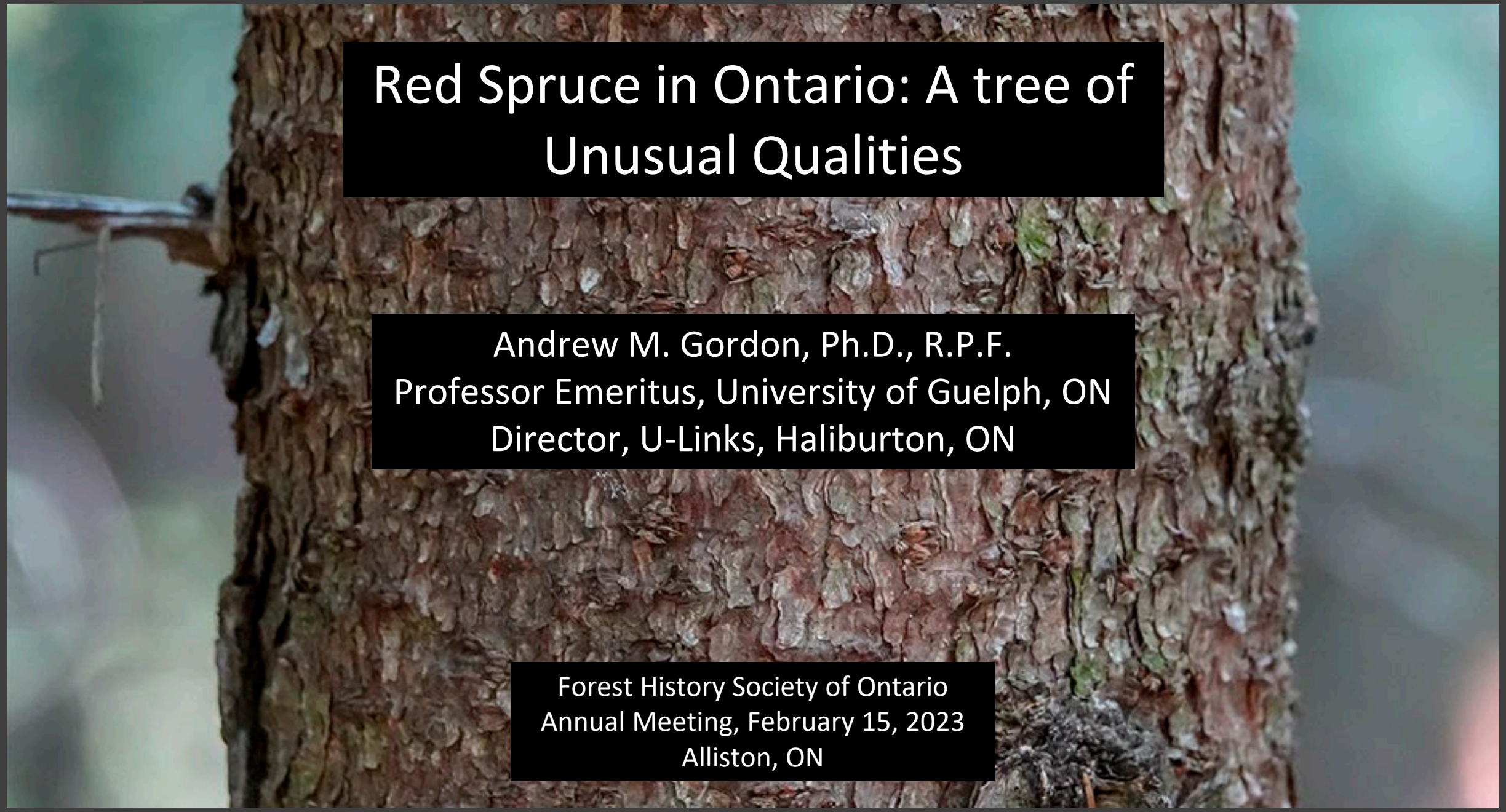


Red Spruce in Ontario: A tree of Unusual Qualities

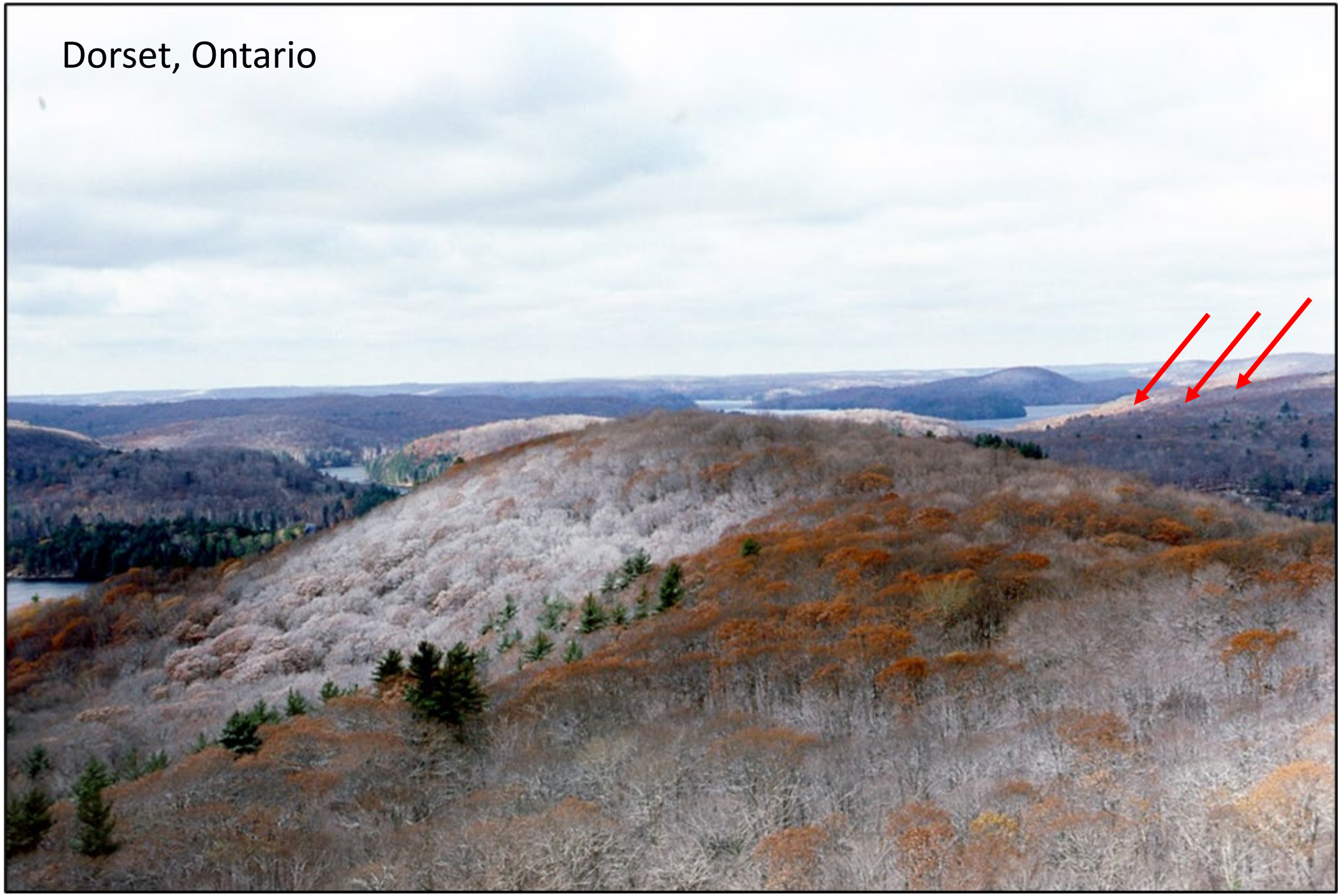
Andrew M. Gordon, Ph.D., R.P.F.
Professor Emeritus, University of Guelph, ON
Director, U-Links, Haliburton, ON

Forest History Society of Ontario
Annual Meeting, February 15, 2023
Alliston, ON

Outline

- Description, Site Relationships, Uses, Range
- Alan G. Gordon, B.Sc.F. (‘54), Ph.D. (‘58)
- Discovery in Ontario
- Is red spruce a hybrid of white spruce and black spruce?
- Red spruce provenance trials and ‘Piceta’
- Fate
- Further Reading/Resources


Red Spruce Stand, West Virginia


Dorset, Ontario

Red Spruce (*Picea rubens* Sarg.)

- yellow spruce, West Virginia spruce, eastern spruce, he-balsam
- Medium-sized tree conifer, can grow to > 350-400 years
- Often difficult to identify, esp. where range overlaps with black spruce
- Thrives in cool, moist climates: ‘north temperate’ vs ‘boreal’
- Mostly acid soils, pH – 4.0 - 5.5
- Shallow till soils, usually with compaction at 0.5 m
- Organic soils overlying rocks in high elevations areas

Compact Till Habitat

From Leak, W. B. and J. R. Riddle. 1979. Why Trees Grow Where They Do In New Hampshire Forests. U.S.D.A. For. Serv. Pub. No. NE-INF-37-79

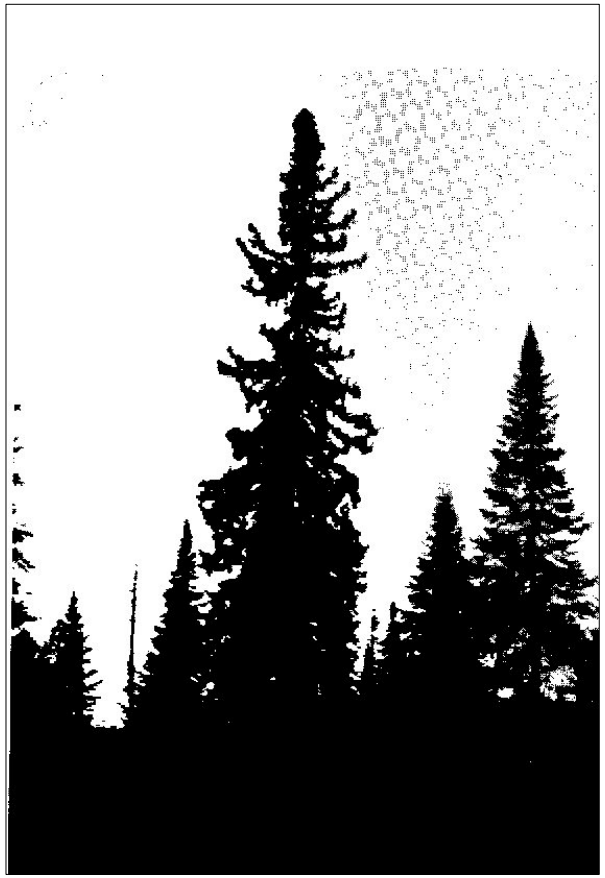
Branches extend horizontally, then curve up – ‘Pagoda’ like

Adirondacks

Finlayson Twp., Algonquin Park

Compare with White Spruce Crowns!

Broad, pendant Crown
central Ontario



Long, linear Crown
central/northern Ontario

Spike-type Crown
central Ontario

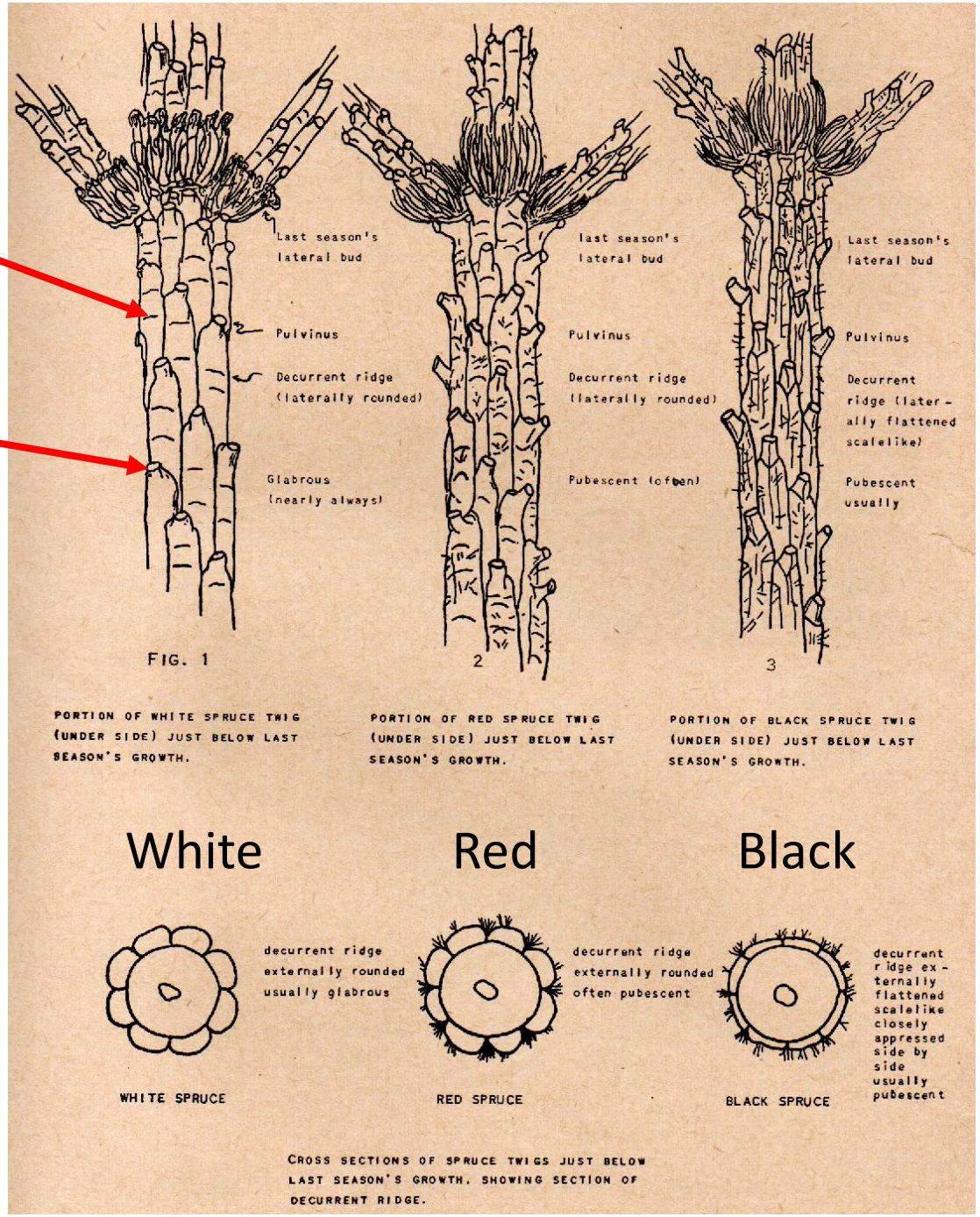
Black spruce

Long, narrow, linear Crown
Alaska

Twig Morphology of the 3 eastern spruces

Decurrent Ridge

Pulvinus
(bears 1 needle)



Source: Gordon, A. G. 1952. Spruce identification by twig characteristics. For. Chron 28(3):45-47.

Red Spruce- a tree of many uses

Lumber
Pulp

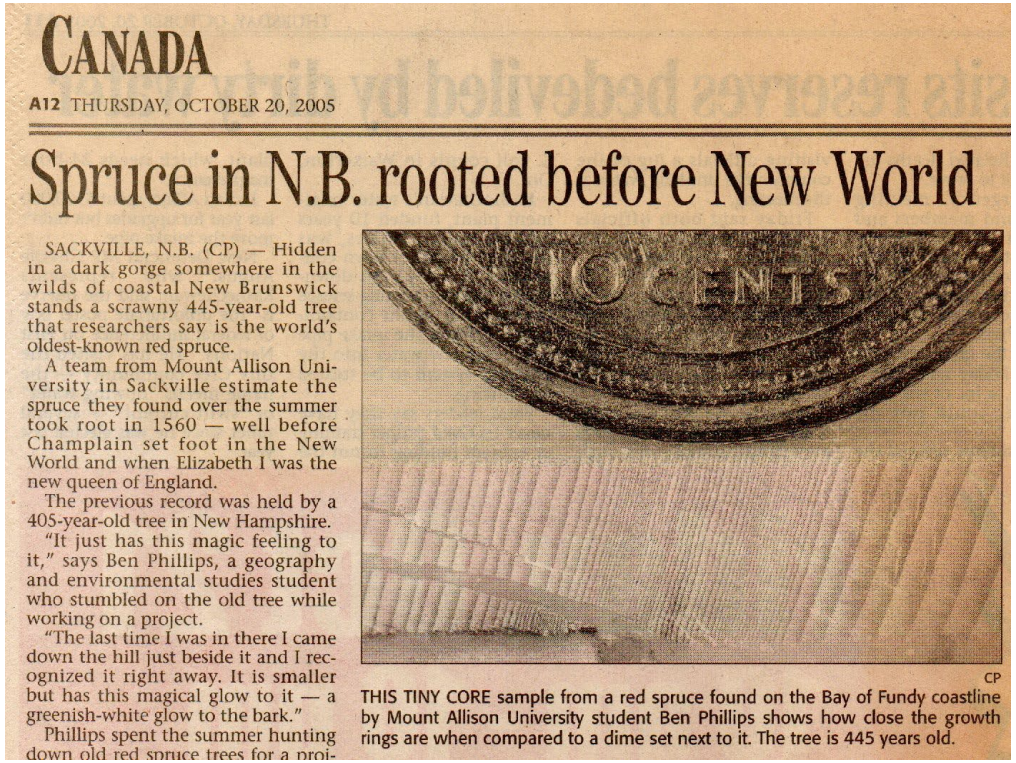
Harvested Red Spruce, Bancroft, Ontario, 1973

Red spruce – other uses …

- Poles, pilings, boatbuilding/cooperage stock

  Flakeboard, plywood - recently

- Deer – Spruce grouse – Mice/voles
- Acoustical Properties …



CANADA

A12 THURSDAY, OCTOBER 20, 2005

Spruce in N.B. rooted before New World

SACKVILLE, N.B. (CP) — Hidden in a dark gorge somewhere in the wilds of coastal New Brunswick stands a scrawny 445-year-old tree that researchers say is the world's oldest-known red spruce.

A team from Mount Allison University in Sackville estimate the spruce they found over the summer took root in 1560 — well before Champlain set foot in the New World and when Elizabeth I was the new queen of England.

The previous record was held by a 405-year-old tree in New Hampshire.

"It just has this magic feeling to it," says Ben Phillips, a geography and environmental studies student who stumbled on the old tree while working on a project.

"The last time I was in there I came down the hill just beside it and I recognized it right away. It is smaller but has this magical glow to it — a greenish-white glow to the bark."

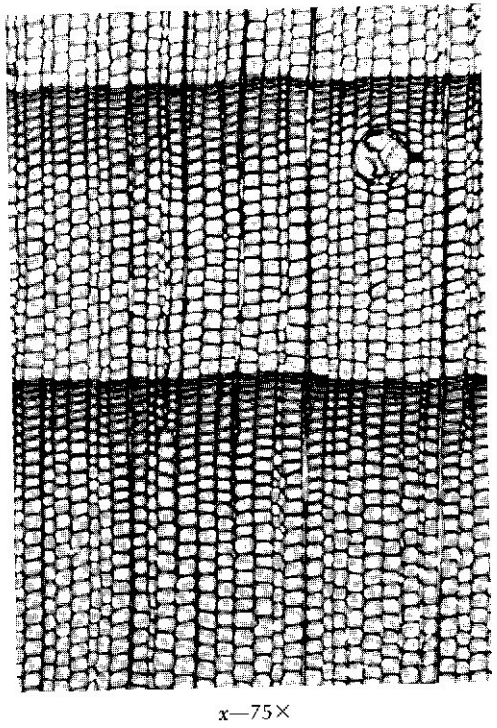
Phillips spent the summer hunting down old red spruce trees for a proj-

CP

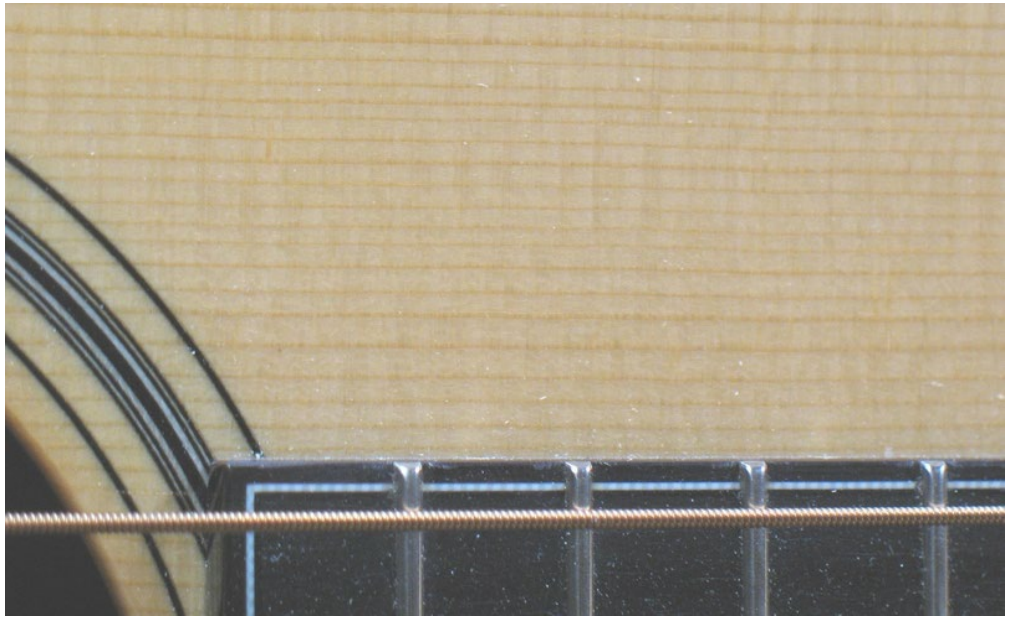
THIS TINY CORE sample from a red spruce found on the Bay of Fundy coastline by Mount Allison University student Ben Phillips shows how close the growth rings are when compared to a dime set next to it. The tree is 445 years old.

Now, 463 years old!

1783 Beginning – Algonquin Park

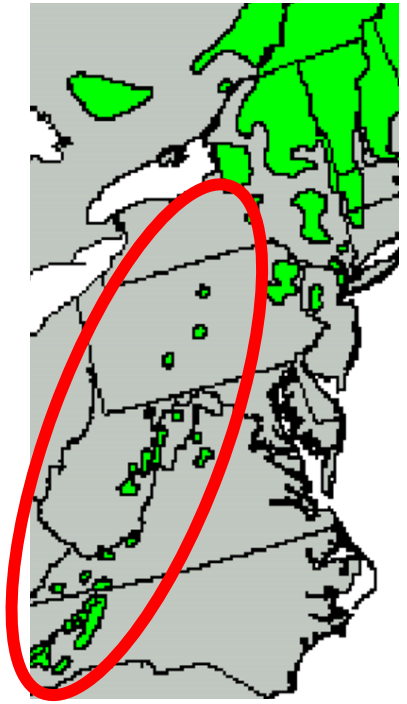


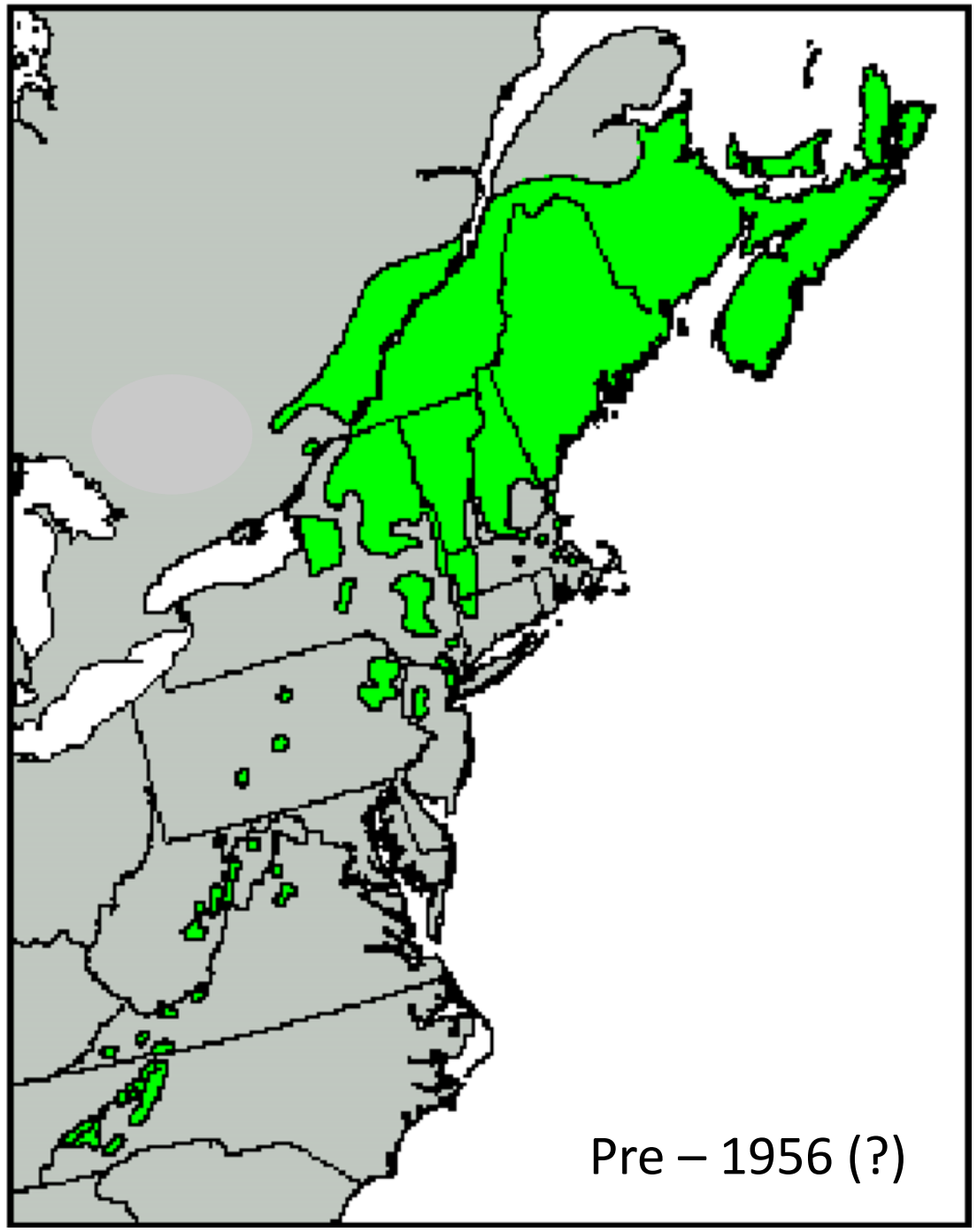
x—75×

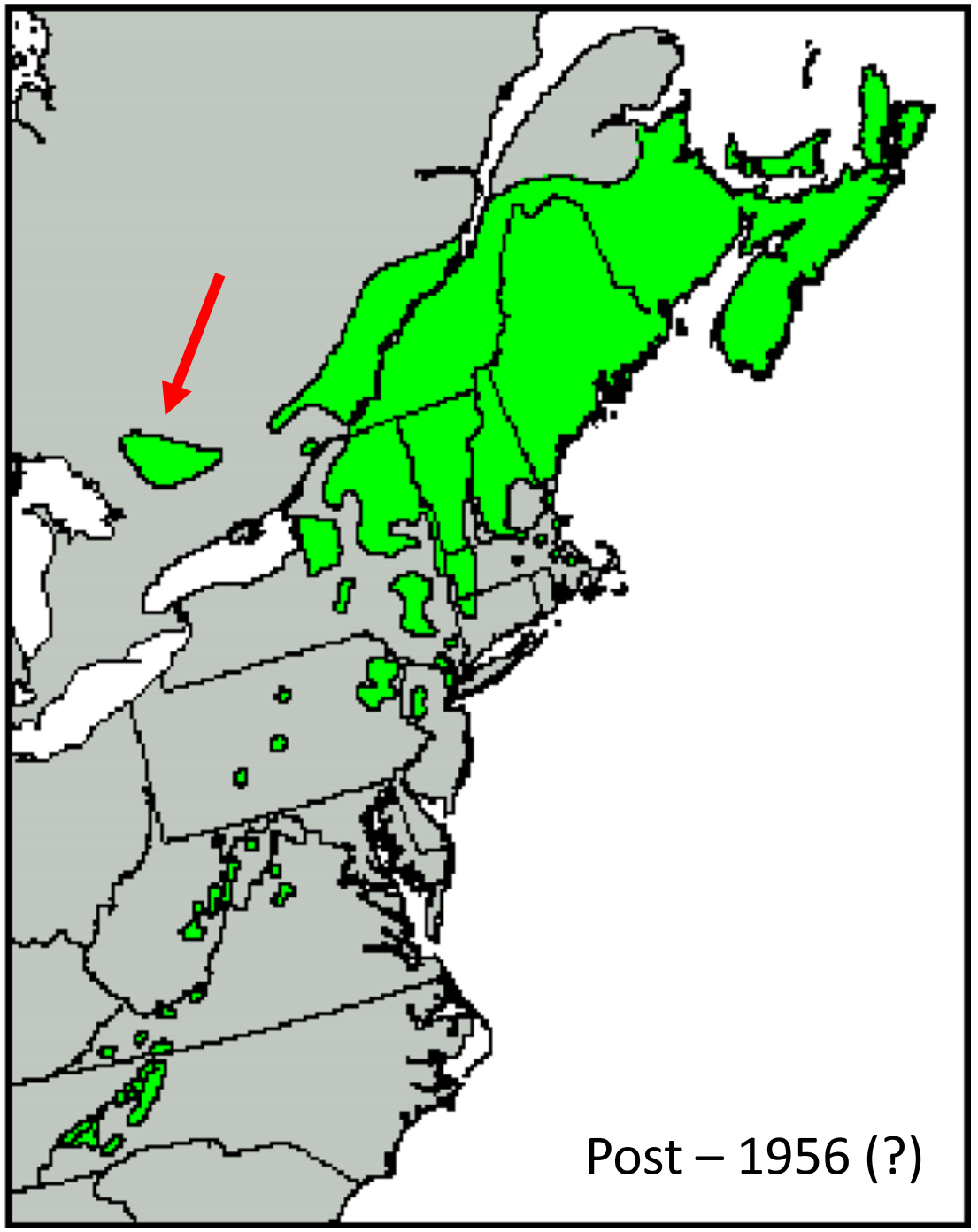


… guitars, piano sounding boards, mandolins, organ pipes, and violin bellies …

Resurgence of use for ‘bluegrass music’

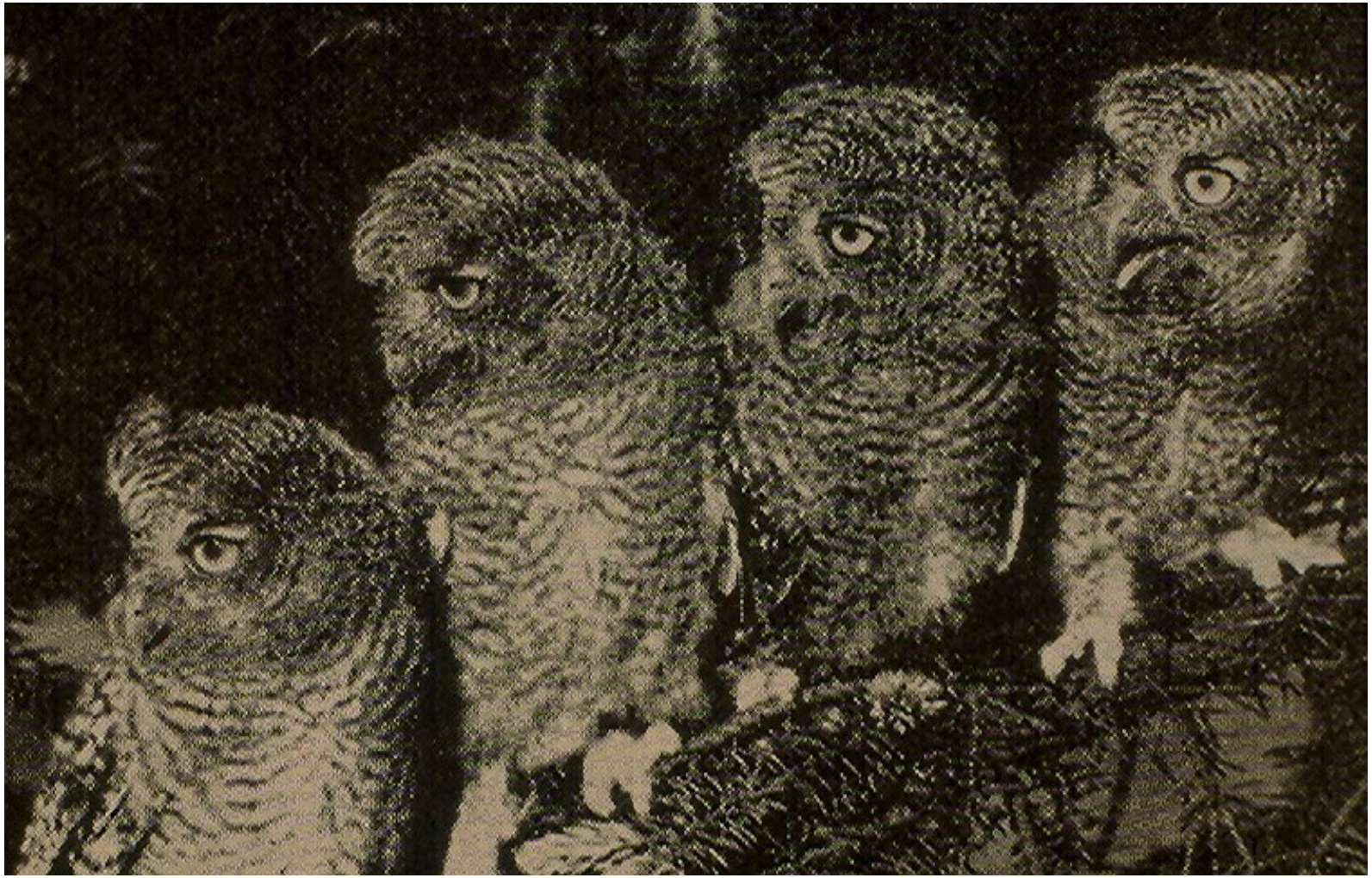



Pre – 1956 (?)


Post – 1956 (?)

Alan G. Gordon (1929 – 2019)

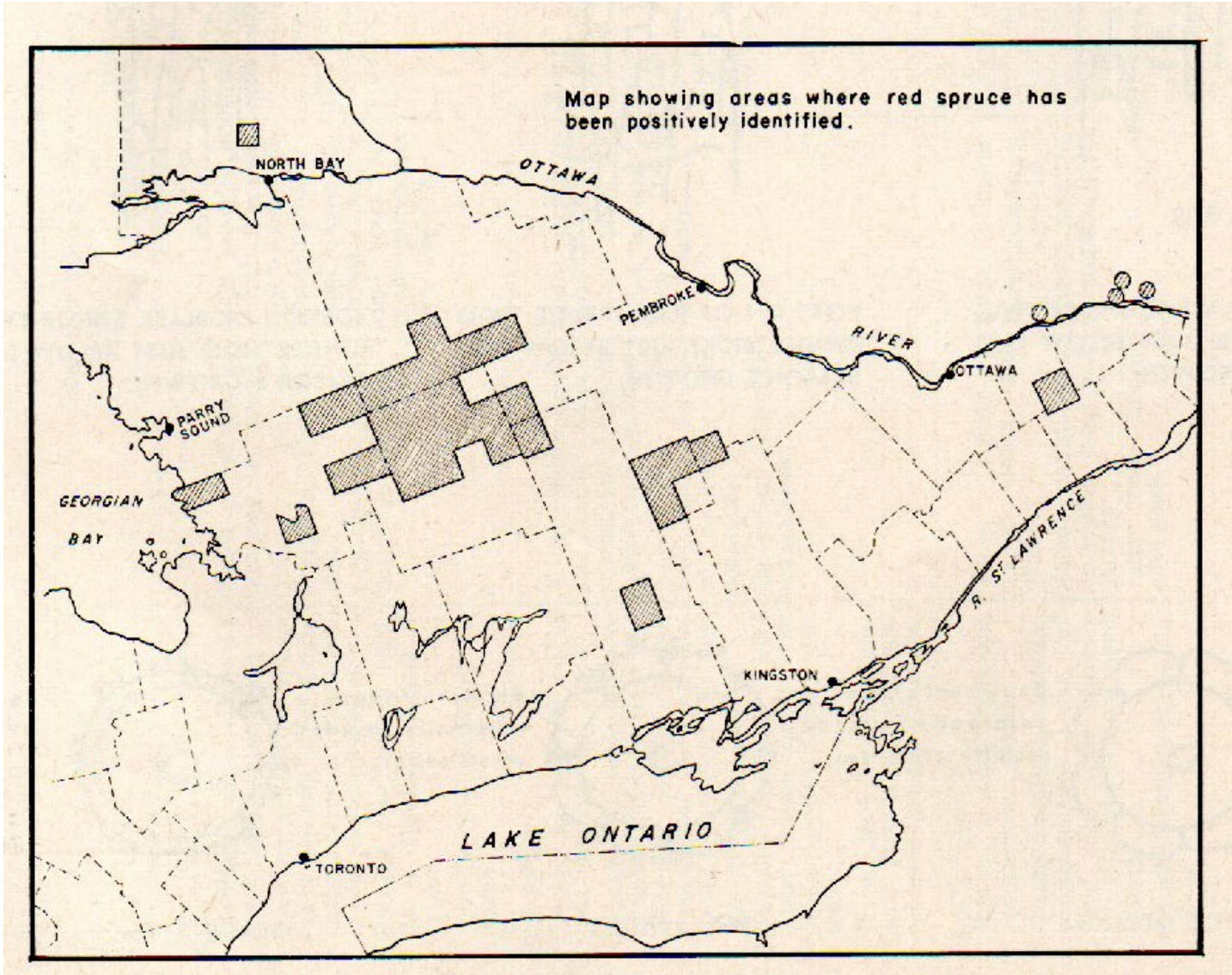
Age 12



Abitibi River
Country, 1947

With Yellow birch, Swan Lake, 1950

The Discovery!



'map has been superceded'

Red Spruce in Ontario

A Tree of Unusual Qualities

by Alan G. Gordon

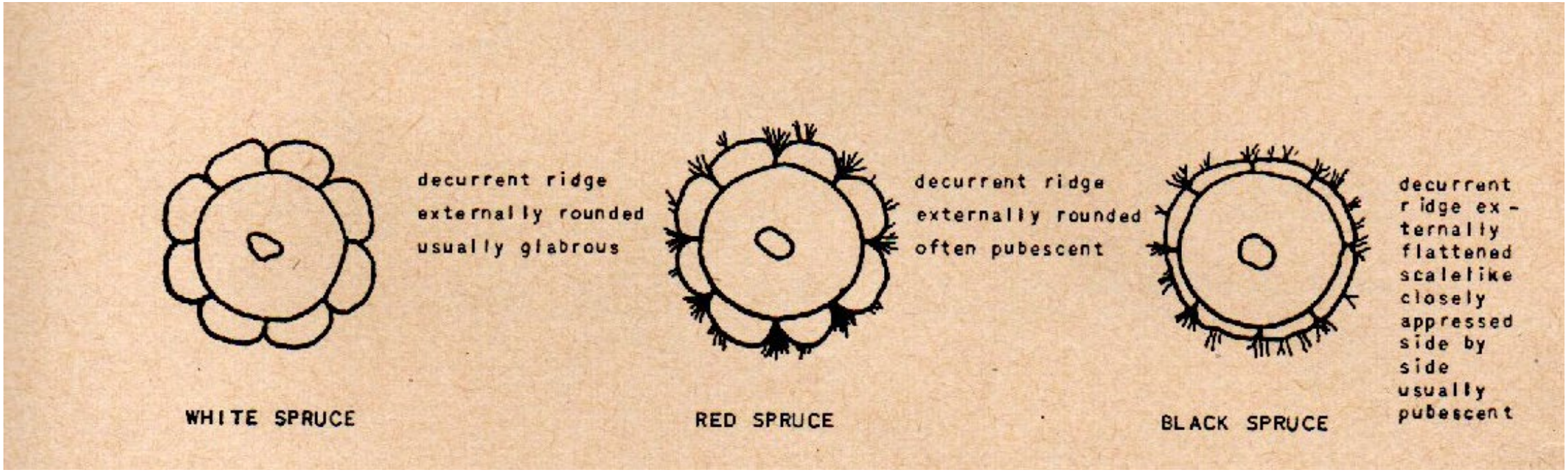
(PHOTOS BY THE AUTHOR)

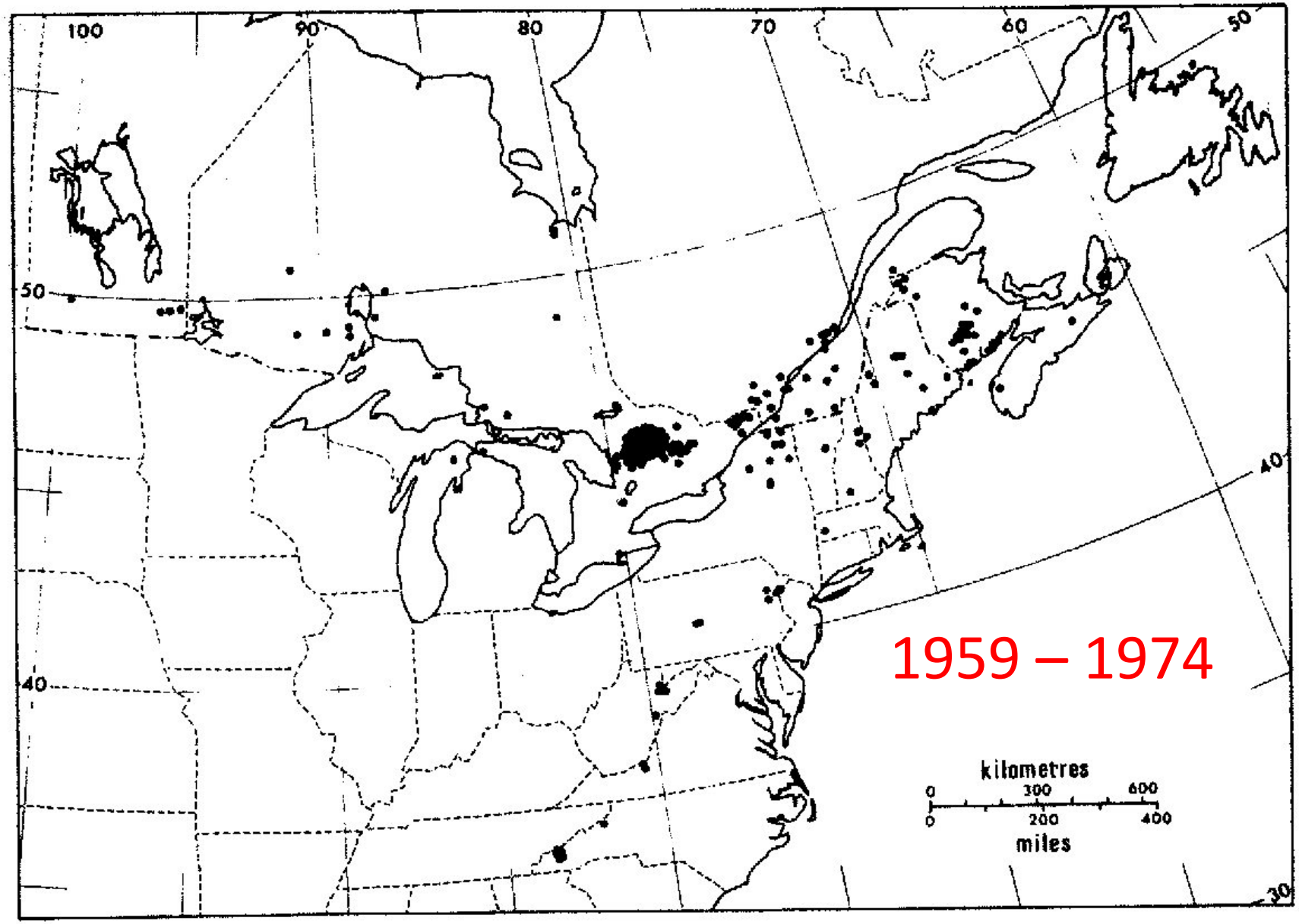
THIS article describes the work of the Division of Research in confirming the occurrence of red spruce in Ontario; determining the extent of its range, and the possible uses of the species in forest culture. This has involved extensive travel and the preparation of a new set of identification features to enable the quick and easy separation of red spruce from black and white. We have progressed far enough in the study of characteristics and uses to know that this tree has some unusual qualities that will make it valuable in managing the forest.

Red spruce occurs throughout the forests of the temperate region, from the Southern Appalachian Mountains through the Adirondacks to the Maritime forests of Maine, Nova Scotia and New Brunswick, and across the St. Lawrence to the Laurentian Mountains in Quebec. The occurrence of the species in Ontario was talked of for many years, but apparently properly authenticated records were not prepared until the Division of Research

Gordon, A. G. 1957. Red spruce in Ontario – A tree of unusual qualities. Sylva 13(1):1-7.

Is red spruce a hybrid between white spruce and black spruce – if not, what is it relationship to other spruces?



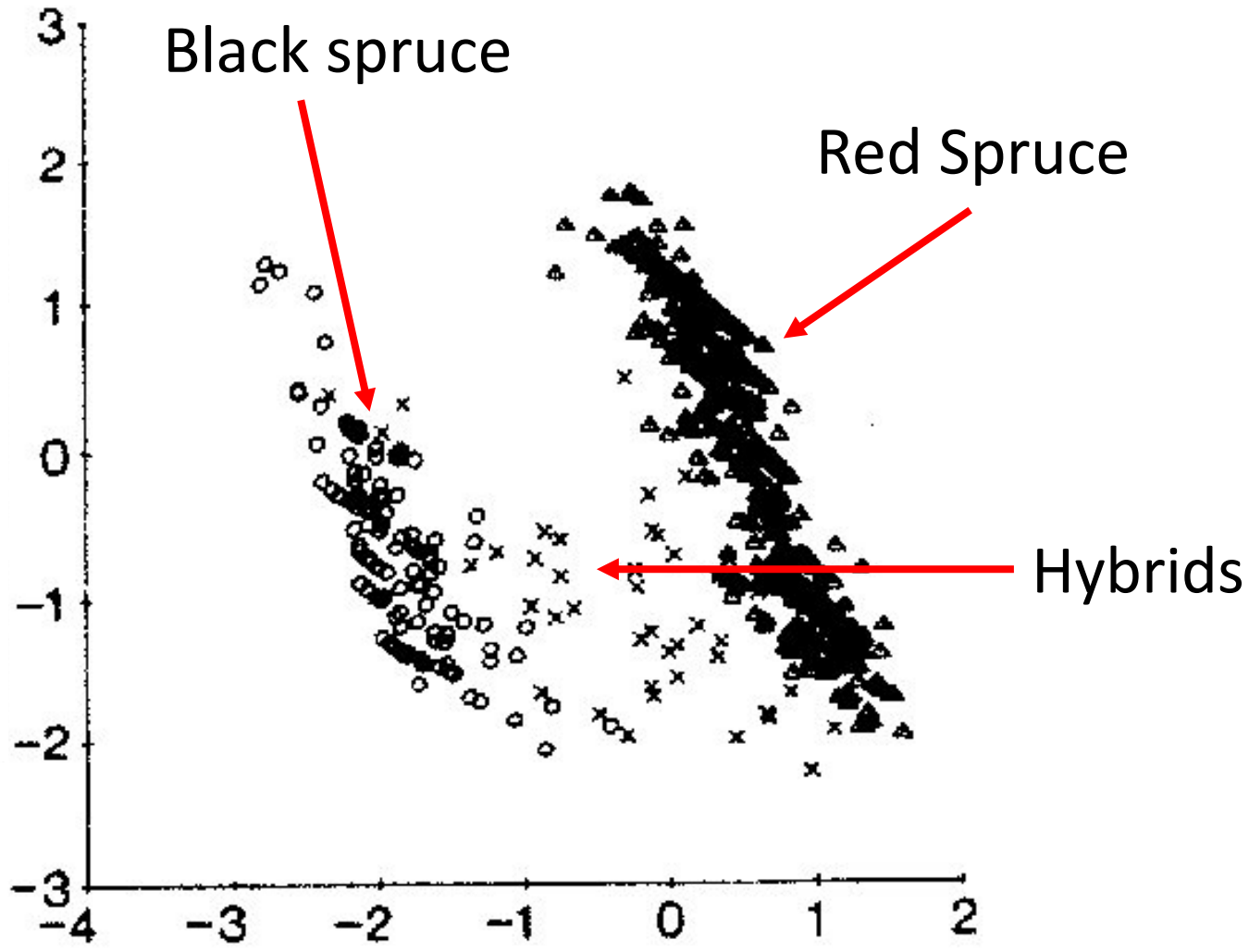


Each dot represents 1 to 8 stands, 10 to 15 trees sampled at each

Gordon, A. G. 1976. The taxonomy and genetics of *Picea rubens* and its relationship to *Picea mariana*. Can. J. Bot. 54(9):781-813.

Measured factors

Foliage colour, bud colour, 1st-year twig colour, decurrent ridge shape, cone shape, cone diameter, cone length, cone diameter-length ratio, cone scale margin, cone persistence, cone colour immmature, cone colour mature, seed wing colour, seed colour, seed length, crown shape ….



Red spruce is not a hybrid, although it infrequently will cross with black spruce.

Red spruce Provenance Trial

Swan Lake Forest Research Station, Algonquin Park

Fate of Red Spruce in Ontario

- *Improper logging has removed it entirely* from most of the townships and counties in which it was originally found
- Not listed on the Species-At-Risk list as either endangered or threatened but has been in decline for more than 50 years and *would now be considered rare!*
- *Algonquin dome* – nowhere left for it to go, given *climate change* …
- A study by Mosseler et al. (Can. J. Bot, 2000) concluded that 'the reproductive status of these small isolated Ontario populations compared favorably with the much larger, more extensive Maritime populations in Nova Scotia and New Brunswick' – study is 20 years out of date …
- Need to rely on *Citizen-Scientists, local conservation organizations*

TREES CANADENSIS – [https://treescanadensis.ca/]

Al Gordon, Loch Awe, Scotland,
2014

Further Reading/Resources

Gordon, A. G. 1952. Spruce identification by twig characteristics. For. Chron. 28(3):45-47.

Gordon, A. G. 1957. Red spruce in Ontario – a tree of unusual qualities. Sylva 13(1):1-7.

Gordon, A. G. 1976. The taxonomy and genetics of *Picea rubens* and its relationship to *Picea mariana*. Can. J. Bot. 54(9):781-813.

Gordon, A. G. 1985. Budworm! What about the forest? p. 3-29 In Spruce-Fir Management and spruce budworm. USDA For. Serv. Report GTR-NE-99, Broomall, PA.

Gordon, A. M., C. Chourmouzis and A. G. Gordon. 2000. Nutrient inputs in litterfall and rainwater fluxes in 27-year old red, black and white spruce plantations in Central Ontario, Canada. For. Ecol. Mgmt. 38(1-3):65-78.

Anderson, H.W. and A. G. Gordon. 1990. The tolerant conifers: Eastern hemlock and red spruce, their ecology and management. OMNR-OFRI Forest Research Rept. No. 113.

Mosseler, A., J.E. Major, J.D. Simpson, B. Daigle, K. Lange, Y.-S. Park, K.H. Johnsen, and O.P. Rajora. 2000. Indicators of population viability in red spruce, *Picea rubens*. I. Reproductive traits and fecundity. Can. J. Bot. 78: 928–940.

Trees Canadensis: https://treescanadensis.ca/ (Owen Clarkin, J. L. Mason)

Forest Gene Conservation Association: https://fgca.net/ (Kerry McLaven, Barb Boysen)

The slides appearing after this slide were not used in the FHS presentation on February 17, 2023.

They are included here for information only; each slide is preceded by an information text slide.

Please feel free to contact me at either of the following e-mails:

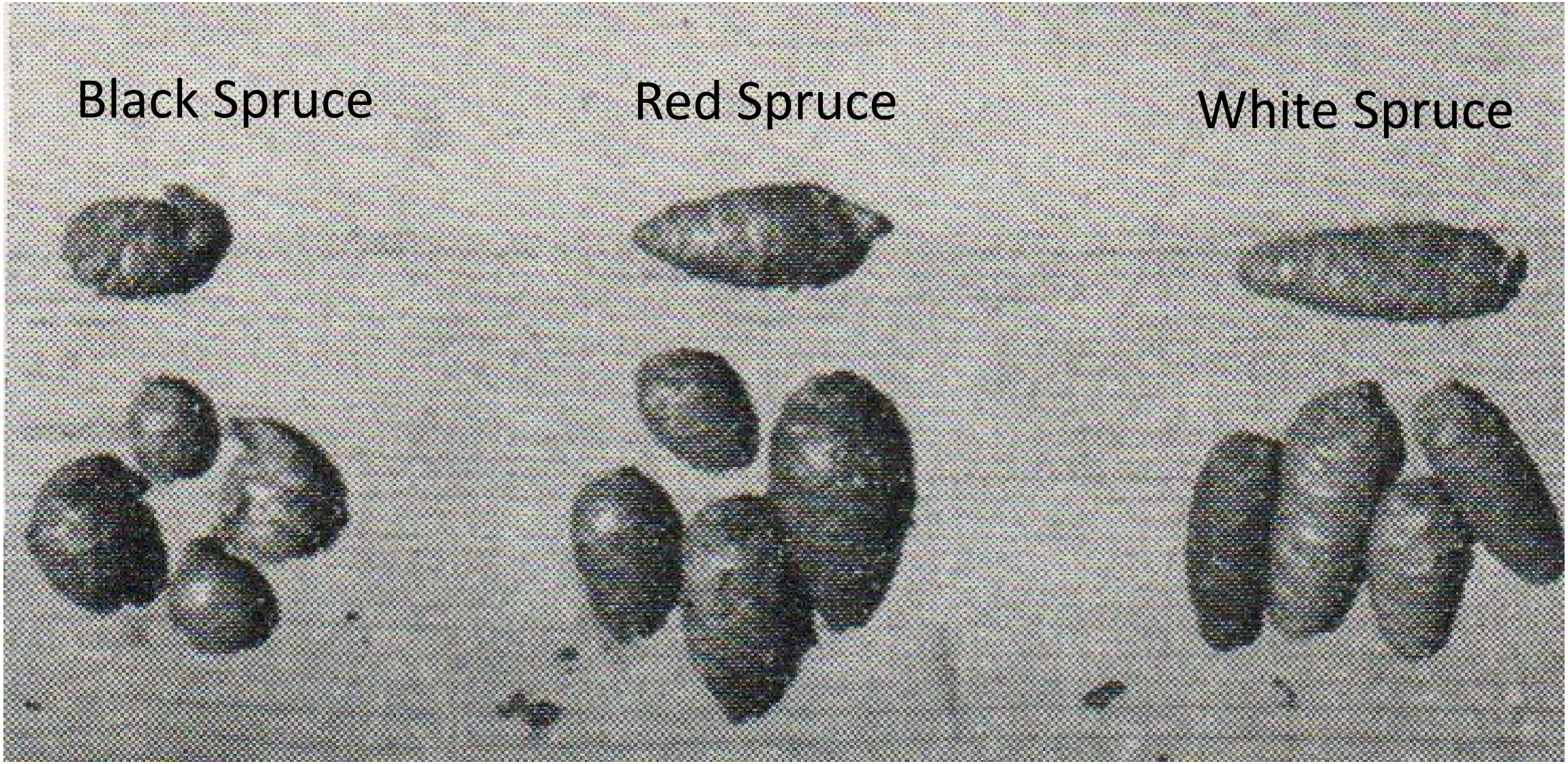
agordon@uoguelph.ca
director@ulinks.ca

Thanks for your attendance!

Cone features can also be utilized to distinguish red spruce from black and white spruce.

This photo is from the original Sylva publication in 1957.

More recent, colour comparisons can be found in a number of publications and on-line.


Black Spruce
Red Spruce
White Spruce

West Virginia is a small state, but had extensive stands of red spruce in the early 1800's. These have largely been decimated now, largely from clearcutting in the 1800's and early 1900's for pulp, and more recently as a result of acid rain and changing climates.

The picture on the left depicts a landing of red spruce in the early 1900's: pictured are 1,000,000 feet of logs! – not board feet, but actual lengths of logs!

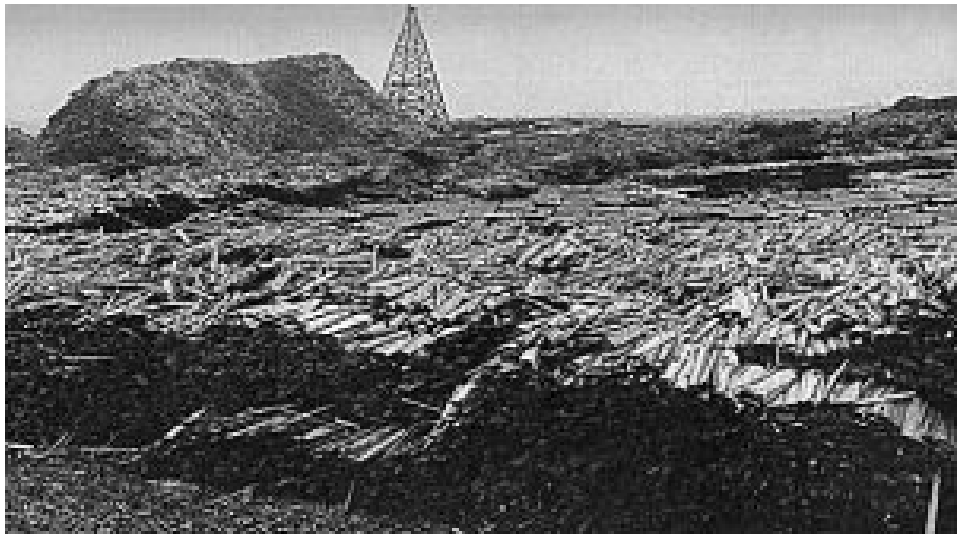
The picture on the right depicts a pulp mill in West Virginia in 1909 – that's a 'sea' of red spruce logs awaiting processing.

Lumber, pulp

1930's: Northeastern States – 2,000,000 cords per year of spruce-fir for pulp –
Conservative estimate: 50% Red Spruce

1990's: Northeastern States – 4,500,000 cords per year (rising in Maine, most other states in decline)

1,000,000 feet of logs!



1909

Ontario – Red spruce not listed on the Species-At-Risk list as either endangered or threatened but has been in decline for more than 50 years and would now be considered rare!

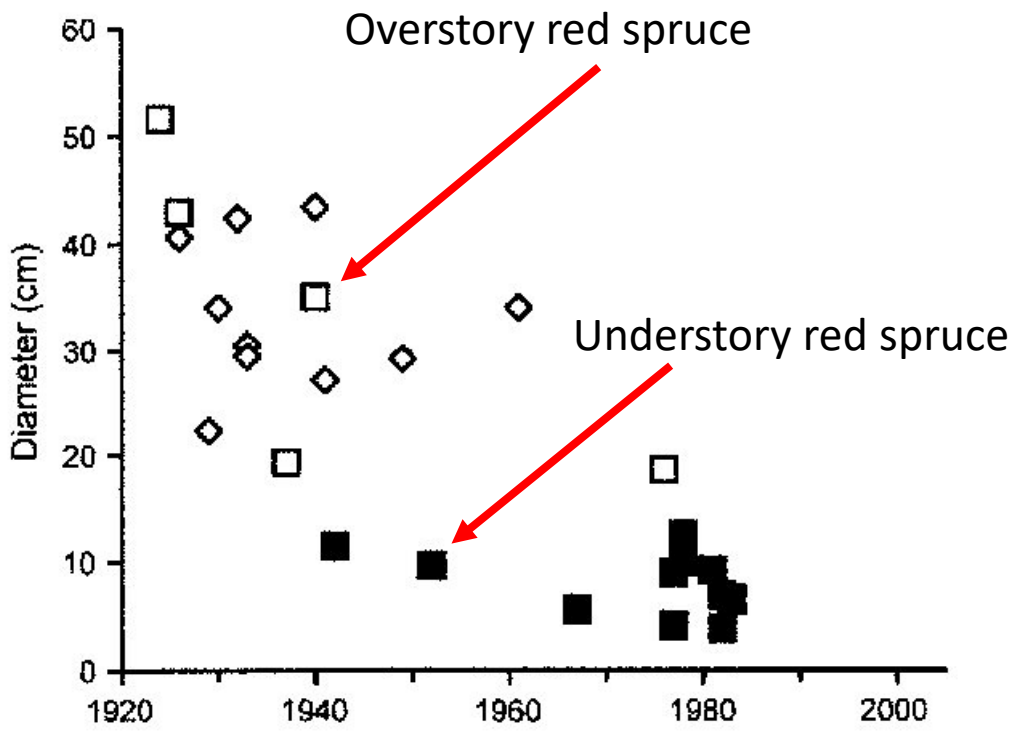
Also, from West Virginia.

The graph on the left indicates how average diameter of overstory (and understory) red spruce trees had decreased as a result of harvesting from the 1920's to the 1980's.

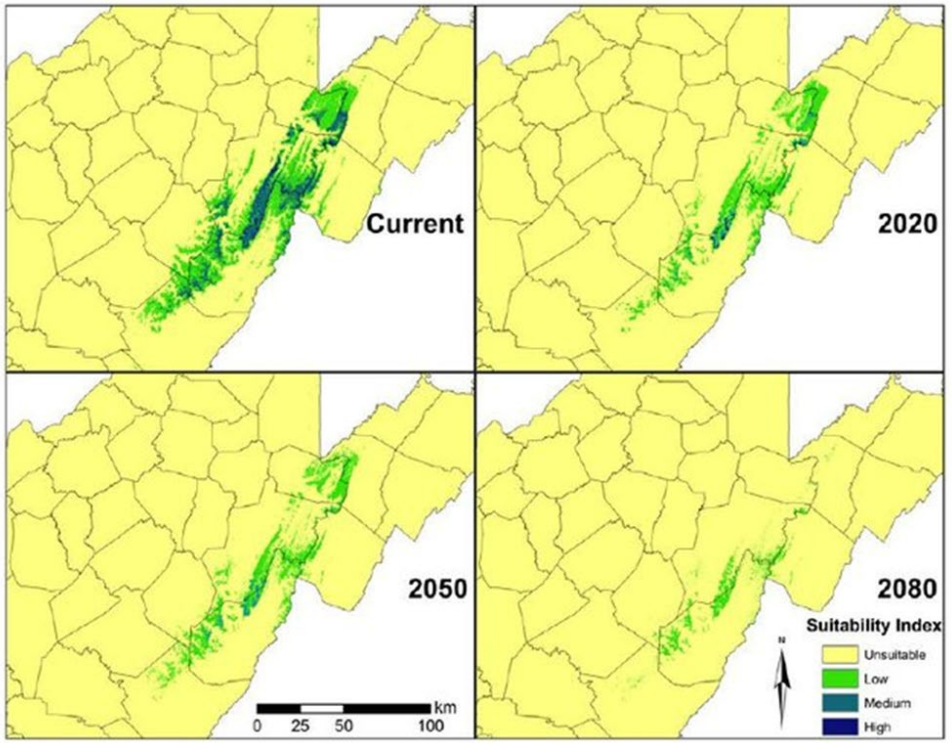
The pictorial on the right indicates the decrease in 'suitable' area for red spruce growth from the early 2000's into the future. The current situation is a result of historical harvesting and acid rain. The future scenario is likely a result of continued climate change resulting in warmer, drier areas not suitable to the regeneration and growth of red spruce.

The lower right numbers show the historical decrease in red spruce occurrence in the State.

West Virginia



Harvesting
Acid Rain



Climate Change

1800's 607,000 ha e.g. 133 cm DBH, 34 m height
1900's 200,000 ha
1978 17,500 ha
2005 12,000 ha

From Rentch, J.S., T. M. Schuler, W.F. Ford and G. J. Nowacki. 2007. Red Spruce Stand Dynamics, Simulations, and Restoration Opportunities in the Central Appalachians. Restor. Ecol. 15(3): 440-452.

In addition to red spruce provenance trials, Dr. Gordon also established a number of '*Piceta*', across the province (and elsewhere), where most of the world's spruces (barring some that could not be obtained from remote parts of China, etc.) are planted together on a common landtype. Provenances of red spruce were included in all *Piceta*; some have done well, and others, especially at boreal latitudes, not so well.

Interestingly, there are living and well-sized individuals of red spruce at the Kenora Picetum; early and extensive competition control since planting (1970's) ensured their continued existence.

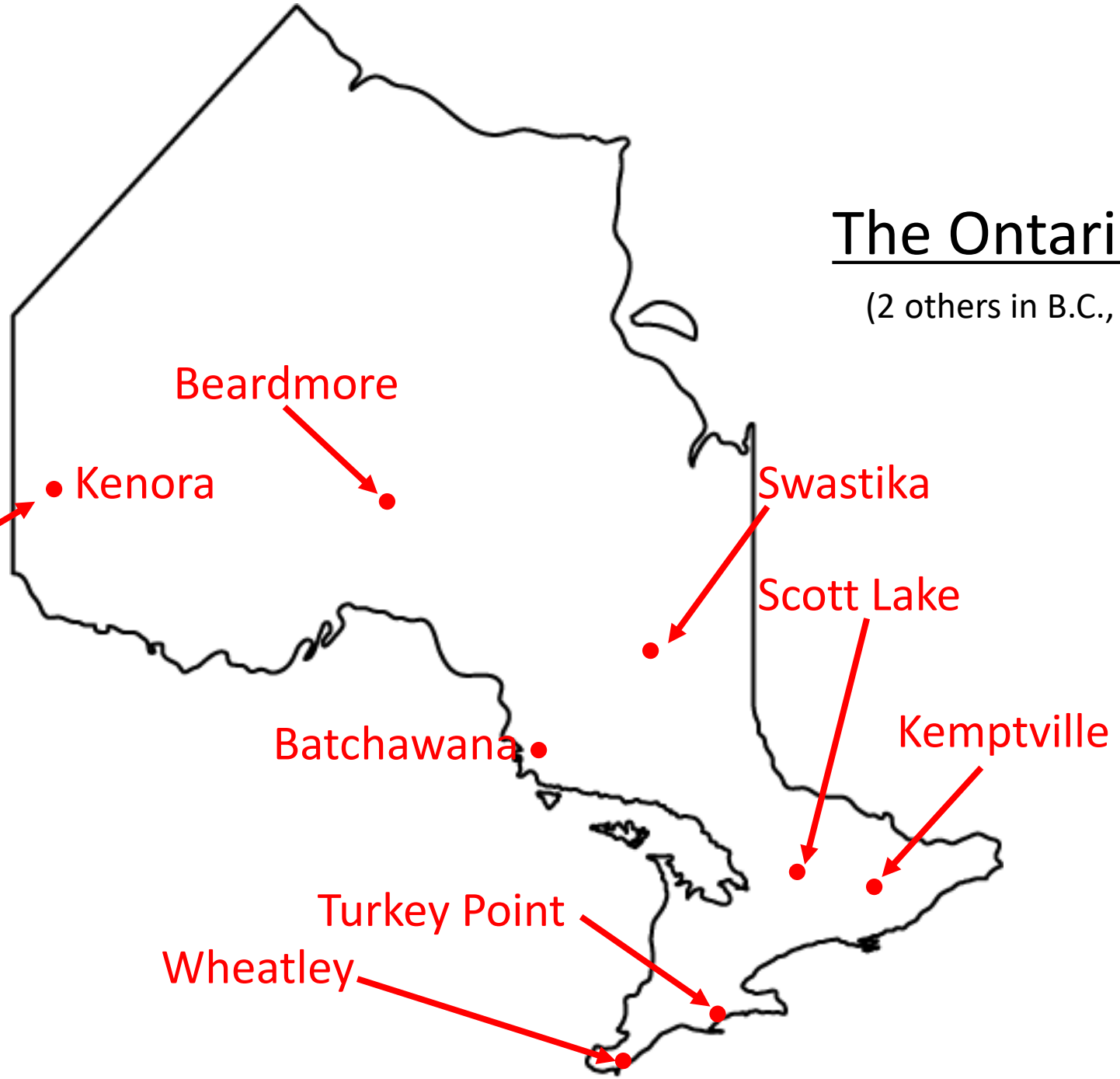
Data on the *Piceta* are maintained by the Centre for Northern Forest Ecosystem Research, Ontario Ministry of Natural Resources and Forestry, Thunder Bay.

All of the world's species of *Picea* (spruce) in replicated plots in 1 location

Ontario

The Ontario *Piceta*

(2 others in B.C., 1 in Scotland)

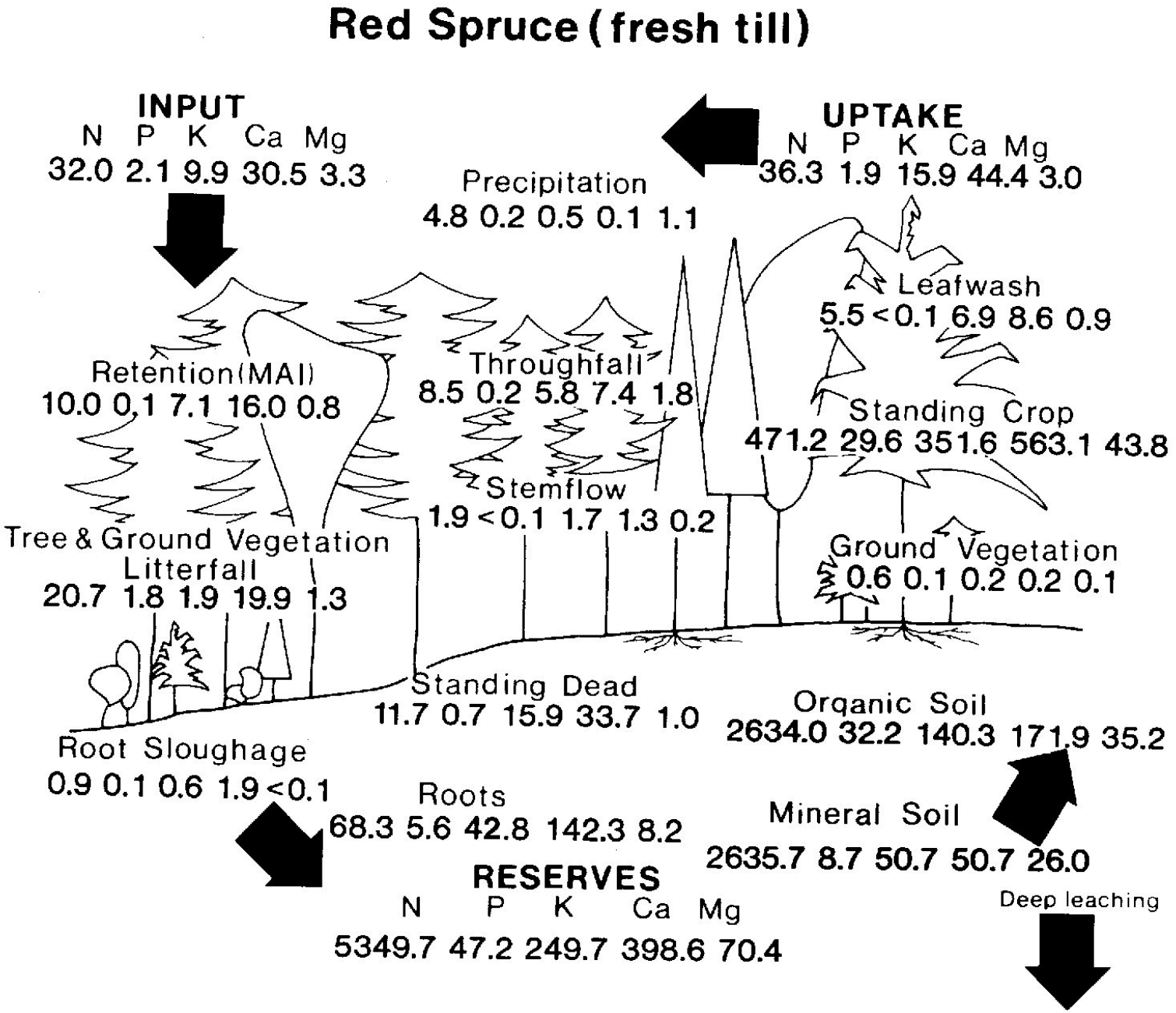


Ontario's farthest north surviving red spruce – planted 1974

Dr. Gordon's research also embraced extensive studies on nutrient cycling in spruce forest ecosystems.

The diagram illustrates a complete macroelement (N, P, K, Mg, Ca) nutrient cycle for red spruce on fresh till in Algonquin Park. Many others have been produced.

Information on the interaction of genetic makeup and the cycling of nutrients by spruce and other tree species on specific sites, can foster an appreciation of how trees and forests can maintain productivity into the future in the face of climate change, harvesting and other pressures.



A stylized nutrient cycle of how a red spruce forest functions …