Establishment and growth of trees encroaching into a boreal peatland in the central Adirondacks, New York State

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Shingle Shanty Preserve and Research Station

Introduction

- Boreal peatlands are of high biodiversity value, serve as buffers to flood events, and are major carbon sinks.
- Tree encroachment into peatland ecosystems is a leading driver of biodiversity loss, and may also lead to losses of carbon stores and ecosystem function.
- Boreal peatlands located at their southern range limits may be highly susceptible to climate warming.
- Through the use of dendrochronology, we assessed establishment dates and annual growth of four tree species (*Picea mariana* (black spruce), *Larix laricina* (tamarack), *Abies balsamea* (balsam fir), and *Thuja occidentalis* (eastern white cedar)), within the Shingle Shanty Preserve (SSP) boreal peatland complex in the central Adirondacks of New York State (Fig. 1).

Objectives

- To determine the timing of tree encroachment into different peatland community types.
- To understand growth trends of encroaching tree species.
- We hypothesized that there would be an increase in encroachment and growth of trees over the past century due to anthropogenic warming, and increased nitrogen deposition.

Methods

- Increment cores were taken from 25 balsam fir, 17 tamarack, 64 black spruce, and 17 eastern white cedar trees from SSFP in 2011 (Fig. 1).
- Cores were mounted and sanded (Fig. 2) and annual growth rings were measured using a Velmax measuring bench and MeasureJ2X software.
- Measured cores were crossdated and establishment dates were determined for each tree (Fig. 3).
- To determine climatic effects on growth, annual ring widths were detrended and will be modelled against a suite of regional climate and deposition data.

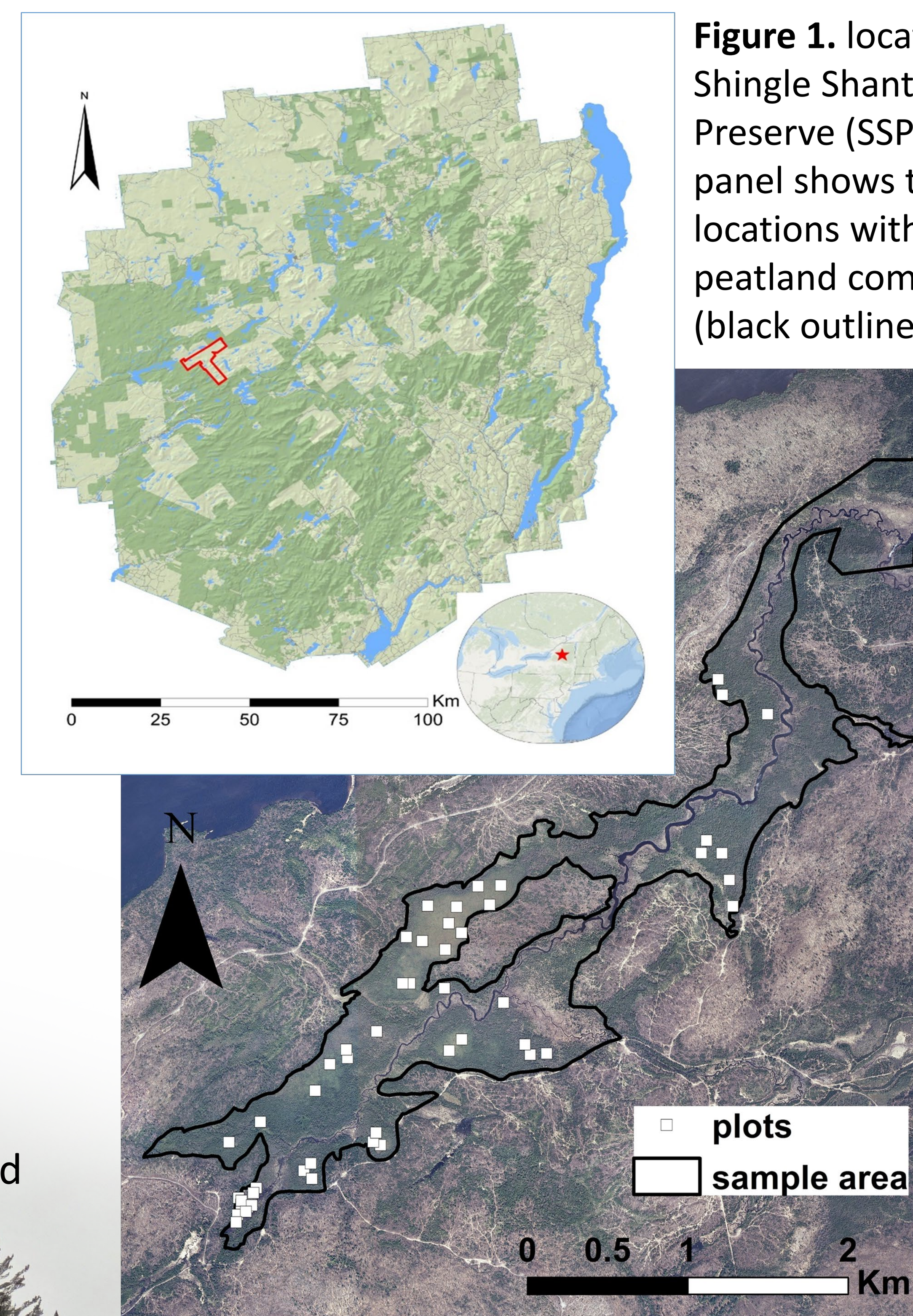


Figure 1. location of Shingle Shanty Preserve (SSP). Lower panel shows tree locations within the peatland complex (black outline).

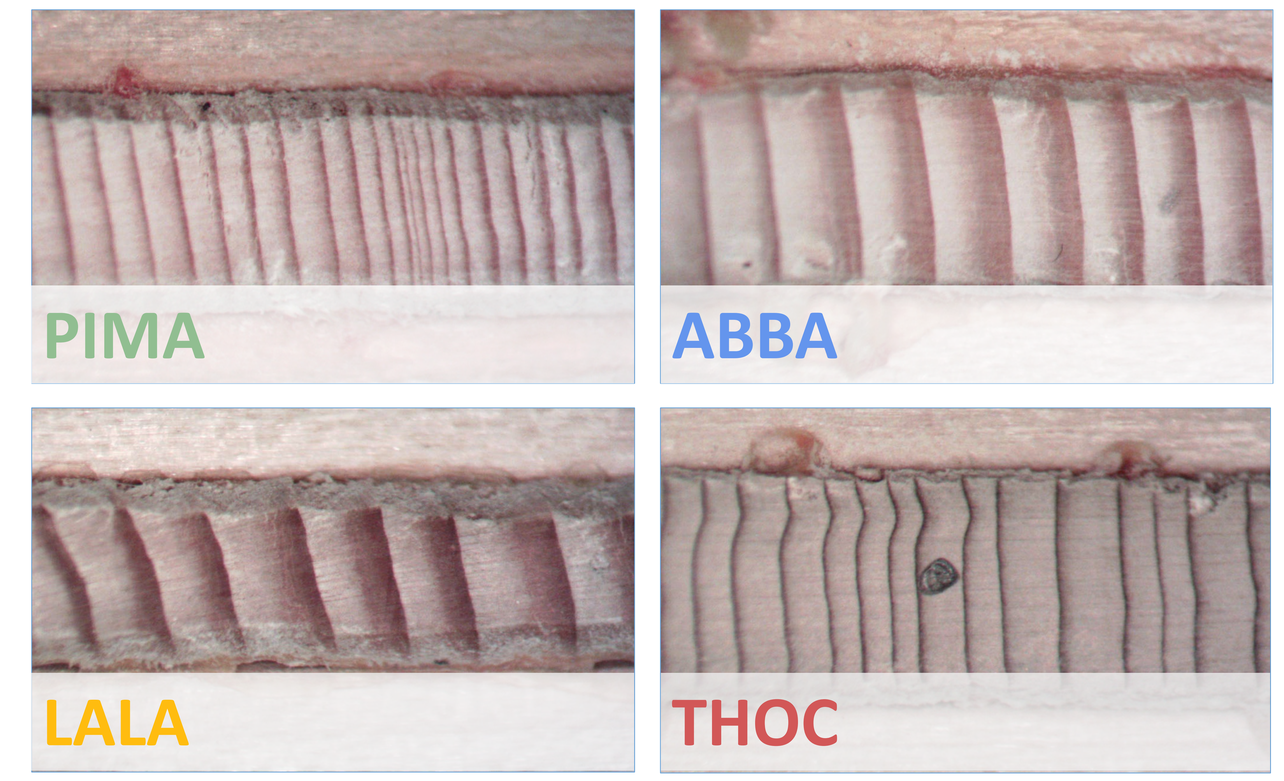


Figure 2. Increment cores from black spruce (PIMA), tamarack (LALA), balsam fir (ABBA), and eastern white cedar (THOC).

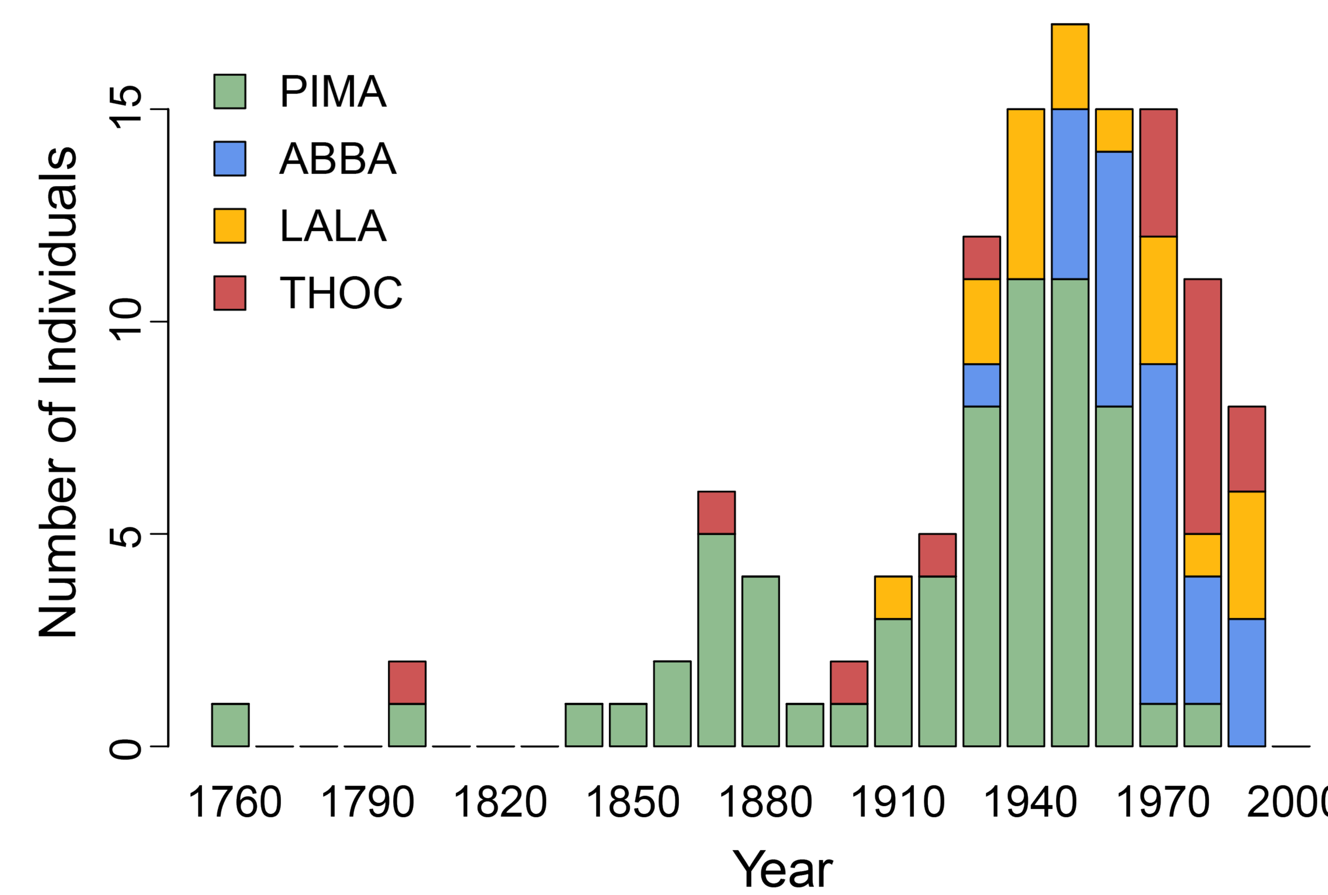


Figure 3. (Above) Establishment per decade, by species, of trees into the SSP peatland complex.

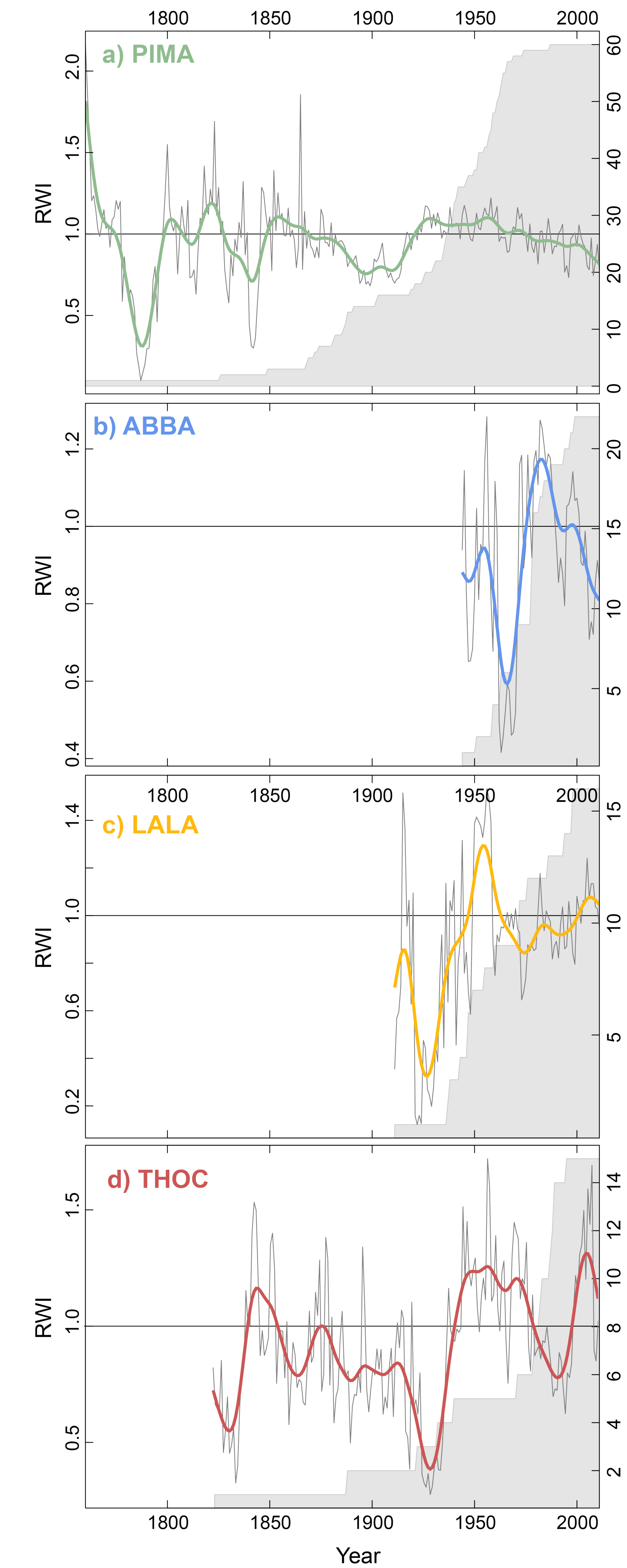
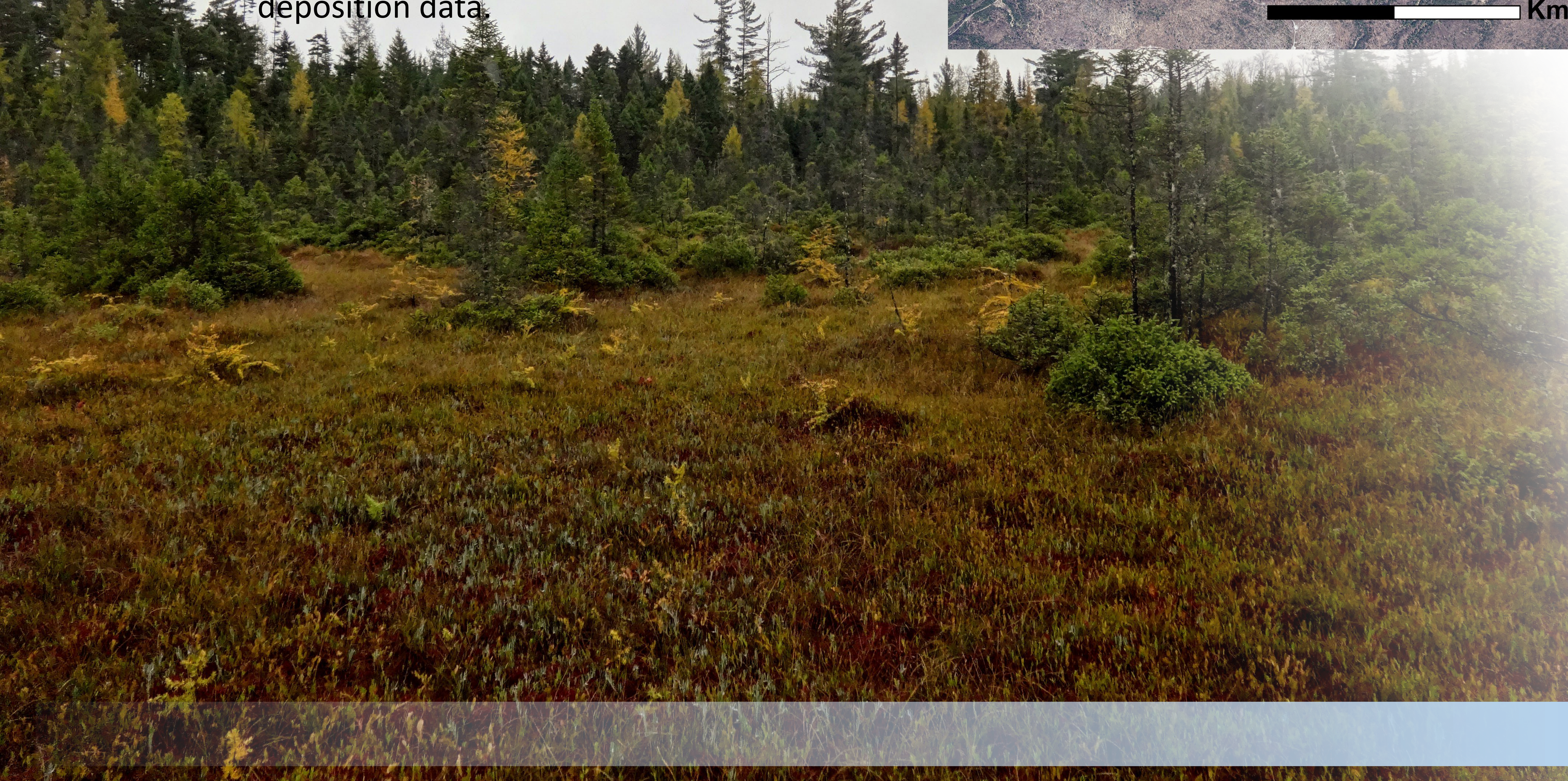


Figure 4. (Right) Ring-width chronologies of a) black spruce, b) balsam fir, c) tamarack, and d) eastern white cedar. PIMA and ABBA both show a steady decline in ring width since the 1950's and late 1970's respectively. LALA shows an overall trend of increasing ring width for the duration of the record. THOC generally increased growth since the 1950's. Gray shaded area represents sample depth.



Conclusion

- Tree encroachment into the peatland complex increased steadily over the first half of the 20th century, peaking in the 1950's, and was predominately black spruce.
- Since the 1950's black spruce establishment has fallen significantly, while balsam fir and tamarack have increased establishment rates.
- Variation in growth patterns will be further assessed for relationships with climate and deposition data.
- Patterns observed may provide insight into ecosystem response to anthropogenic warming and deposition.

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