Dendroecology reveals successional changes in pitch pine growth in Vermont sandplain forests

Declan McCabe

Saint Michael's College Founded 1904

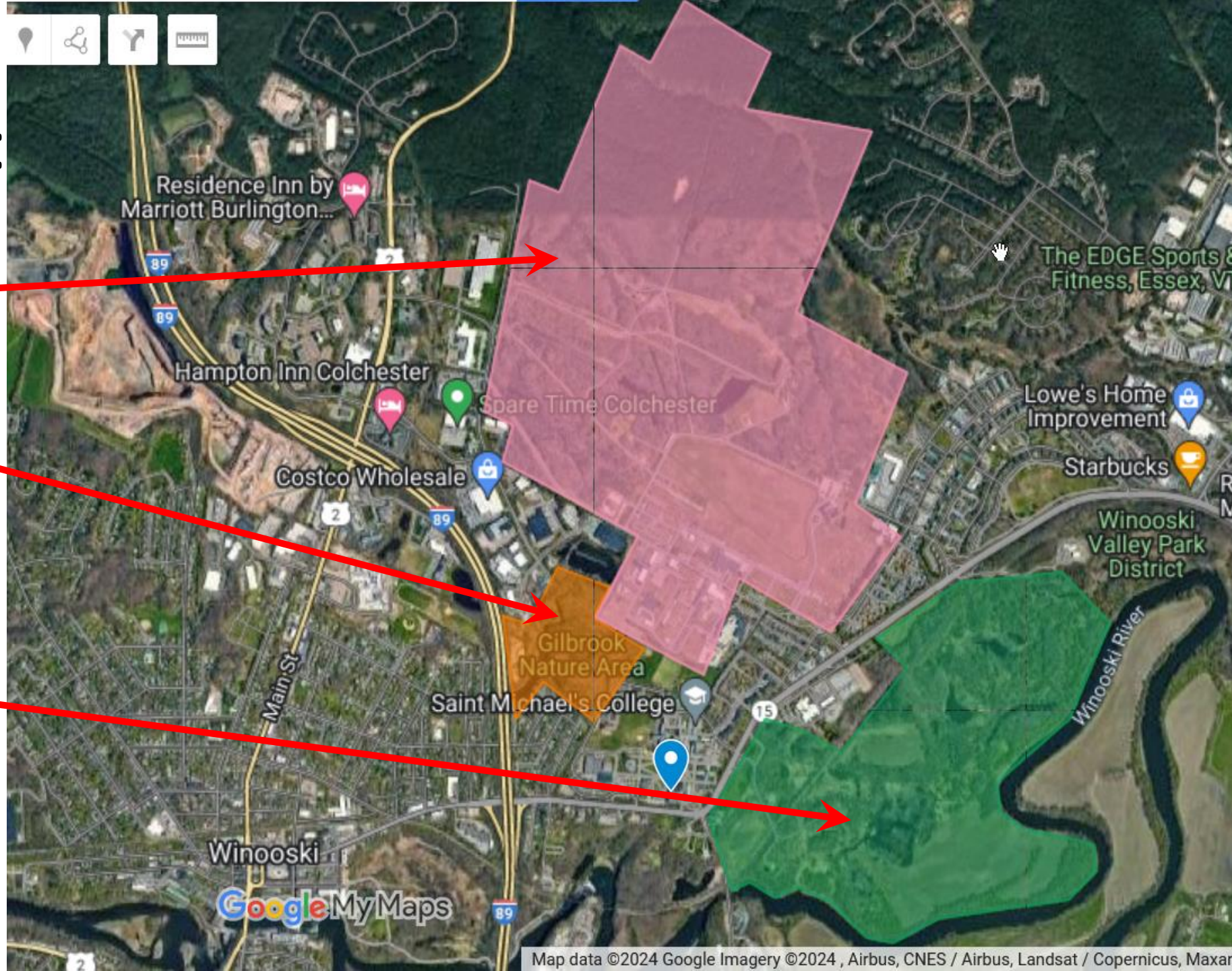
Sandplain Forest: an endangered ecosystem

- Chittenden County sandplains formed in the Winooski River Delta
- Post-glacial uplift raised them first above sea level, and later to where they are now
- Burlington, South Burlington, Winooski, Colchester, and Essex are among the towns on this delta
- Flat sandy soils are amenable to agriculture and development

…….Sand plain forests are scarce!

Our field sites:

- Camp Johnson
- Gilbrook Natural Area
- Saint Michael's College Natural Area



Pitch pines

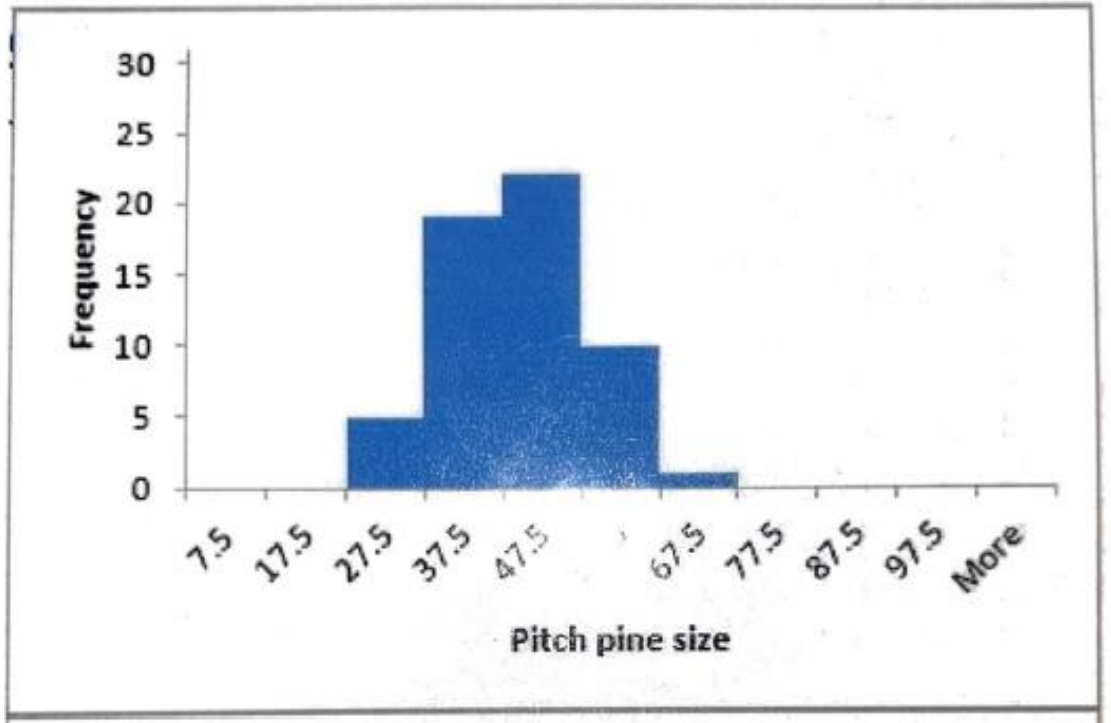
- Are fire adapted
- Early successional
- Characteristic of sand plain forests

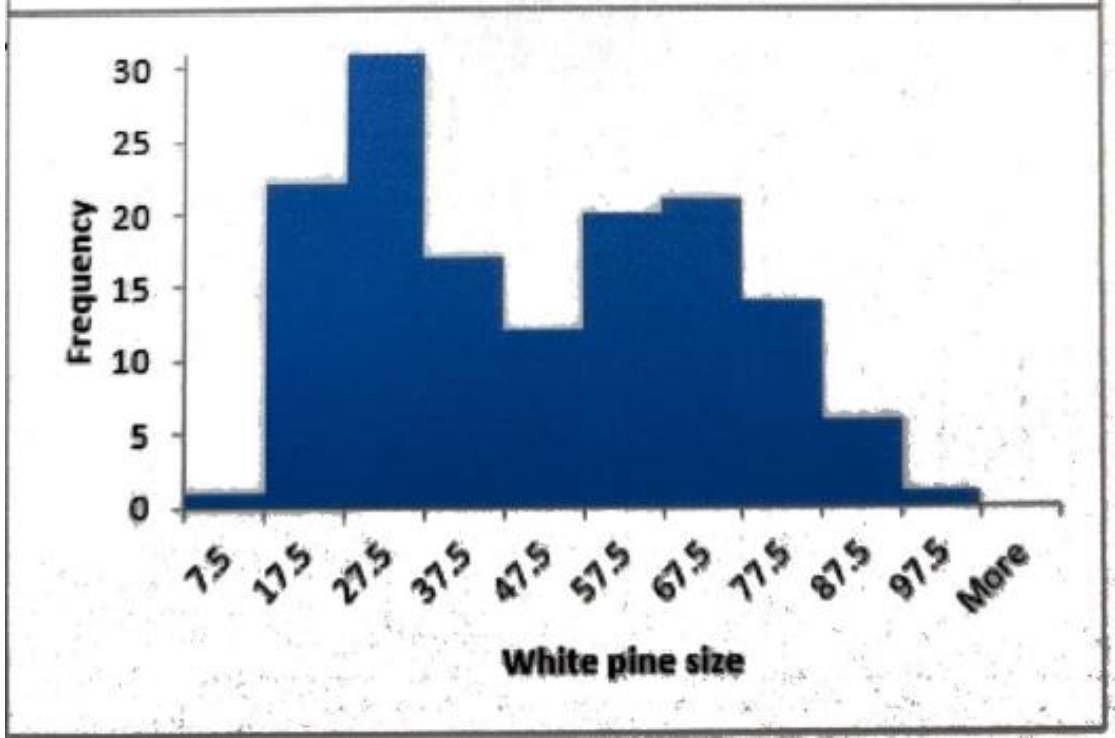
Pine demographics

- Data Credit: Community Ecology Class Fall 2023

- DMH (cm) of all pines in sandplain remnant in Saint Michael's College Natural Area

- Bottom line:
  - White pines are thriving and recruiting
  - Pitch pines are a population in decline





Hypotheses given the demographics, succession, and prescribed burns

- H_1: In fire suppressed site, pitch pine growth should be rapid and then slowing as succession advances
- H_2: Pitch pines growing in full sun should have relatively uniform growth over time
- H_3: Prescribed burns should reset succession and pitch pine should again grow rapidly
- H_4: Pitch pines in unburned control sites adjacent to prescribed burns should have rapid and then slow growth

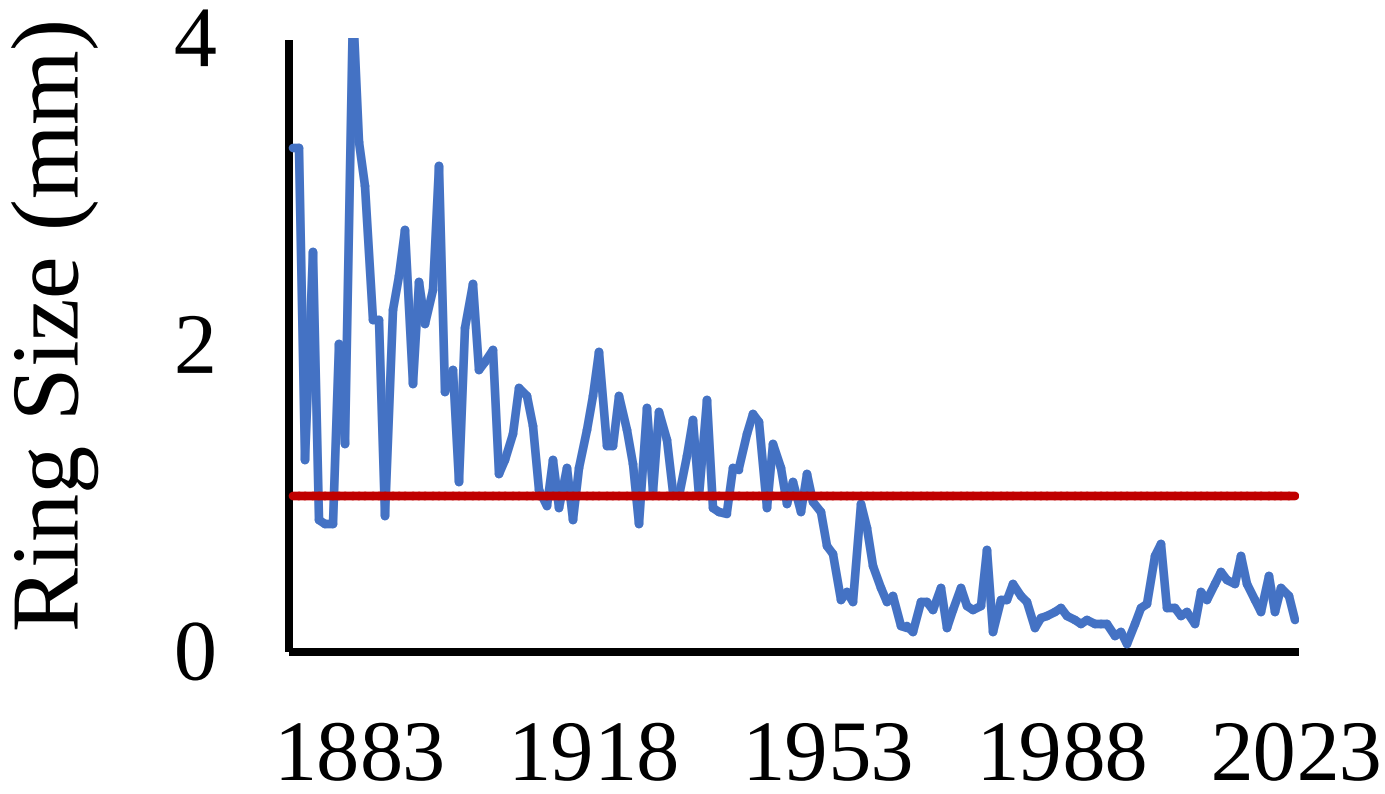
Sites for each Hypothesis

- H_1: Fire suppressed: SMC Natural Area
- H_2: Full sun: North bank of beaver pond Gilbrook: two trees
- H_3: Prescribed burns in Camp Johnson: three sites
- H_4: Unburned control sites Camp Johnson: 1 tree

Methods

- Increment borer
- Core mounted, sanded, boiled linseed oil applied
- Images captured using a Wild M5
- Ruler in frame on each image
- Measurements made in ImageJ

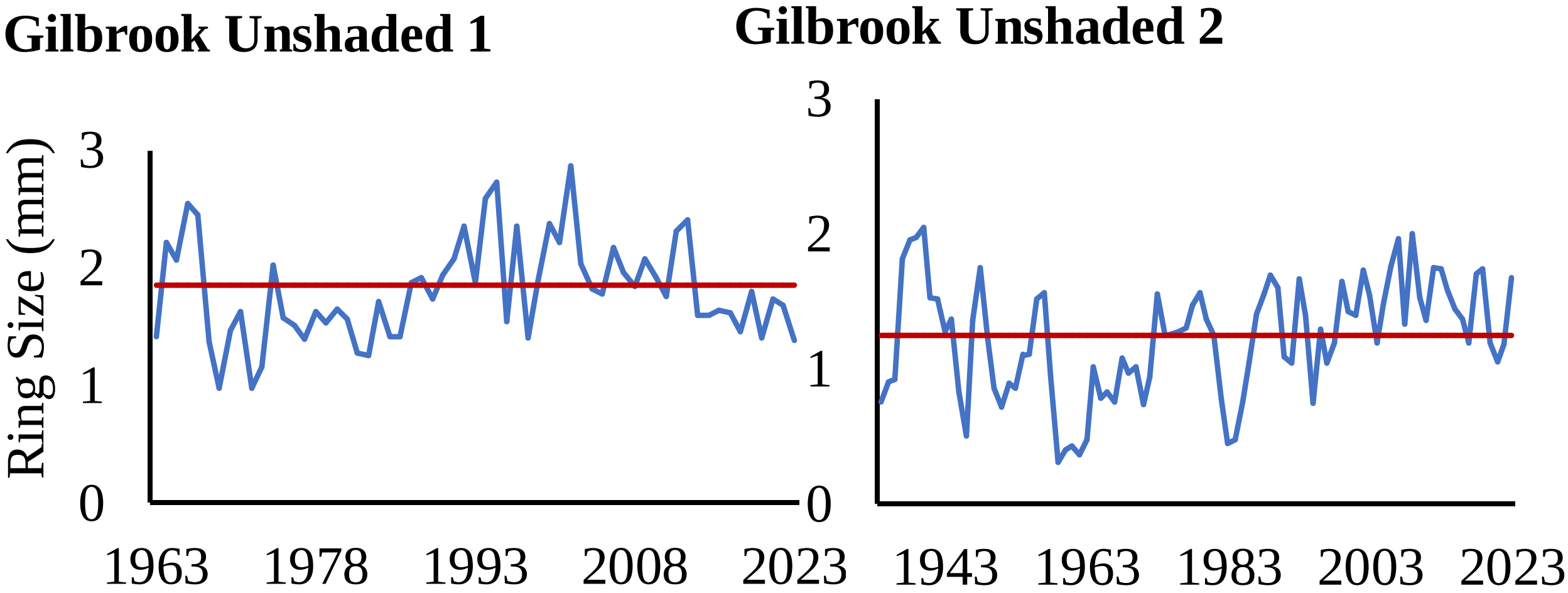
Results. H_2:
Fire-suppressed pitch pine grow fast then slow



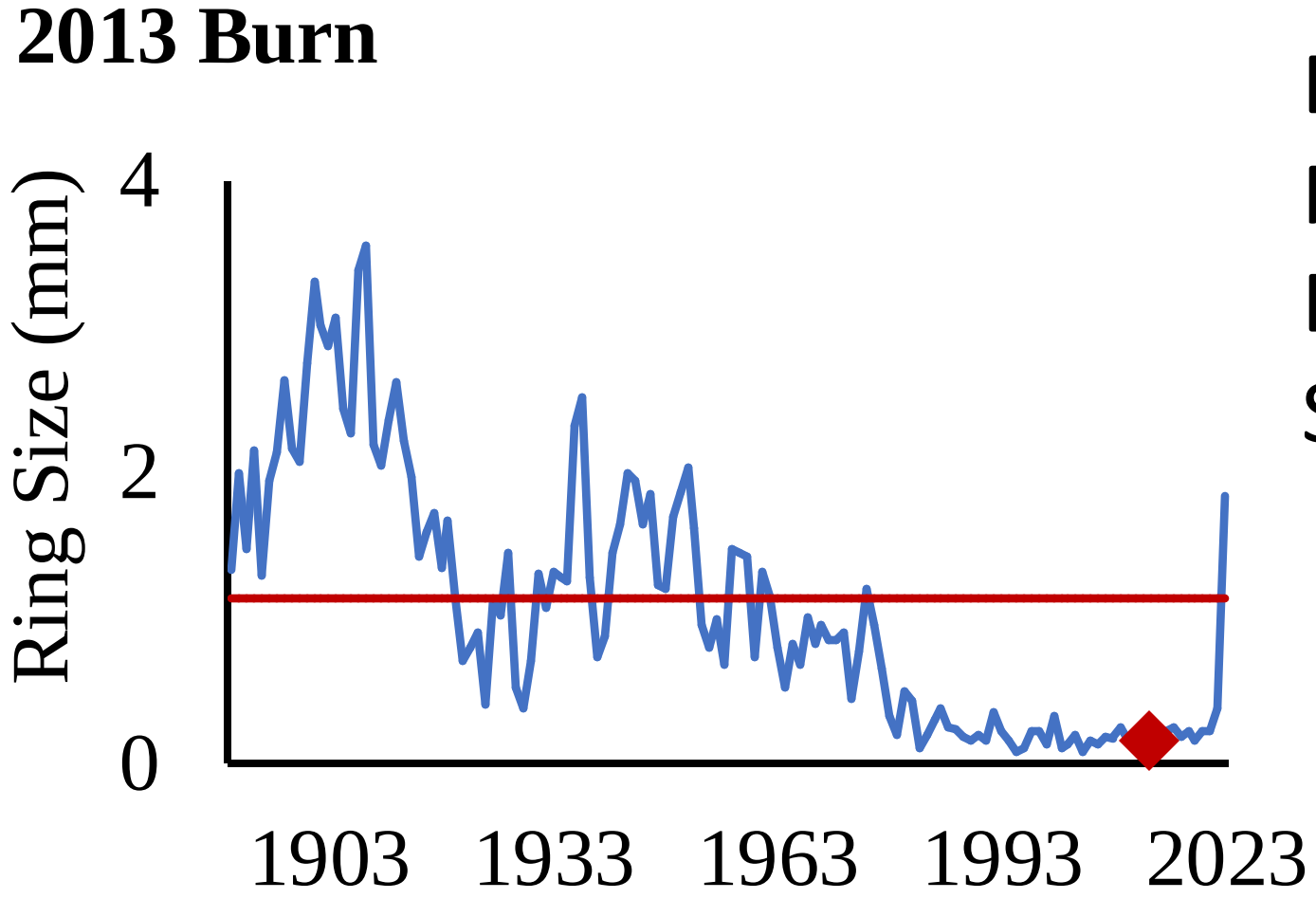
Data credit: Sarah Newton, Skyleigh Bickings, Jackson Sargent

- **SMC Natural Area Sub-Canopy Pitch Pine**

Results. H_2: Uniform growth in full-sun pitch pines

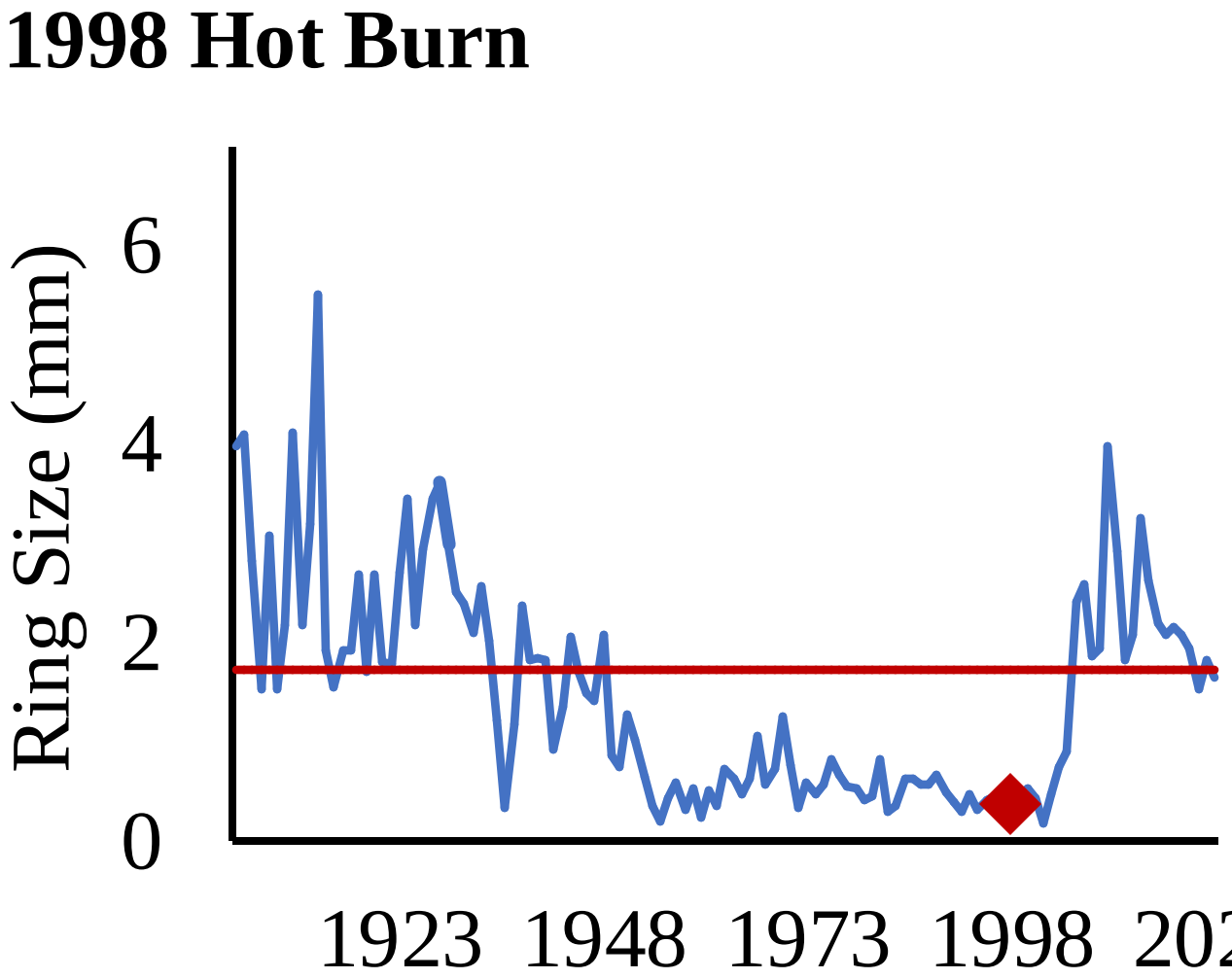


Results. H_3: Prescribed burns reset succession and pitch pine growth



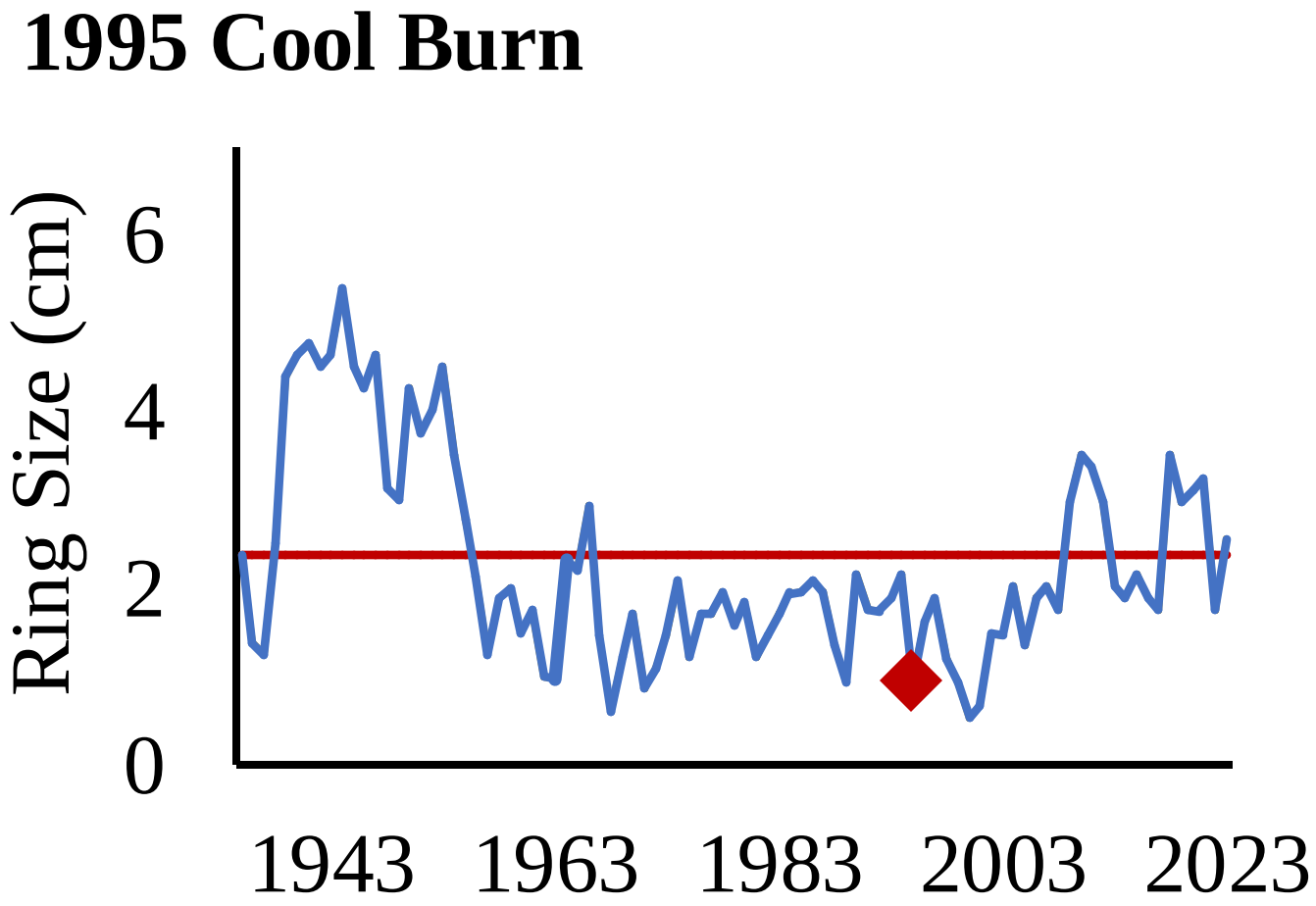
Data credit: Sarah Newton, Skyleigh Bickings, Jackson Sargent

Results. H_3: Prescribed burns reset succession and pitch pine growth



Data credit: Sarah Newton, Skyleigh Bickings, Jackson Sargent

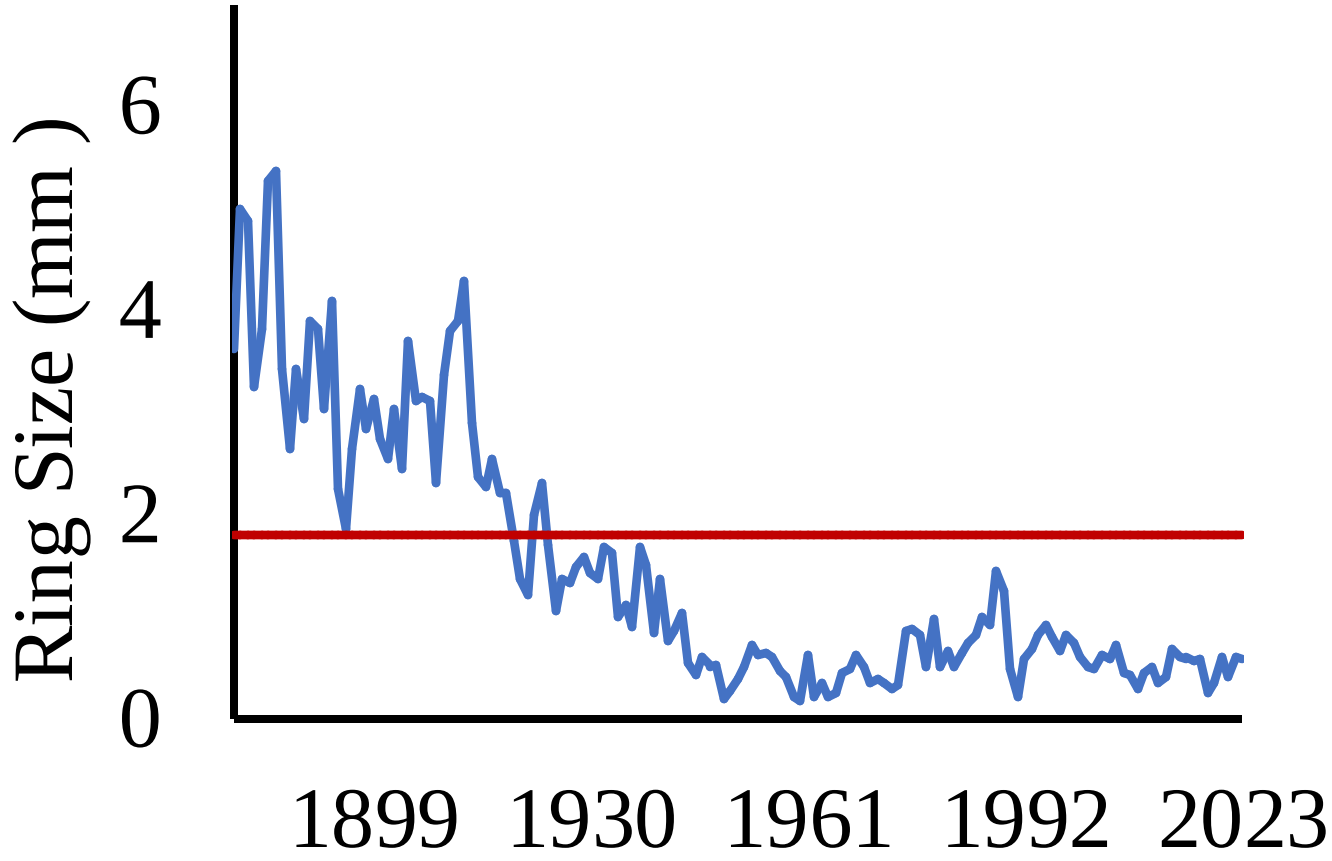
Results. H_3: Prescribed burns reset succession and pitch pine growth



Data credit: Sarah Newton, Skyleigh Bickings, Jackson Sargent

Results. H_4:
Control pitch pine grow fast then slow

Unburned Control



Data credit: Sarah Newton, Skyleigh Bickings, Jackson Sargent

- **Camp Johnson control site, Sub-Canopy Pitch Pine**

Conclusions

- H_1: In fire suppressed site, pitch pine growth should be rapid and then slowing as succession advances
- H_2: Pitch pines growing in full sun should have relatively uniform growth over time
- H_3: Prescribed burns should reset succession and pitch pine should again grow rapidly
- H_4: Pitch pines in unburned control sites adjacent to prescribed burns should have rapid and then slow growth

All hypotheses supported

Take-home messages

- Prescribed burns enhance pitch pine growth in mid to late successional forests

- Tree coring provides unique insights for teaching and research

Questions, input, suggestions?

- Important: this was developed as teaching that became UG research
- Calling all plant ecologists……..