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Long-term Fire Incidence in Coastal Forests of British Columbia

Introduction

Fossil charcoal and pollen records from five sediment cores were used to reconstruct the post-glacial fire and vegetation history on southern Vancouver Island (Figure 1). Specifically, macroscopic charcoal fragments representative of local fire activity were used to reconstruct the post-glacial fire intervals (Whitlock and Millspaugh 1996). Studies such as this are important because they provide insight to the projected changes in distribution, composition, and fire activity of future forests under a global warming climatic scenario (Hebda 1997, 1998).

Discussion

Following deglaciation, the landscape was characterized by a lodgepole pine (*Pinus contorta*) biogeochron between ca. 14 000 - 11 500 years before present (ybp) which experienced no fire, possibly because no ignition source existed or there was a lack of available fuel for combustion (Figure 2). Mixed forests consisting of lodgepole pine, spruce (*Picea*), fir (*Abies*), western hemlock (*Tsuga heterophylla*), mountain hemlock (*Tsuga mertensiana*), and alder (*Alnus*) replaced the lodgepole pine forests in the late Pleistocene and persisted until the start of the Holocene (10 000 ybp).

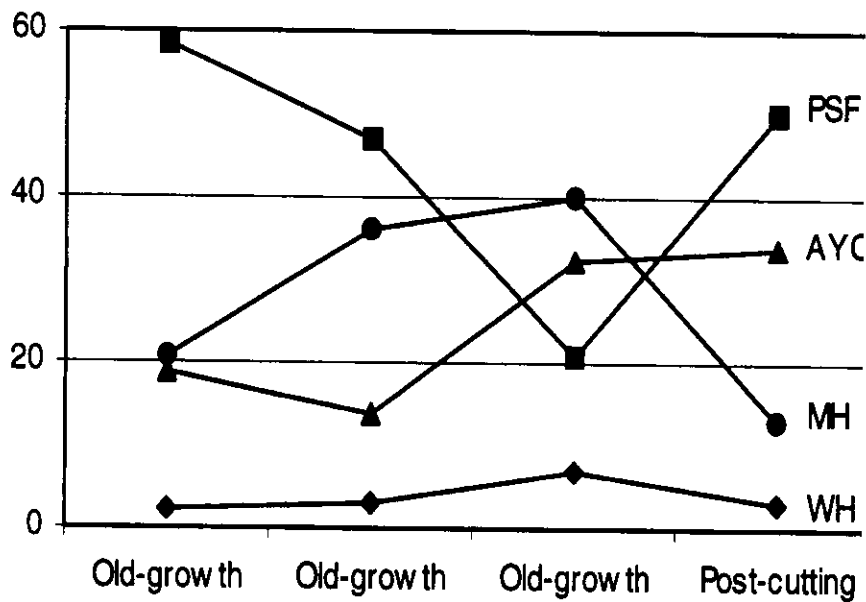


Figure 1. Regional location map showing sediment core sites analysed for both pollen and charcoal (●), charcoal only (◦), and high elevation sites currently being analysed (◻).

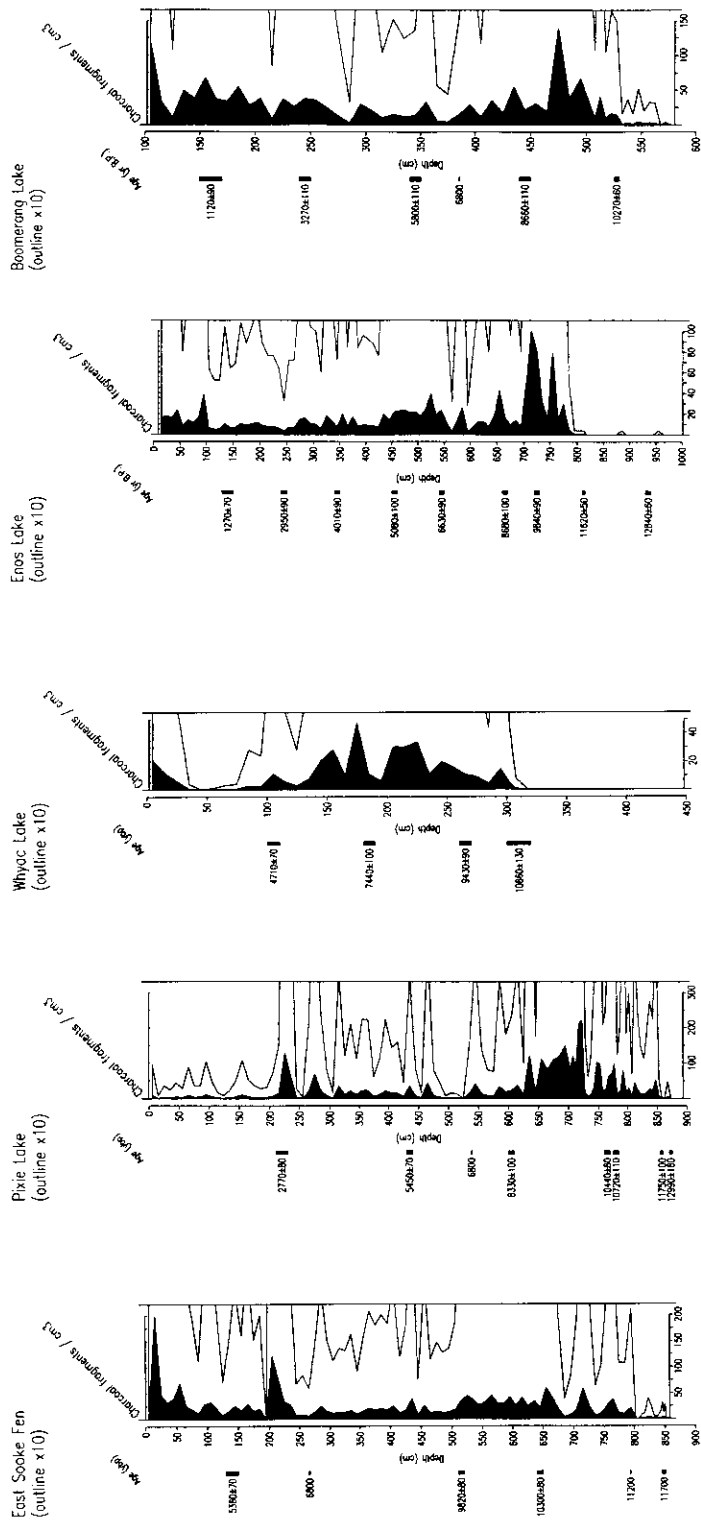


Figure 2. Charcoal profiles of sediment cores from Southern Vancouver Island. Ages are given in radiocarbon years. Sample beta numbers and descriptions are available upon request.

An increase in macroscopic charcoal concentrations at East Sooke Fen and Pixie Lake indicate fire became common during this interval. The early Holocene Xerothermic interval extended from 10 000 to 7000 ybp and is interpreted to have been 1-2°C warmer and drier than present (Hebda 1995). East Sooke Fen and Pixie Lake pollen records indicate Coastal Douglas-fir (CDF) biogeoclimatic zone-like (Meidinger and Pojar 1991) forests consisting of Douglas-fir (*Pseudotsuga menziesii*) and bracken fern (*Pteridium*) were present during this interval; whereas Whyac Lake, in a more moist climate, records Coastal Western Hemlock (CWH) zone-like (Meidinger and Pojar 1991) forests consisting of spruce, western hemlock, and possibly alder. A dramatic increase in the concentration of macroscopic charcoal fragments at Enos, Boomerang, and Pixie lakes during this interval suggests these areas experienced a profound increase in fire activity (Figure 2). Whyac Lake exhibits a minor increase in charcoal accumulation at this time. Surprisingly, charcoal concentrations remain low and even decrease in East Sooke Fen during the early Holocene, possibly because of taphonomic factors related to less rainfall for transporting charcoal, or because less forested landscapes produced fewer charcoal fragments. The warm dry early Holocene obviously experienced abundant fire and can be viewed as a 'pyrothermic' interval. Moister climate ushered in a warm wet Mesothermic interval at 7000 - 4000 ybp which was followed by neoglacial cooling between 4000 ybp and present. These moistening and cooling trends resulted in the establishment of CWH forests consisting of western hemlock and Cupressaceae species over most of southern Vancouver Island. An overall decrease in charcoal concentration suggests a regional reduction in either fire frequency or magnitude during

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this interval, although locally isolated fire events are evident in most sites (Figure 2). Charcoal-free intervals representing time intervals of ca. 3000 years occur at the more moist sites of Pixie and Whyac Lakes and imply that fire played a limited role in forest disturbance. However, the continuous deposition of charcoal at East Sooke Fen and Enos and Boomerang lakes suggests fires remained an important disturbance factor on the drier east side of southern Vancouver Island during the mid-to-late Holocene; the persistence of fire may be related to aboriginal landscape management practices at this time. A recent increase in charcoal concentration coincides with European settlement and landscape clearing.

Conclusion

Fossil charcoal and pollen collected from several sites around southern Vancouver Island show that vegetation composition and fire activity have varied considerably during the late Pleistocene and Holocene. Our results reveal that natural disturbance regimes of coastal forests were strongly shaped by climate, vegetation composition, and possibly human activity. Future forest disturbance and successional patterns may differ considerably from those of the recent past and become more comparable to those of the early Holocene Xerothermic or pyrothermic as the global warming trend progresses.

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