Stand and Cohort Structures of Old-growth Red Pine forests in Minnesota

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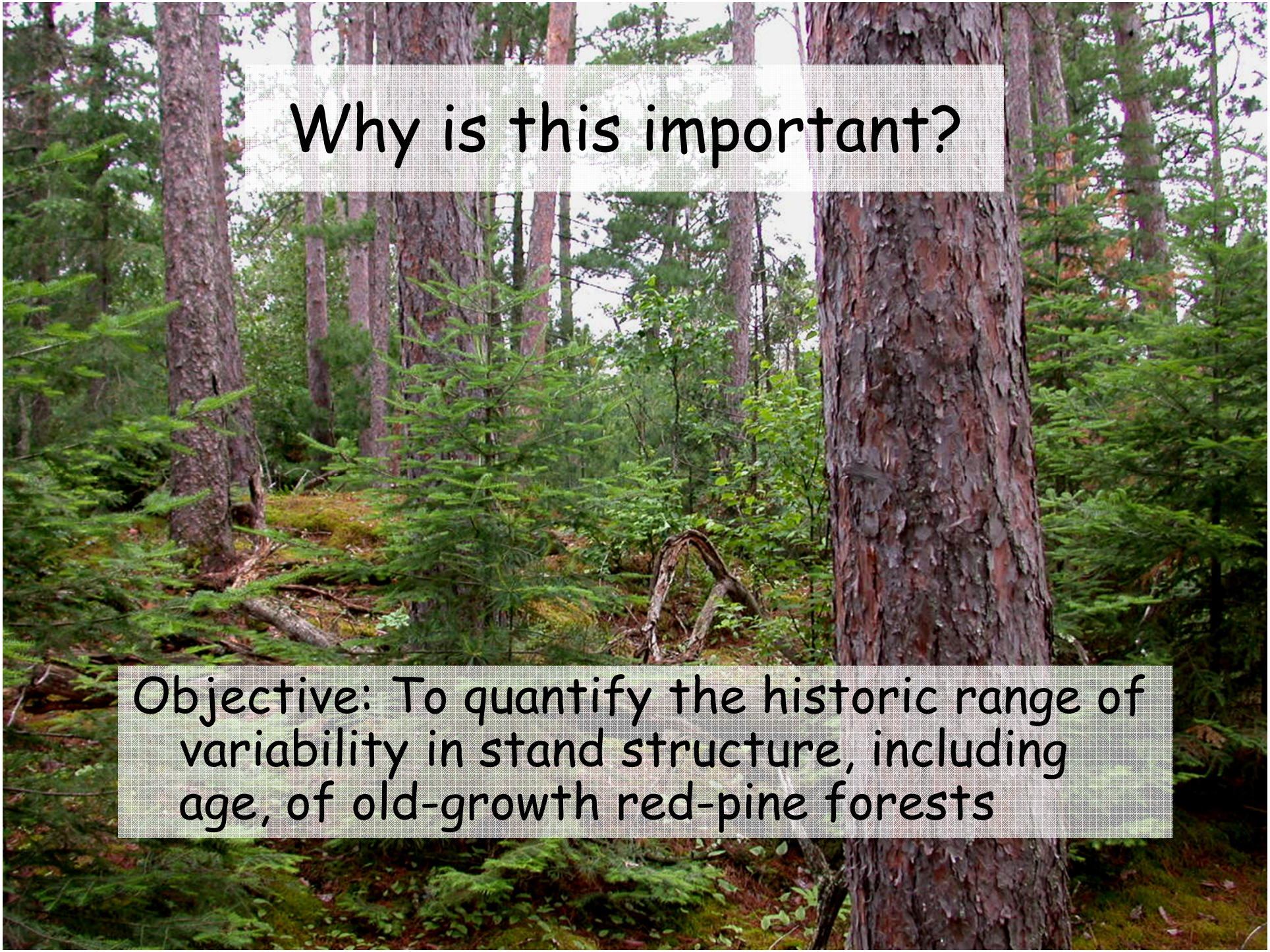
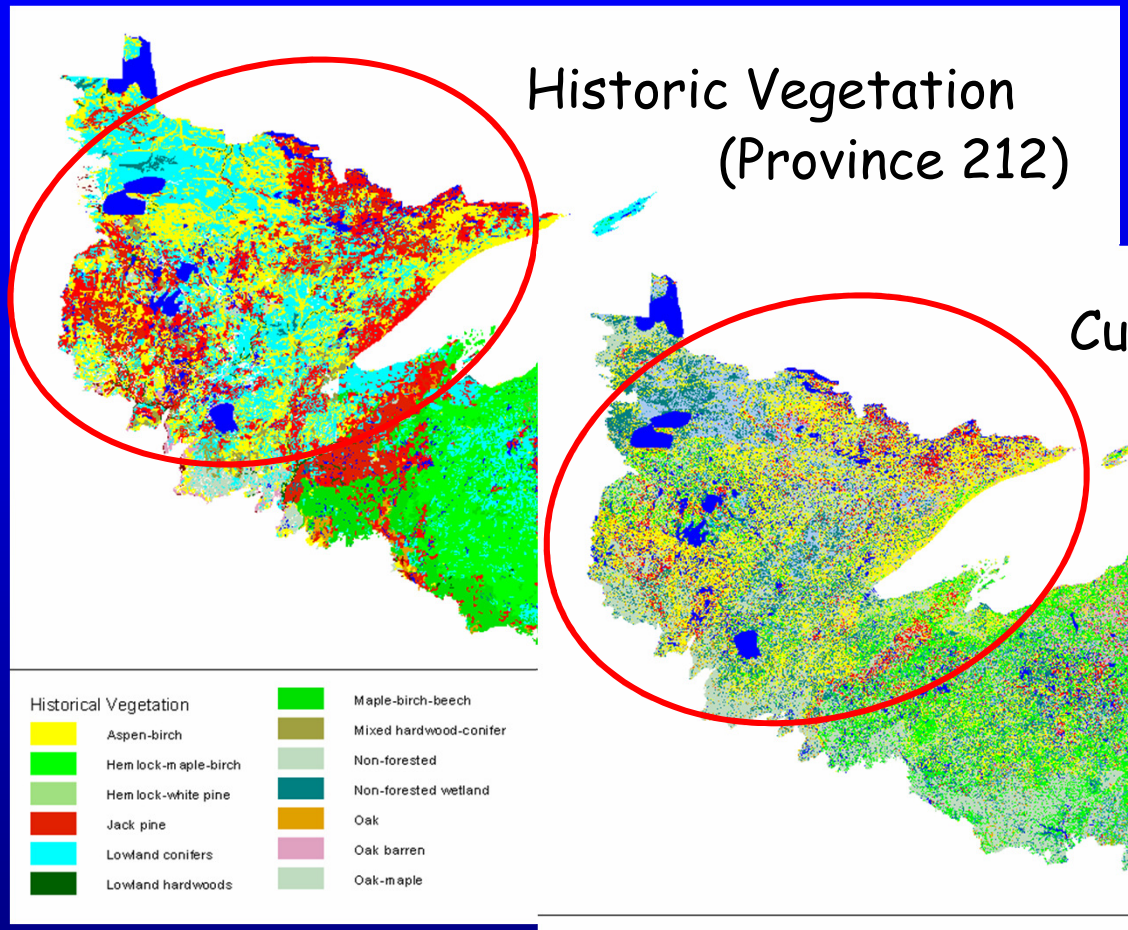
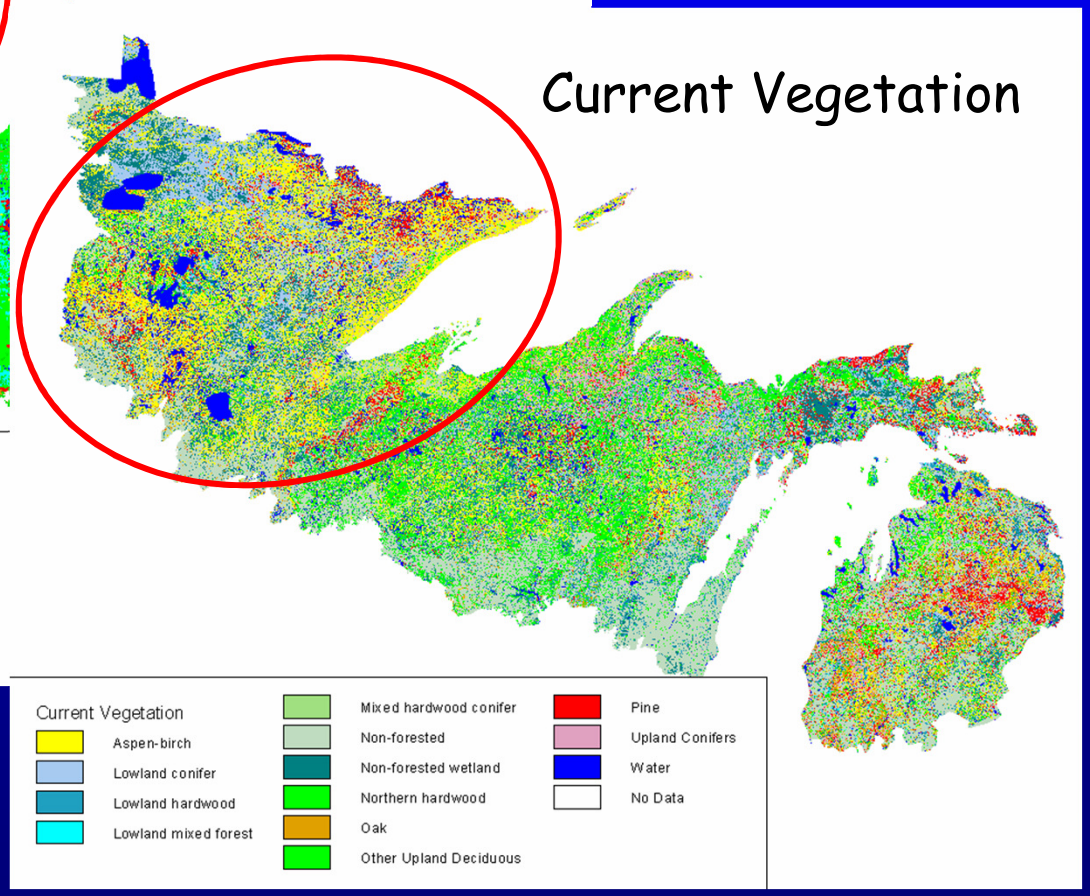


Why is this important?

Objective: To quantify the historic range of variability in stand structure, including age, of old-growth red-pine forests

Loss of pine-dominated forests

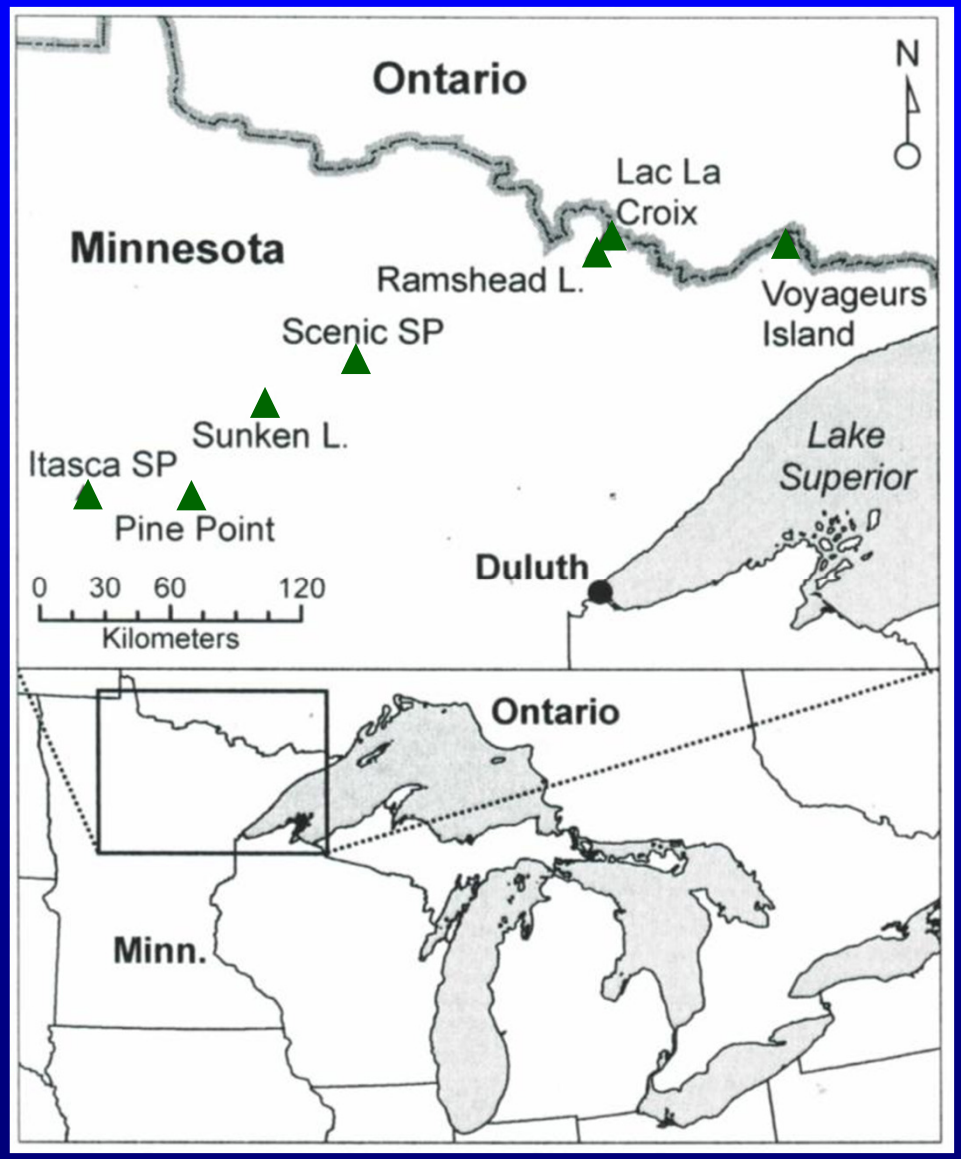




Courtesy of D. Cleland

Current situation

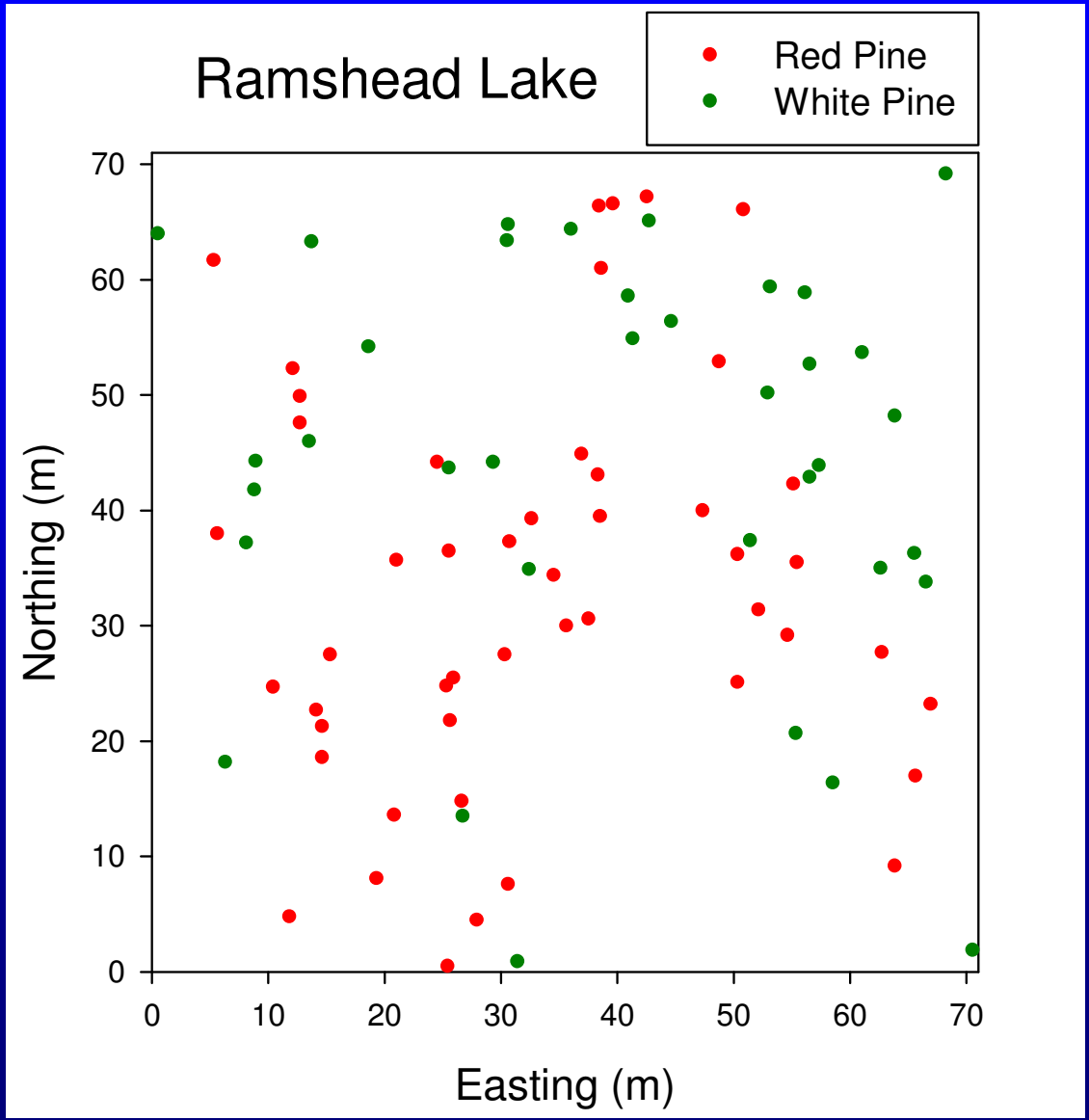
Old-growth red pine study sites



Methods Overview

- Establish one half-hectare plot at each site
- Map and inventory CWD
- Map all trees and snags
- Core all pines (living and dead)

Stem maps (example)



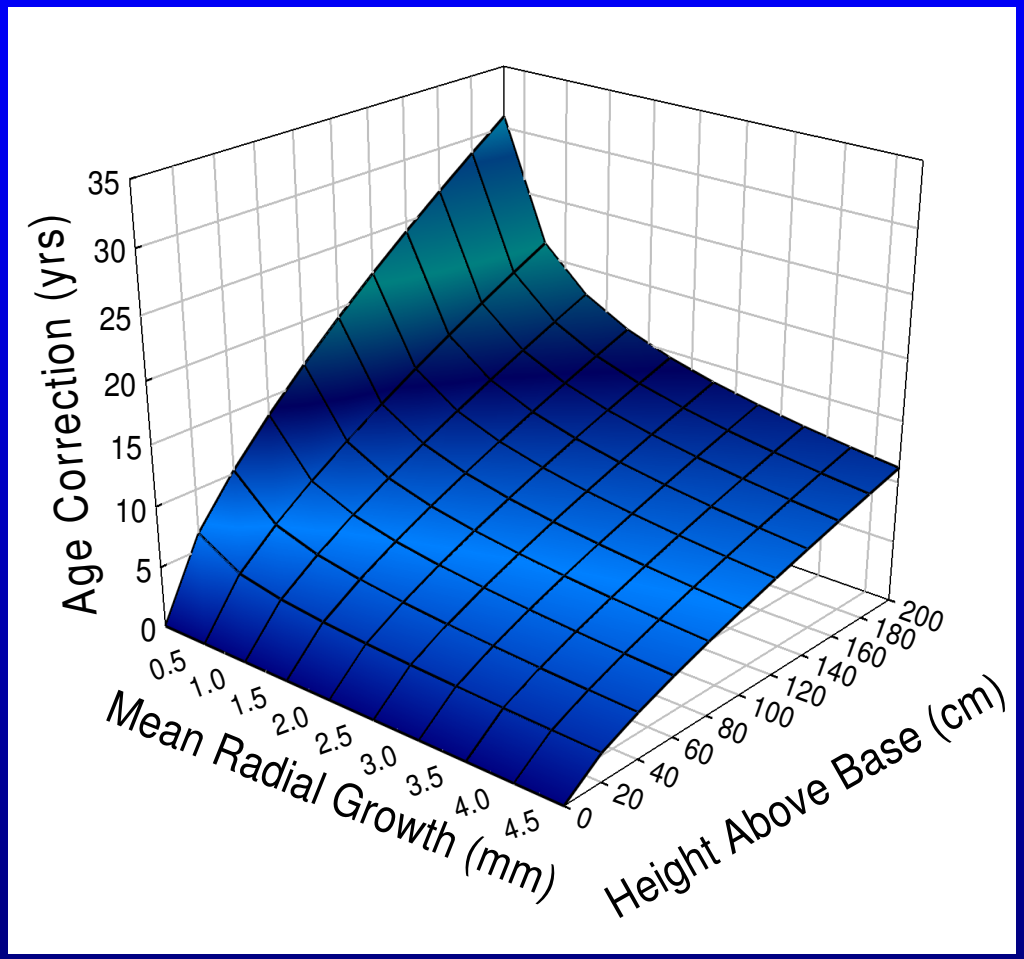
Coring (near base) all pine trees
(plus a subset of non-pines)

Coring dead pines (12 mm borer)

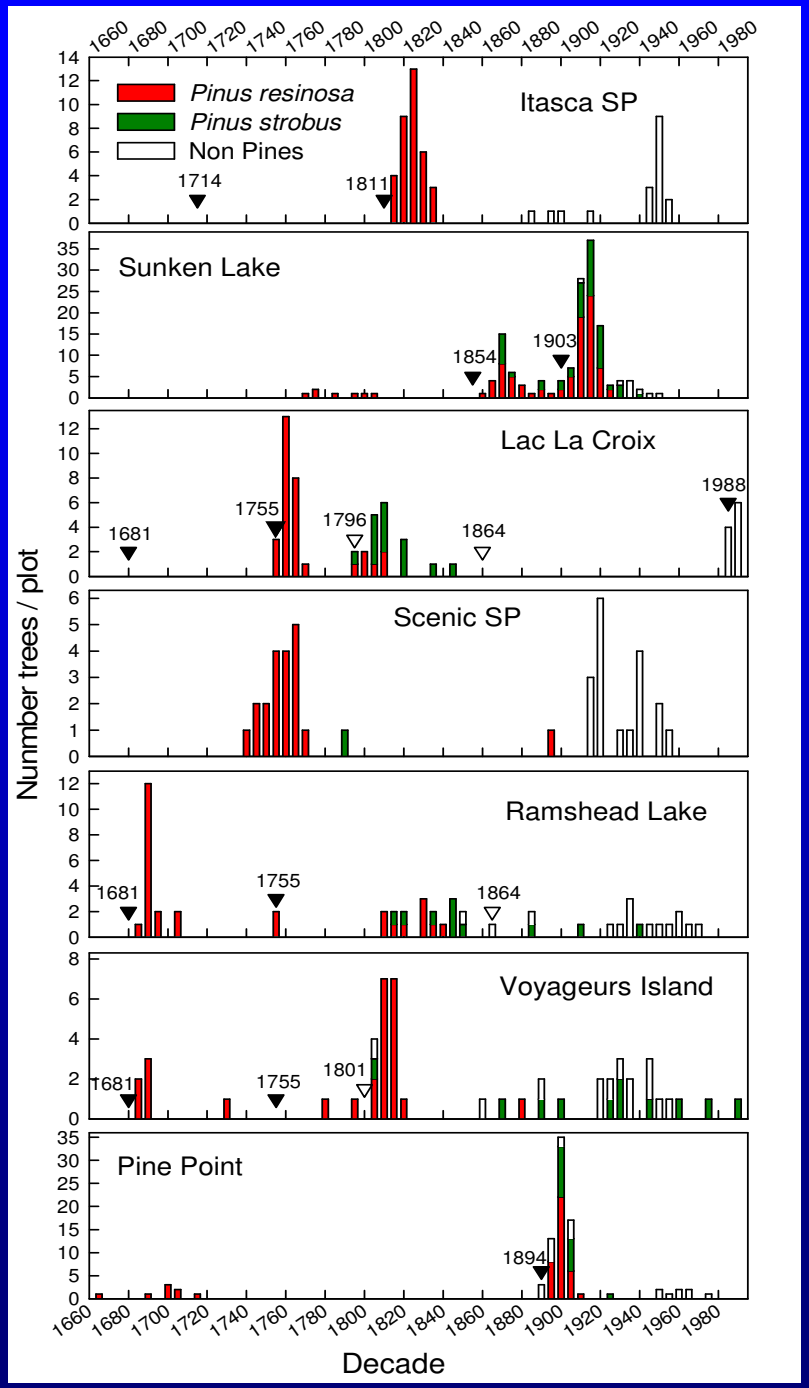
Large deadwood cores: examples

Cross-dating deadwood samples

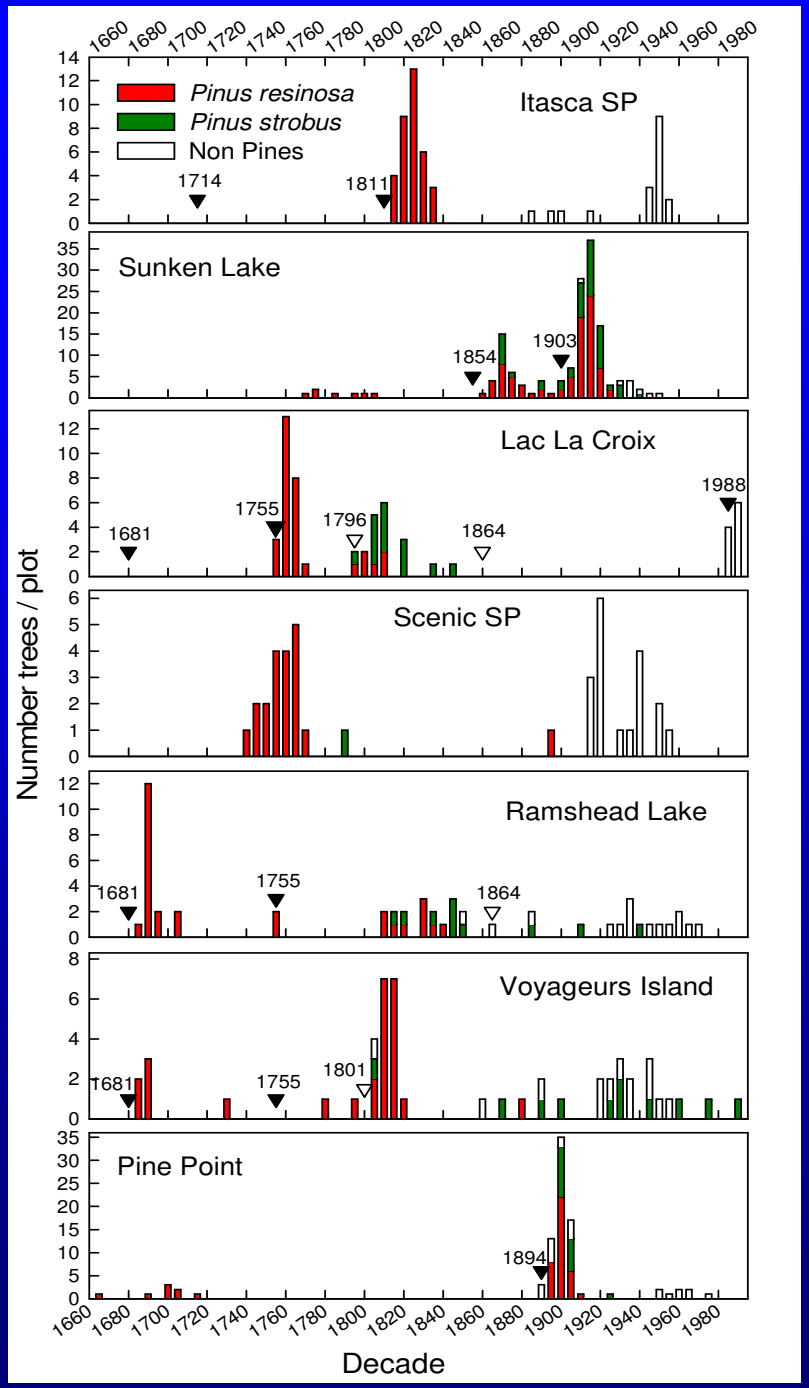
Refining tree age estimates



Fraver, S. and others. 2011. Improving tree age estimates derived from increment cores: A case study of *Pinus resinosa*. *Forest Science* 57:164-170.



Age Structures

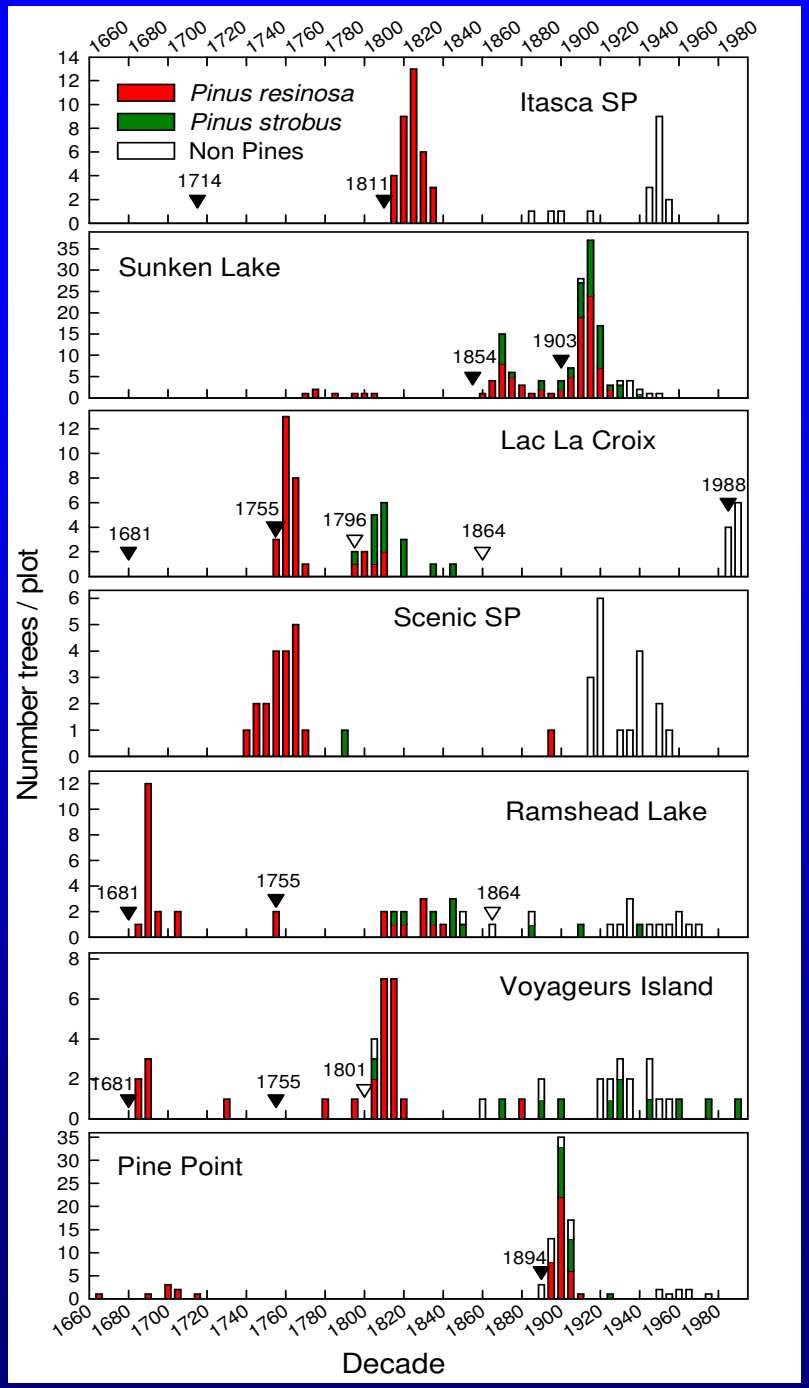


Single

Single

Age Structures

Age Structures



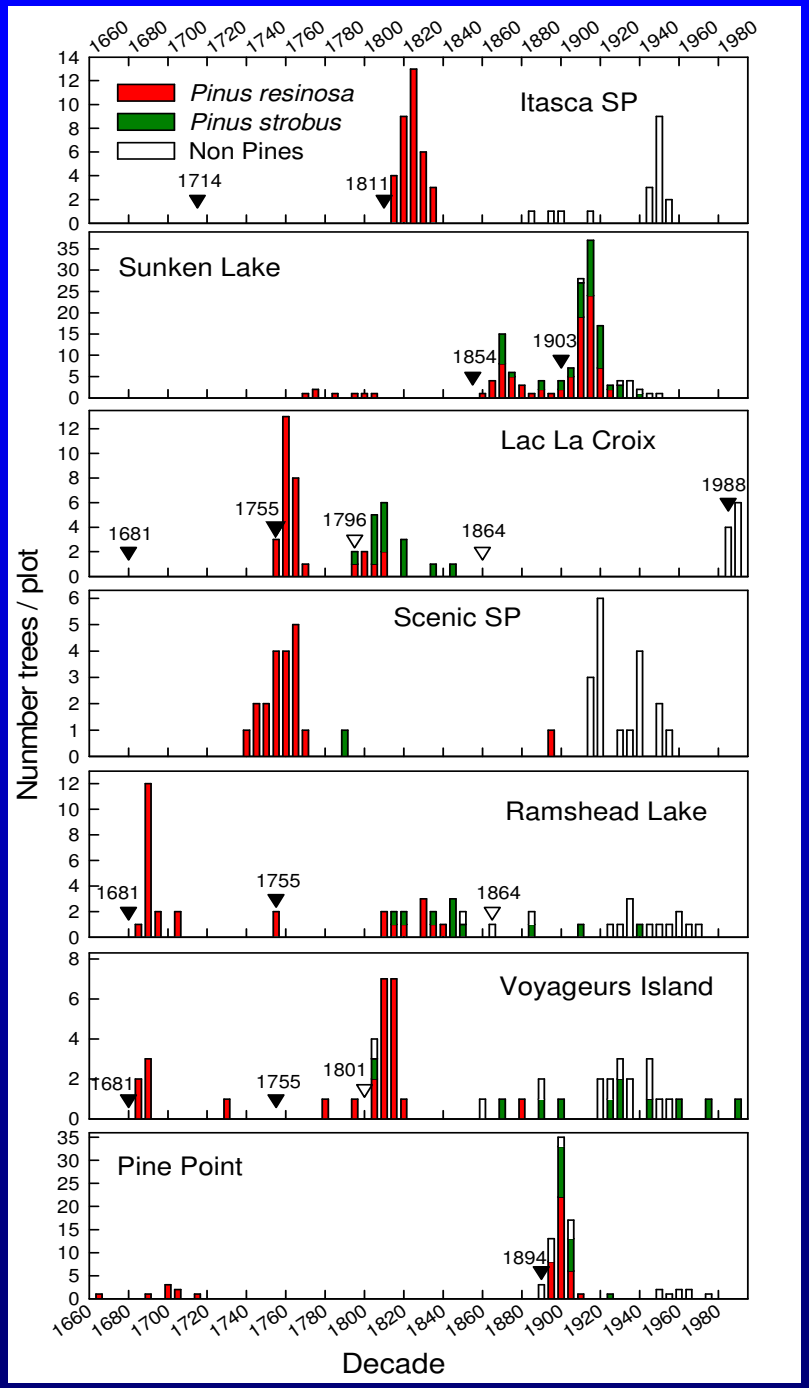
Single

Double

Single

Double

Age Structures



Single

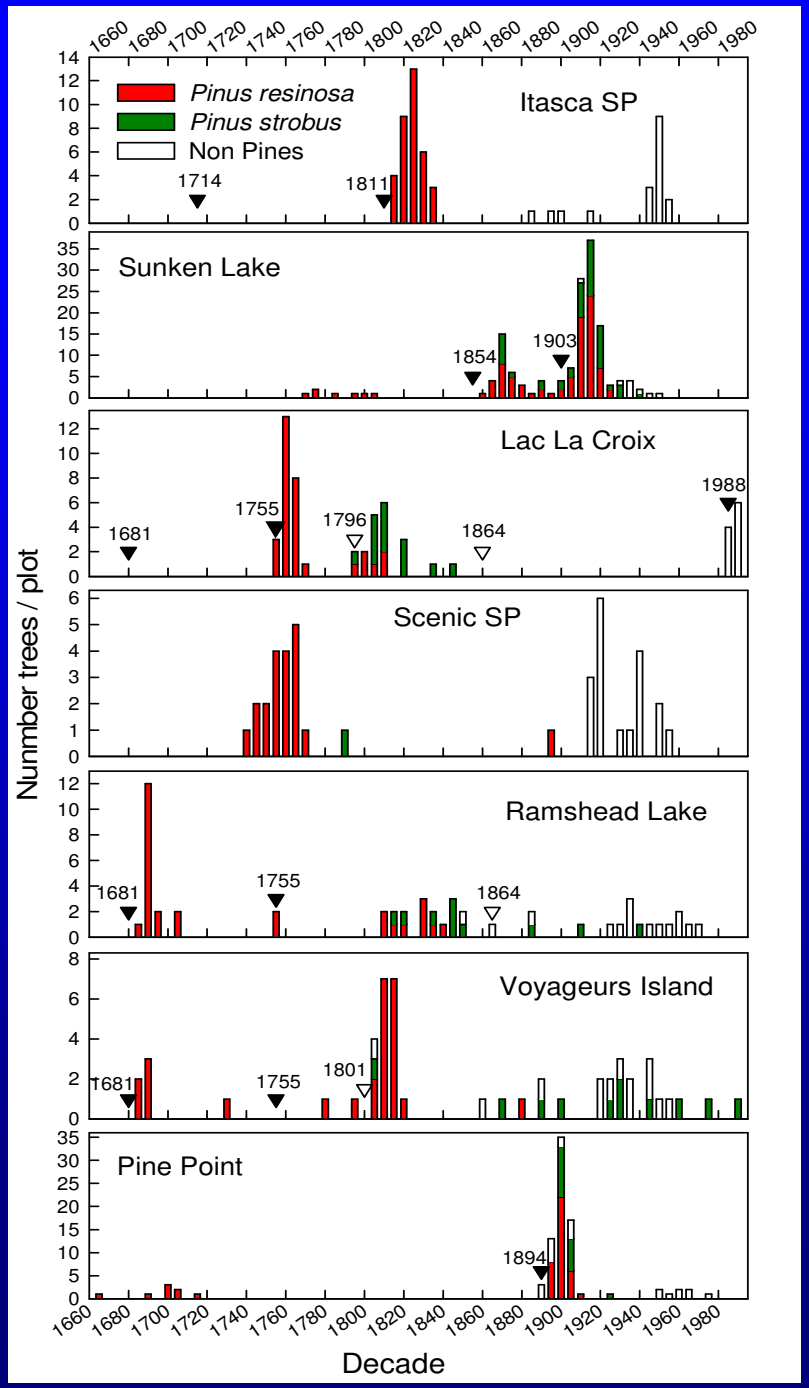
Double

Single

Double (sporadic)

Double (sporadic)

Double



Age Structures

Single

Triple

Double

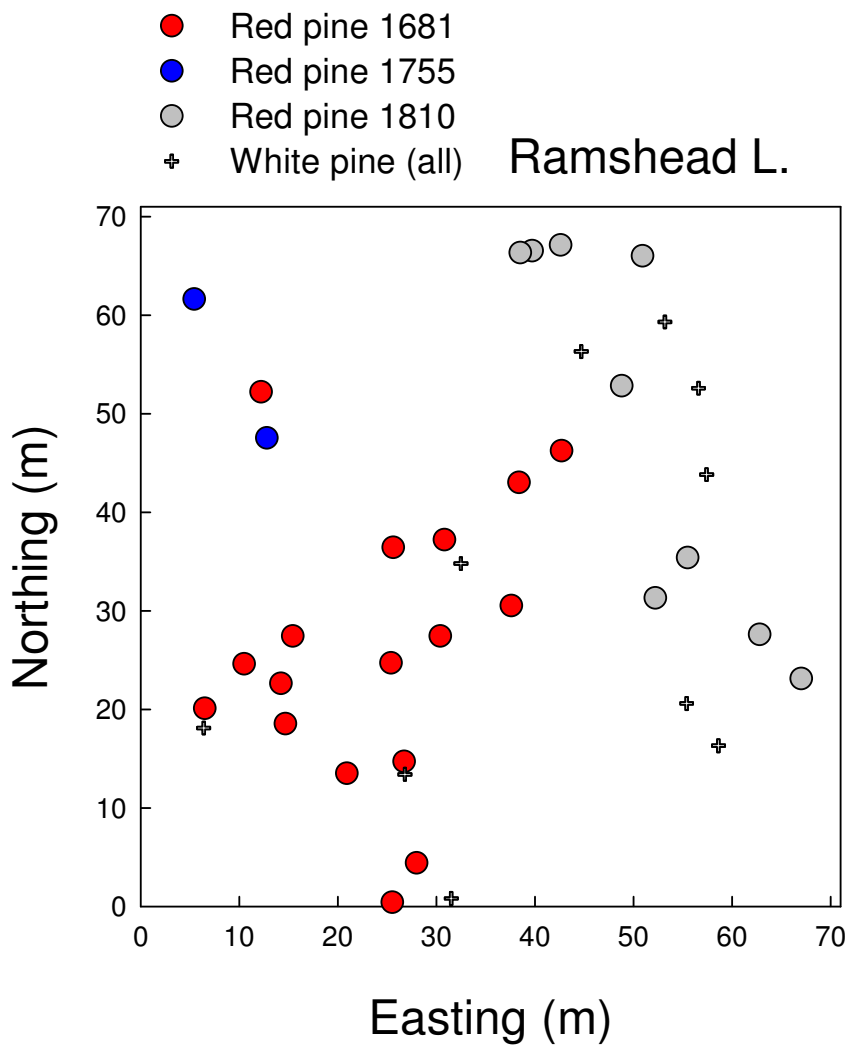
Single

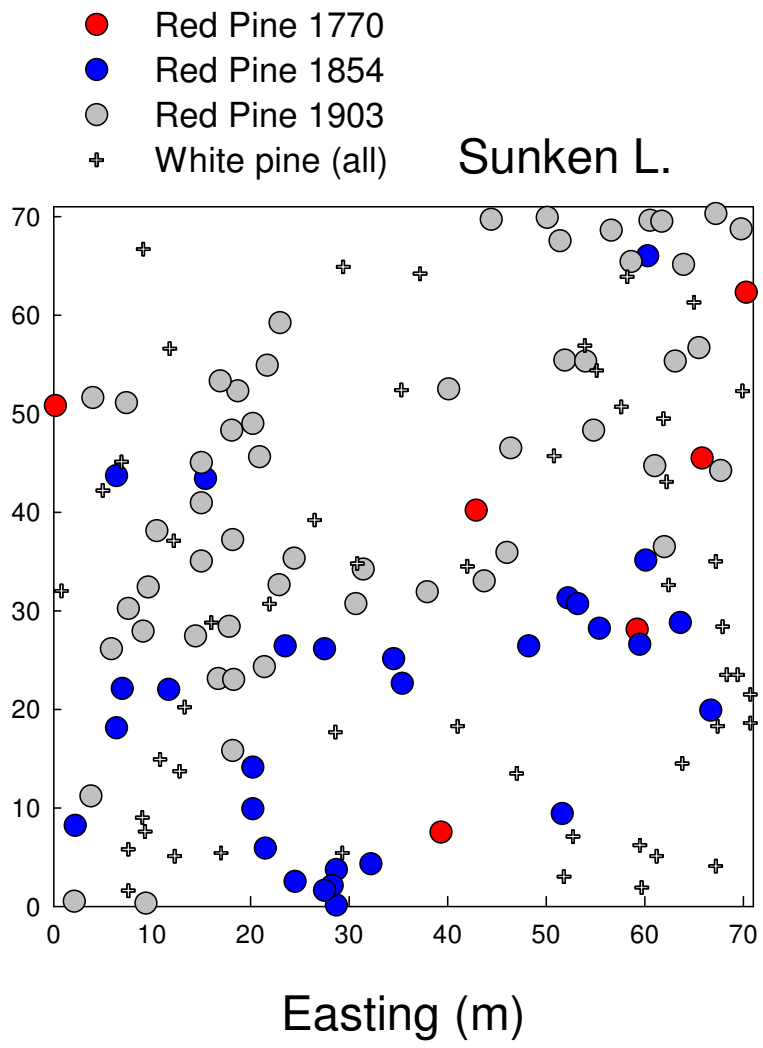
Double (sporadic)

Double (sporadic)

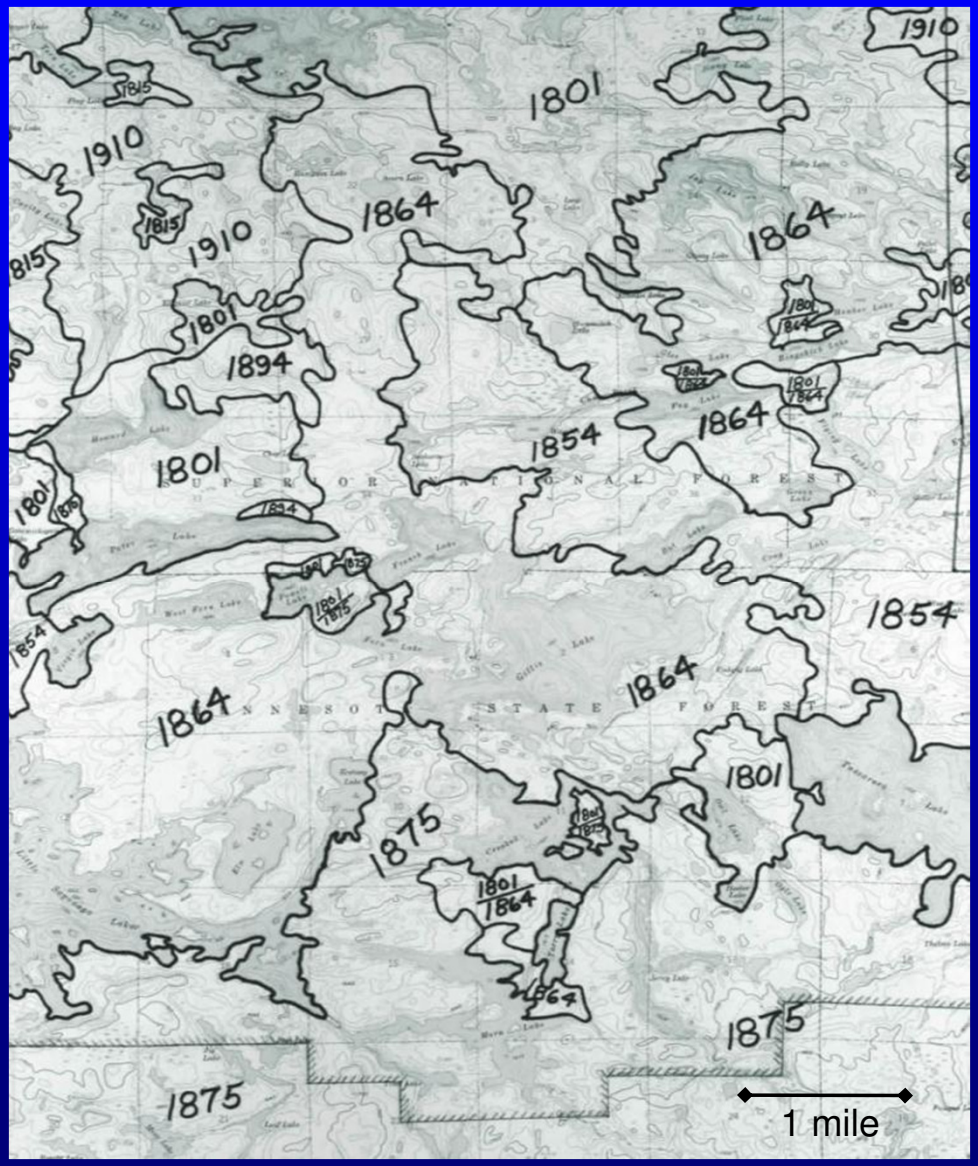
Double

Spatial pattern of cohorts





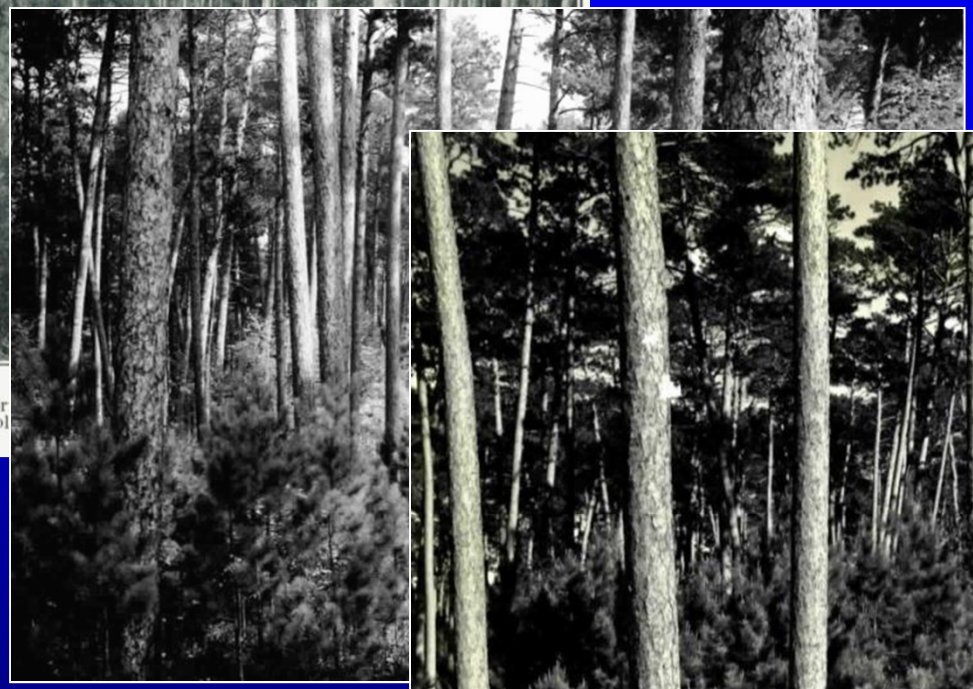
Heinselman's stand-origin maps



Heinselman 1973

Early recognition of multiple cohorts

H. Shirley 1932



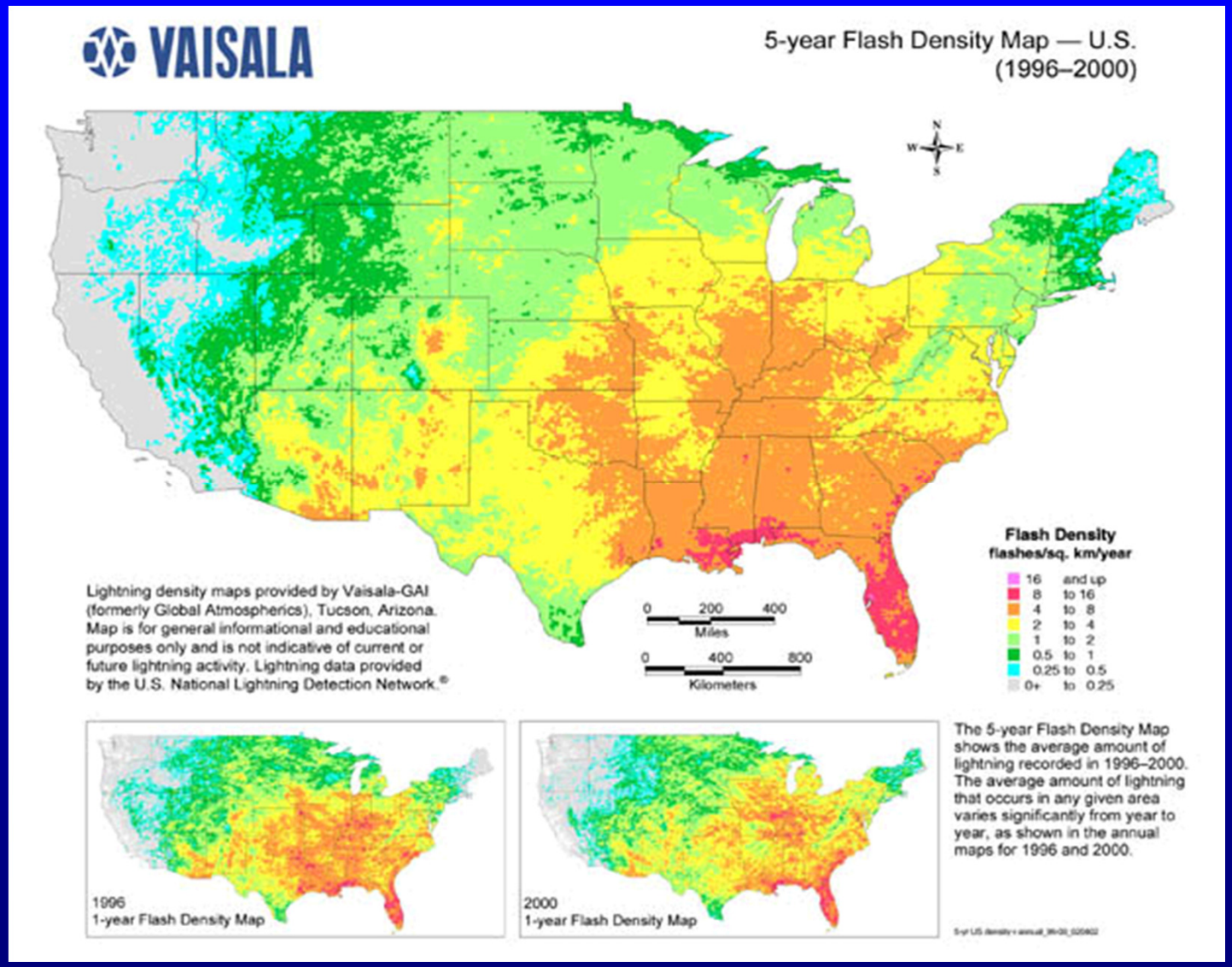
Stand Structure

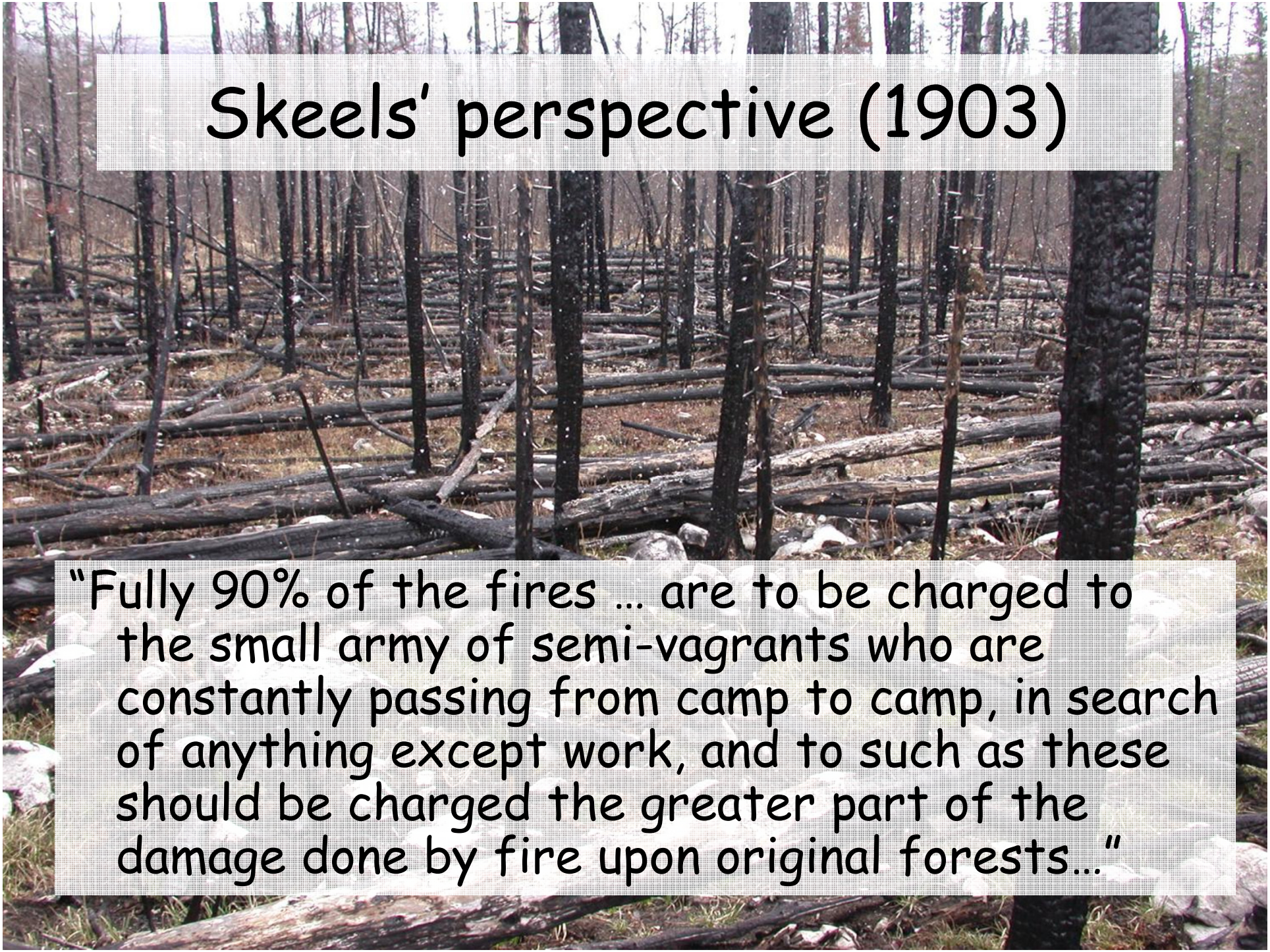
Site	Live Trees BA/ha	Live Trees Stems/ha	Snags BA/ha	Snags Stems/ha	CWD Vol/ha
Itasca State Park	43.1	494	3.6	54	62
Sunken Lake	38.6	482	5.4	140	75
Lac La Croix	27.3	184	7.4	56	128
Scenic State Park	39.3	564	2.7	24	82
Ramshead Lake	33.7	320	7.0	78	120
Voyageurs Island	25.6	292	14.2	126	158
Pine Point	36.2	520	8.1	88	76
Mean	34.8	408	6.9	81	100

Conclusions

- Cohort structures varied between sites, ranging from one to three cohorts
- Spatial patterns of cohorts suggests small-scale patchiness
- A wide range of reference conditions exist in these old-growth red pine stands

Lightning Flash Densities





Skeels' perspective (1903)

"Fully 90% of the fires … are to be charged to the small army of semi-vagrants who are constantly passing from camp to camp, in search of anything except work, and to such as these should be charged the greater part of the damage done by fire upon original forests…"

'Figure 6.6: Stands composed mainly of red pine generally occur as open groves … with little shrub cover and few understory trees' (Heinselman 1996)

Current lack of red pine regeneration