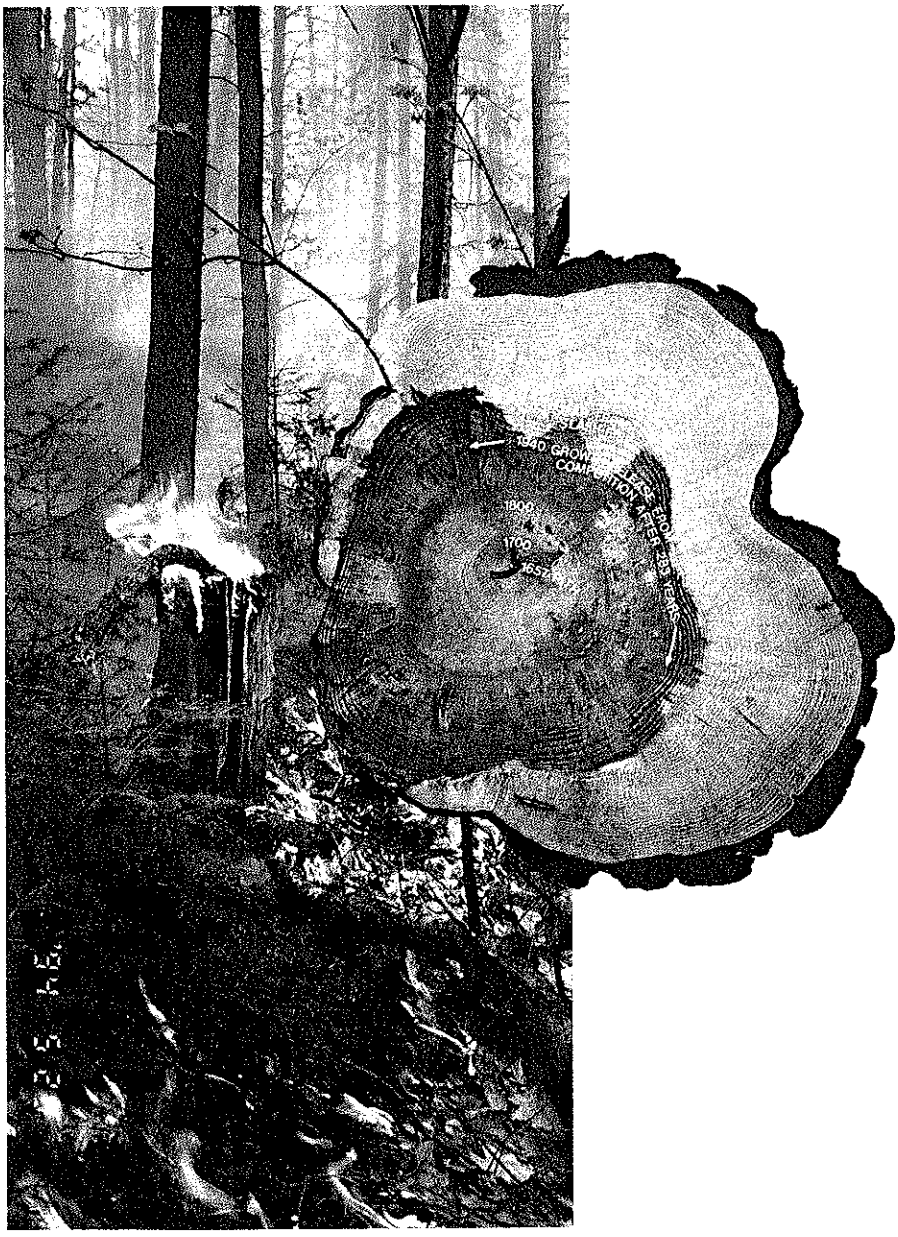
Forest Research Report No. 134

Ontario

A Dendrochronological Fire History of Opeongo Lookout in Algonquin Park, Ontario



Funded by the Sustainable Forestry Initiative

Ontario Forest Research Institute
OFRI • IRFO

Forest Research Report No. 134

A Dendrochronological Fire History of Opeongo Lookout in Algonquin Park, Ontario

by

Richard P. Guyette
1-30 Agriculture Building
School of Natural Resources
University of Missouri
Columbia, Missouri 65211

and

Daniel C. Dey
Ontario Ministry of Natural Resources
Ontario Forest Research Institute
P.O. Box 969, 1235 Queen Street East
Sault Ste. Marie, Ontario
P6A 5N5

1995

Canadian Cataloguing in Publication Data

Guyette, Richard
A dendrochronological fire history of Opeongo Lookout in Algonquin Park, Ontario

(Forest research report, ISSN 0381-3924 ; 134)
Issued by Ontario Forest Research Institute.
Includes bibliographical references.
ISBN 0-7778-4634-9

1. Forest fires—Ontario—Algonquin Provincial Park—History.
I. Dey, Dan.
II. Ontario. Ministry of Natural Resources.
III. Ontario Forest Research Institute.
IV. Title.
V. Series.

SD421.34C2G89 1995 634.9'618 C95-964094-0

Printed in Ontario, Canada

Single copies of this publication are available at no charge from the address noted below. Bulk orders may involve charges.

Ministry of Natural Resources
Ontario Forest Research Institute
P.O. Box 969
1235 Queen Street East
Sault Ste. Marie, Ontario
P6A 5N5 CANADA

Telephone: (705) 946-2981
Fax: (705) 946-2030
E-mail: ofriin@epo.gov.on.ca

Cette publication scientifique n'est disponible qu'en anglais.

Cover art: Carmen Misasi

This paper contains recycled materials.

Abstract

Guyette, Richard P. And Daniel C. Dey. 1995. A dendrochronological fire history of Opeongo Lookout in Algonquin Park, Ontario. Ontario Ministry of Natural Resources, Ontario Forest Research Institute, Sault Ste. Marie, Ontario, Forest Research Report No. 134, 4 p.

Fire-scarred stumps and natural snags of red pine (*Pinus resinosa* Ait.) on a 70-m tall bluff along Costello Creek, 2 km south of Lake Opeongo, were dated using dendrochronological methods. A fire scar chronology was constructed from 18 of the red pine samples that contained 34 dated fire scars.

The composite fire scar chronology spanned 358 years from 1636 to 1994. The fire-return interval was 46 years between 2 medium-intensity fires and was 27 years between fires of low intensity or greater. Fire frequency at the study site increased circa 1780 to a mean fire-free interval of 17 years (1780 to 1940). No fires were observed after 1940. Analysis of pith and outside ring data indicated that the fires were not of the stand replacement type. The steep topography and exposed rocky surfaces may have mitigated the effects of intense fires on stand survival. About 66% of the pines were scarred during the 2 medium-intensity fires.

The variation in fires from 1636 to 1994 is associated with the movement of people into and out of the area. Before 1780, disease epidemics killed many Natives in Ontario, and others were displaced during fur trade wars, which led to a reduction in anthropogenic fires. As a result, only 1 fire was recorded between 1636 and 1779. Beginning about 1780, Natives and later Europeans began immigrating into the study area, and fires began to increase in frequency. After 1940, efforts to suppress fires increased, and fire was practically eliminated in the study area.

Keywords: Fire history, dendrochronology, red pine, presettlement, disturbance, anthropogenic.

Acknowledgments

This study was supported by the Ontario Forest Research Institute's Great Lakes-St. Lawrence Silviculture Program. We are grateful to Matt Myers and the Algonquin Park Staff for their assistance in site selection.

Table of Contents

List of Figures

Introduction

Anthropogenic fire has influenced vegetation at the landscape level since humans first arrived in North America. Natives used fire to cultivate ecosystems for their benefit. Fire was used for hunting animals, increasing browse and forage for game animals, improving the production of berry-producing plants, and conducting warfare, as well as for agricultural purposes (Pyne 1982, Dickason 1992, Kidwell 1992).

The arrival of European immigrants between 1600 and 1800 displaced Native populations in eastern North America and altered their traditional subsistence economies. New forest disturbance regimes, particularly those dominated by fire, accompanied the Native migrations. In ecosystems where Native populations were decimated by European diseases (Dobyns 1983, Rousseau and Brown 1990, Trigger 1990, Trigger and Day 1994), abrupt population declines reduced ignition sources and fire frequency. The Algonquin and other First Nations of Ontario, who frequented the Opeongo area, lost more than half of their people to European diseases from 1634 to 1640 (Rousseau and Brown 1990, Trigger and Day 1994). In addition, the traditional movements of Natives throughout central Ontario were altered when the Iroquois drove the Hurons, Algonquins and other tribes from their homelands (circa 1649).

A site that reflects how humans have affected the landscape and fire activity is an area along Costello Creek, south of Lake Opeongo, Algonquin Park, Ontario. In this report, we present a fire history of this area derived from a tree-ring analysis of fire-scarred red pine (*Pinus resinosa* Ait.) remnants. We associate changes in the fire regime of this site with fluctuations in human population levels and changes in how people use fire to manipulate the environment.

Methods

The study site is on a 70 m tall bluff along Costello Creek, 2 km south of Lake Opeongo, Algonquin Park, Ontario (Figure 1). The area is known as Opeongo Lookout and contains an extensive ground cover of *Vaccinium* spp. growing under an open, patchy red pine overstory. The fringe of pine along the bluff merges into a hardwood forest above the study site.

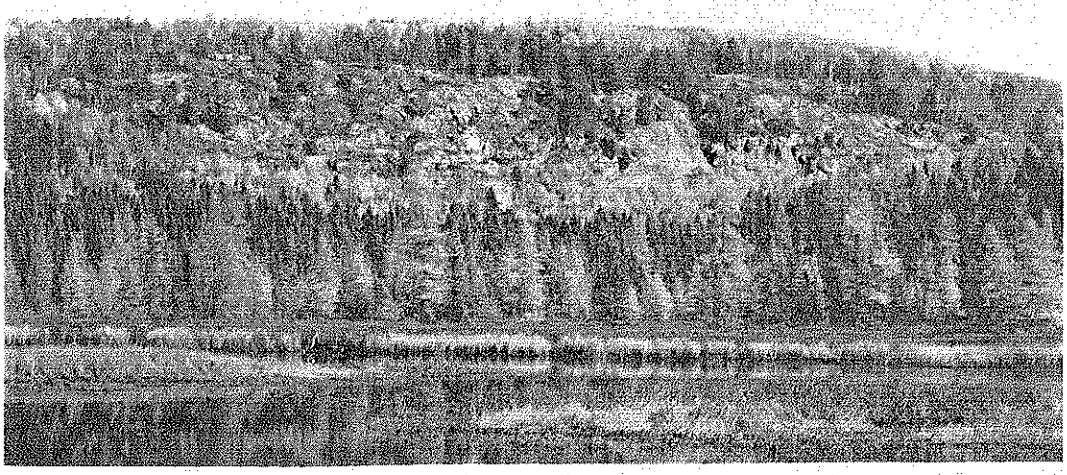


Figure 1. Site of the fire history study. Red pine stumps and natural remnants were sampled on a bluff along Costello Creek, Algonquin Park, Ontario.

Using dendrochronological methods, fire-scarred stumps and natural remnants of red pine were dated. A fire scar chronology was constructed from 34 dated fire scars on 18 pine remnants sampled along a 1-km section of bluff. Samples were obtained from windthrown stems, stumps and standing snags. The samples were selected based on their soundness, size, number of rings, and completeness of the tree ring series, and the presence of fire scars. For each sample, compass orientation of the cross-section, slope and aspect were recorded.

All pines sampled had charcoal present on the bole and fire scars. For this study, fire scars were defined as wounds occurring low on the tree bole and were identified by a callus tissue and growth response to the death of a cambial section.

The detailed observations of annual rings necessary for cross-dating required that cross-sections be surfaced to reveal the structure of the rings. Cross-sections were surfaced using an electric hand planer with a sharp carbide blade. If rings were very narrow or indistinct, the ring structure and cellular detail were revealed using sandpaper (220 to 600 grit), fine steel wool, or razor cuts.

Ring-width series from each sample were measured and plotted. Plots were used for visual cross-dating (Stokes and Smiley 1968, Guyette and Cutter 1991). The COFECHA computer program (Holmes et al. 1986) was used to ensure the accuracy of both relative and absolute dating of the samples. A floating chronology (undated in absolute time) was established from the samples with the highest common ring-width variance. Absolute dating of the pine remnants was accomplished by ring-width comparisons with a red pine dating chronology constructed from old living trees from Trap Bay on Lake Opeongo, 15 km northeast of the study site (Guyette and Dey, unpublished).

Results and Discussion

The composite fire scar chronology spanned 358 years from 1636 to 1994 (Figure 2). The fire-return interval between 2 medium-intensity fires was 46 years, while the return interval for fires of low intensity or greater was 27 years. Only 1 fire was observed from 1636 to 1779. Fire frequency at the site increased circa 1780 to a mean fire-free interval of 17 years (1780 to 1940). No fires were observed after 1940. Based on the pith or outside ring date distributions, no stand replacement fires occurred. The steep topography and exposed rocky surface of the study site may have mitigated the effects of intense fire. Sixty-six percent of trees were scarred in the 2 medium-intensity fires.

Changes in tree ring indices (Cook et al. 1992; Guyette, unpublished) indicate that the climate did not change significantly during the period of this chronology. Thus, the abrupt change in fire frequency beginning in 1780 could not be due to climatic factors, such as drought or lightning frequency. The increase in fires probably resulted from a change in human-initiated ignitions at the study site.

In the mid-17th century, European diseases may have decimated the local Native population near the study site. Hessel (1993) reviewed early outbreaks of diseases such as smallpox and reports mass death among the Algonkins and Kichesippirini, who inhabited the Algonquin Park and Ottawa Valley areas. Thus, in the early 1600s, before the tree-ring record at the study site starts, disease epidemics may have dramatically affected the fire-disturbance regime. Then about 1780, as Natives and Europeans began reoccupying the area, the fire frequency increased abruptly. This new fire regime continued through the era of the first colonization roads (circa 1860s) (Shaw 1994) and into the modern era of fire suppression.

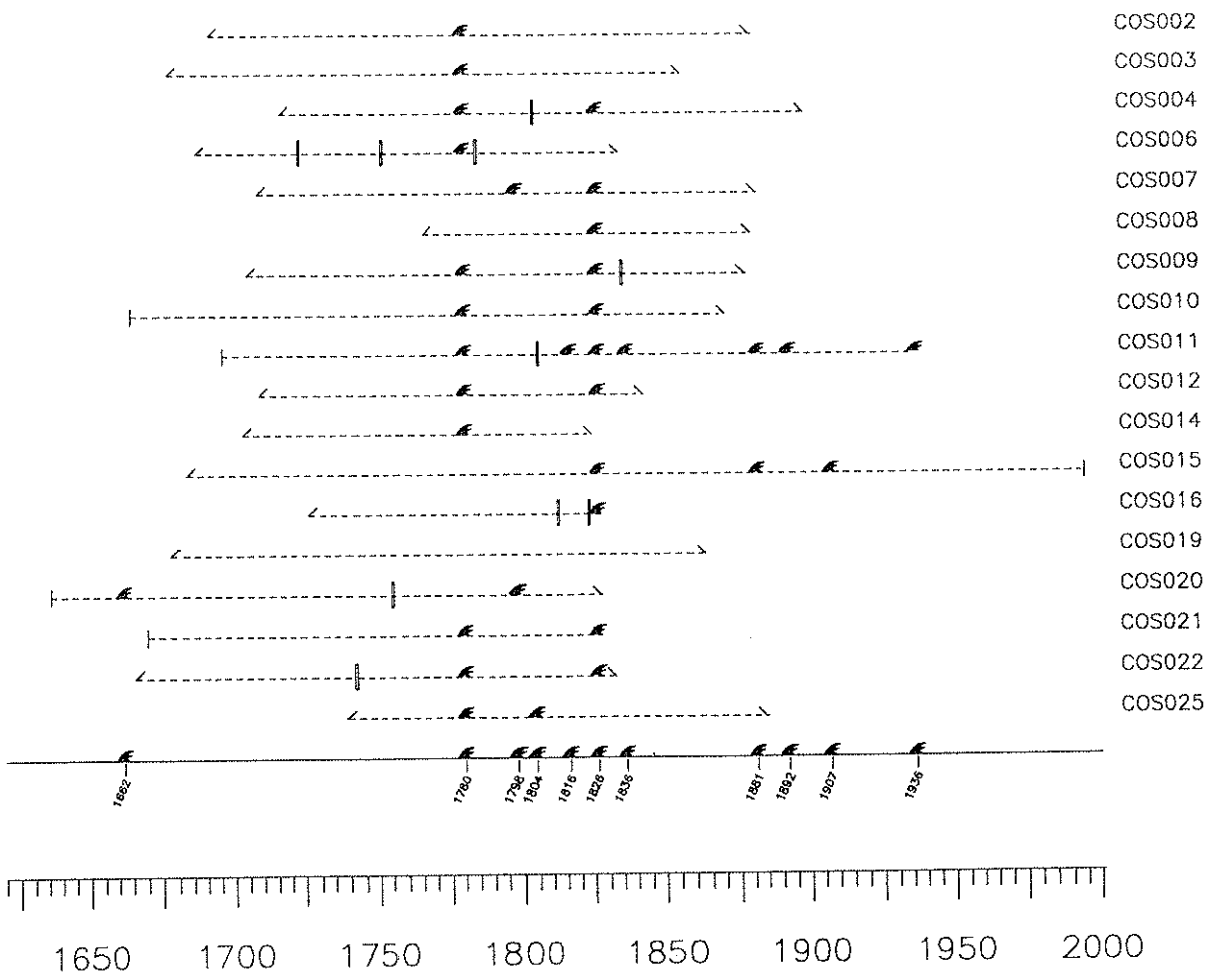


Figure 2. A plot of dated samples and their associated fire scars, injuries, pith dates and outside rings, as well as a composite fire chronology. Solid flames indicate fire scars. The long vertical bars indicate injuries that may or may not have resulted from fires. Short, thin vertical bars indicate pith dates, and thin slanted bars indicate inside and outside rings of the sample.

Summary

A composite fire scar chronology was developed for the period from 1636 to 1994 for a red pine stand on a bluff along Costello Creek, near Lake Opeongo, Algonquin Park. The fire-return interval was 46 years between fires of medium intensity or greater and was 27 years between fires of low intensity or greater. Only one fire was observed between 1636 and 1779. Fire frequency at the study site increased abruptly in 1780. From 1780 to 1940, the mean fire-free interval was 17 years. No fires were observed after 1940.

Abrupt changes in fire frequency from 1636 to 1994 were attributed to changes in human population levels and activities in the study site area. This fire chronology began at a time when Ontario Native populations were being decimated by European diseases.

In addition, the influence of Europeans and the fur trade caused major shifts in concentrations of Natives in Ontario. Invasions by the Iroquois in the mid-17th century displaced many of the Native inhabitants of central Ontario. The significant increase in fire frequency, beginning in 1780, is associated with the immigration of Natives and Europeans into the study area. The lack of fire after 1940 was due to increased efforts to suppress fires.

Literature Cited

Cook, E.R.; Stahle, D.W.; Cleaveland, M.K. 1992. Dendroclimatic evidence from eastern North America. *In* Climate since AD 1500. Bradley, R.S.; Jones, P.D. (eds.). Routledge, London. 679 p.

Dickason, O.P. 1992. Canada's first nations: a history of founding peoples from earliest times. McClelland & Stewart Inc. Toronto, ON. 590 p.

Dobyns, H.F. 1983. Their numbers become thinned, Native American population dynamics in eastern North America. University of Tennessee Press. Knoxville, TN. 378 p.

Guyette, R.P.; Cutter, B.E. 1991. Tree-ring analysis of fire history of a post oak savanna in the Missouri Ozarks. Natural Areas Journal 11: 93-99.

Hessel, P. 1993. The Algonkin Nation. Kichesippi Books. Arnprior, ON, Canada. 124 p.

Holmes, R.L.; Adams, R.K.; Fritts, H.C. 1986. Quality control of crossdating and measuring: a users manual for the program COFECHA. *In* Tree-ring chronologies of western North America: California, eastern Oregon and northern Great Basin. Laboratory of Tree-Ring Research, University of Arizona, Tucson, Arizona. pp. 41-49.

Kidwell, C.S. 1992. Systems of knowledge. Chapter 13. *In* America in 1492 the world of the Indian peoples before the arrival of Columbus. A.M. Josephy, Jr. (ed.). Alfred A. Knopf. New York. pp. 369-403.

Pyne, S.J. 1982. Fire in America. Princeton University Press. Princeton, NJ. 654 p.

Rousseau, J.; Brown, G.W. 1990. The Indians of northeastern North America. *In* Readings in Canadian history pre-confederation. R.D. Francis; D.B. Smith (eds.). Third edition. Holt, Rinehart and Winston of Canada, Limited. Toronto, ON. pp. 3-16.

Shaw, S.B. 1994. The Opeongo. General Store Publishing House. Burnstown, ON. 103 p.

Stokes, M.A.; Smiley, T.L. 1968. Introduction to tree-ring dating. University of Chicago Press. Chicago, IL. 78 p.

Trigger, B.G. 1990. The French presence in Huronia: the structure of Franco-Huron relations in the first half of the seventeenth century. *In* Readings in Canadian history pre-confederation. R.D. Francis; D.B. Smith (eds.). Third edition. Holt, Rinehart and Winston of Canada, Limited. Toronto, ON. pp. 16-48.

Trigger, B.G., G.M. Day. 1994. Southern Algonquian middlemen: Algonquin, Nipissing, and Ottawa, 1550-1780. *In* Aboriginal Ontario historical perspectives on the First Nations. E.S. Rogers, D.B. Smith (eds.). Ontario Historical Studies Series. Government of Ontario. Dundurn Press. Toronto, ON. pp. 64-77.