colin J. Courtney Mustaphi
Carleton University Paleoecological Laboratory

Introduction

Lake sediment records are used to reconstruct long term fire and vegetation histories through the analysis of macroscopic charcoal, plant remains, and pollen. These data are useful for interpreting the historical fire regime and how fire activity responded to climatic variability and changes to the vegetation cover and human activity. Knowledge about these past interactions is useful for understanding how ecosystems developed to what we see today and for informing land management decisions and projecting future scenarios or ecosystem change.

Long-Term Fire Records

Obtaining multiple records across the heterogeneous landscape of mountainous environments is crucial for examining the full variability of the fire regime and to understand the varying relative importance of the controls and influences of the fire regimes. Top-down controls of fire, such as climate, increase the synchronicity of fires throughout a region. Bottom-up controls, like topography, vegetation type, fuel conditions, and fuel connectivity are also very important. The climate of the West Kootenays is warmer and wetter than that of the East Kootenays, which has led to the development of different vegetation zones and fire regimes. To better understand the controls of the fire regime of the West Kootenays, five lake records of fire activity (Figure 1) were analyzed and showed that aspect was an important factor influencing the frequency of fire and influenced if fires across multiple watersheds were synchronous. North-facing sites burned less frequently over the past 5000 years, while south-facing sites burned more often (Figure 2). Sites sharing a similar aspect were also more synchronous at centennial time windows. Sites with opposing aspect were asynchronous at centennial time windows.

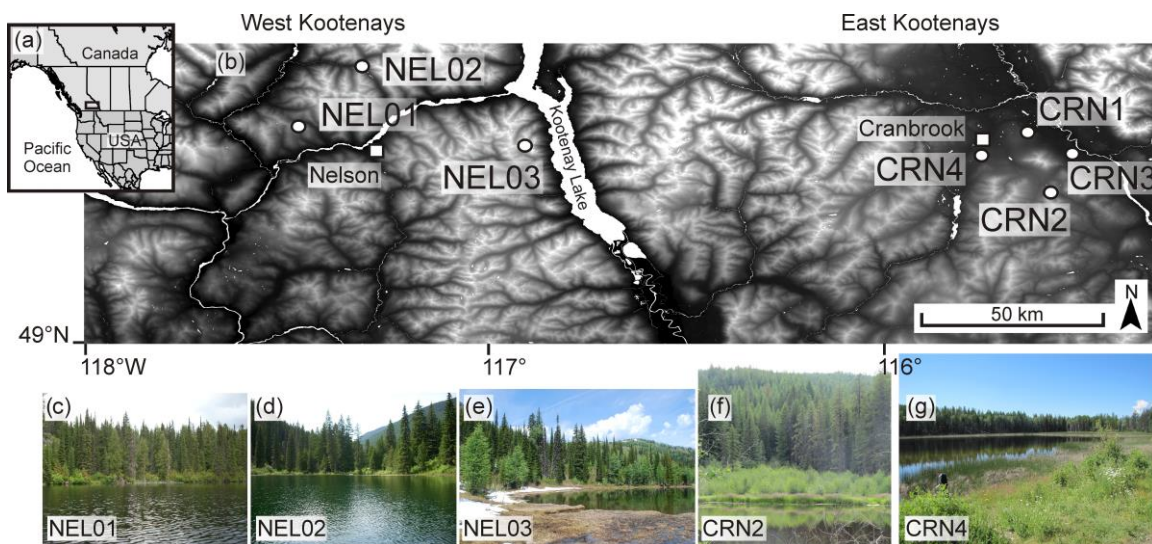


Figure 1: Locations of lake sites (a and b) and photographs at the lake sites showing surrounding vegetation cover (c to g).

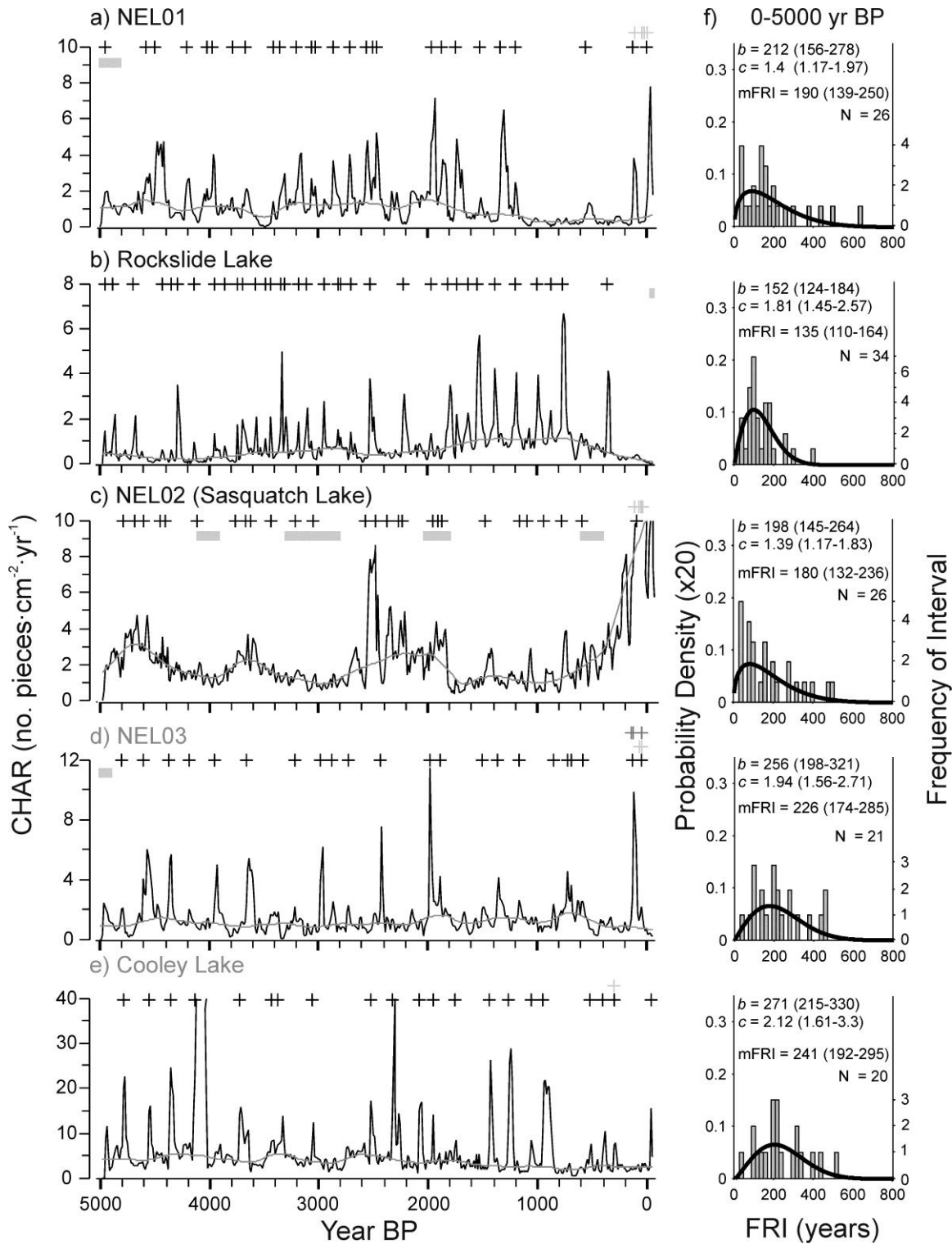


Figure 2: Fire records analyzed using CharAnalysis software showing the background charcoal accumulation rates (grey line) and the charcoal accumulation rates (black line) with the inferred fire episodes ('+' symbols) for south-facing lake sites (a to c) and north-facing sites (d and e). The histograms show the distribution of the fire return intervals (FRIs) and the Weibull modeled median FRI (Courtney Mustaphi and Pisaric, in press). Rockslide and Cooley Lake records were developed by Gavin et al., 2006.

A New Charcoal Classification System

Additionally, we have begun to classify charcoal based on morphology of the individual fragments (Figure 3). It has been shown that charcoal morphology reflects the fuel type and transport process that delivered it to the depositional environment. Charcoal morphology data is useful for adding more information to our paleoecological interpretations of the past forests and allows for quantitative multivariate analyses of the data. The charcoal classification system can be readily used by new analysts and is adaptable to new study sites in any biome through the addition or removal of charcoal morphotypes.

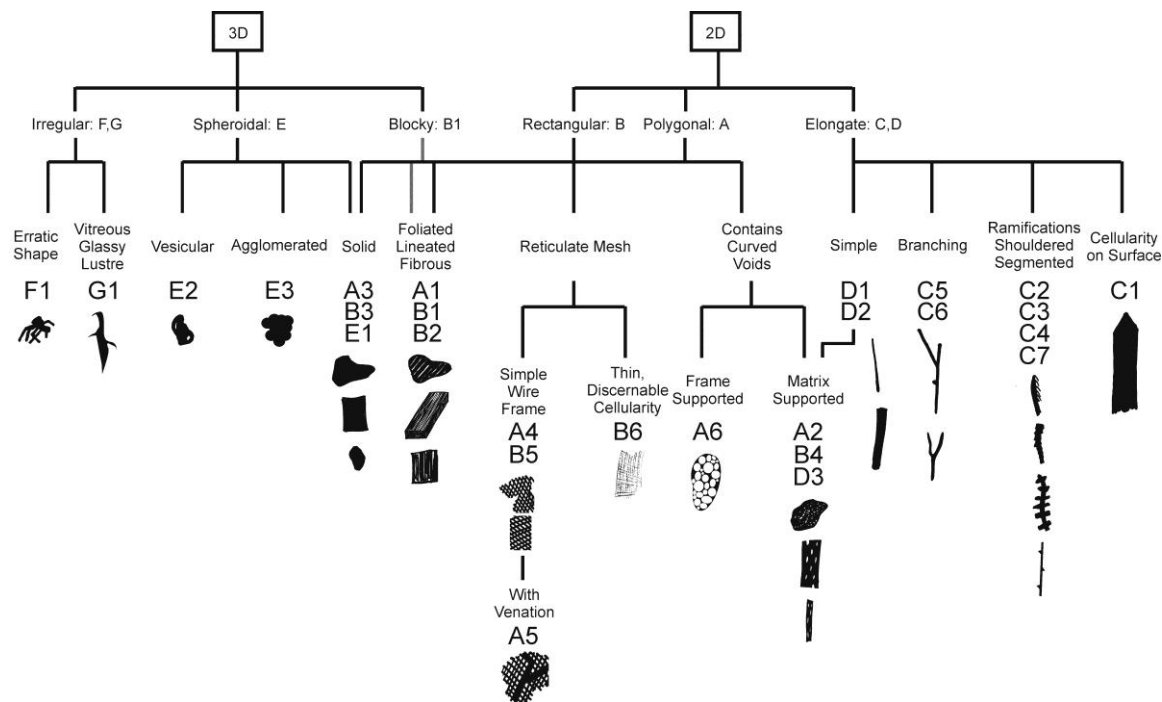


Figure 3: Identification flow chart of the 27 charcoal morphotypes identified in the Holocene lake sediments of the Kootenays.

The Holocene: 10,000-Year Fire Records

Currently, we are analyzing the full Holocene records from multiple lake sites and writing the manuscripts that will be submitted to peer-reviewed journals. These longer records will allow us to investigate the full postglacial history and development of the vegetation cover and how the fire regimes have evolved through time. It is anticipated that we will not only build a better understanding of the past in this area, but also investigate the spatial controls influencing the fire regimes in response to changes to climate, human land use, and vegetation cover.

References

- Courtney Mustaphi, CJ and MFJ Pisaric. In press. Varying influence of climate and aspect as controls of montane forest fire regimes during the late Holocene, south-eastern British Columbia, Canada. *Journal of Biogeography*
- Gavin, DG, FS Hu, K Lertzmen, P Corbett. 2006. Weak climatic control of stand-scale fire history during the late Holocene. *Ecology* 87: 1722-1732.