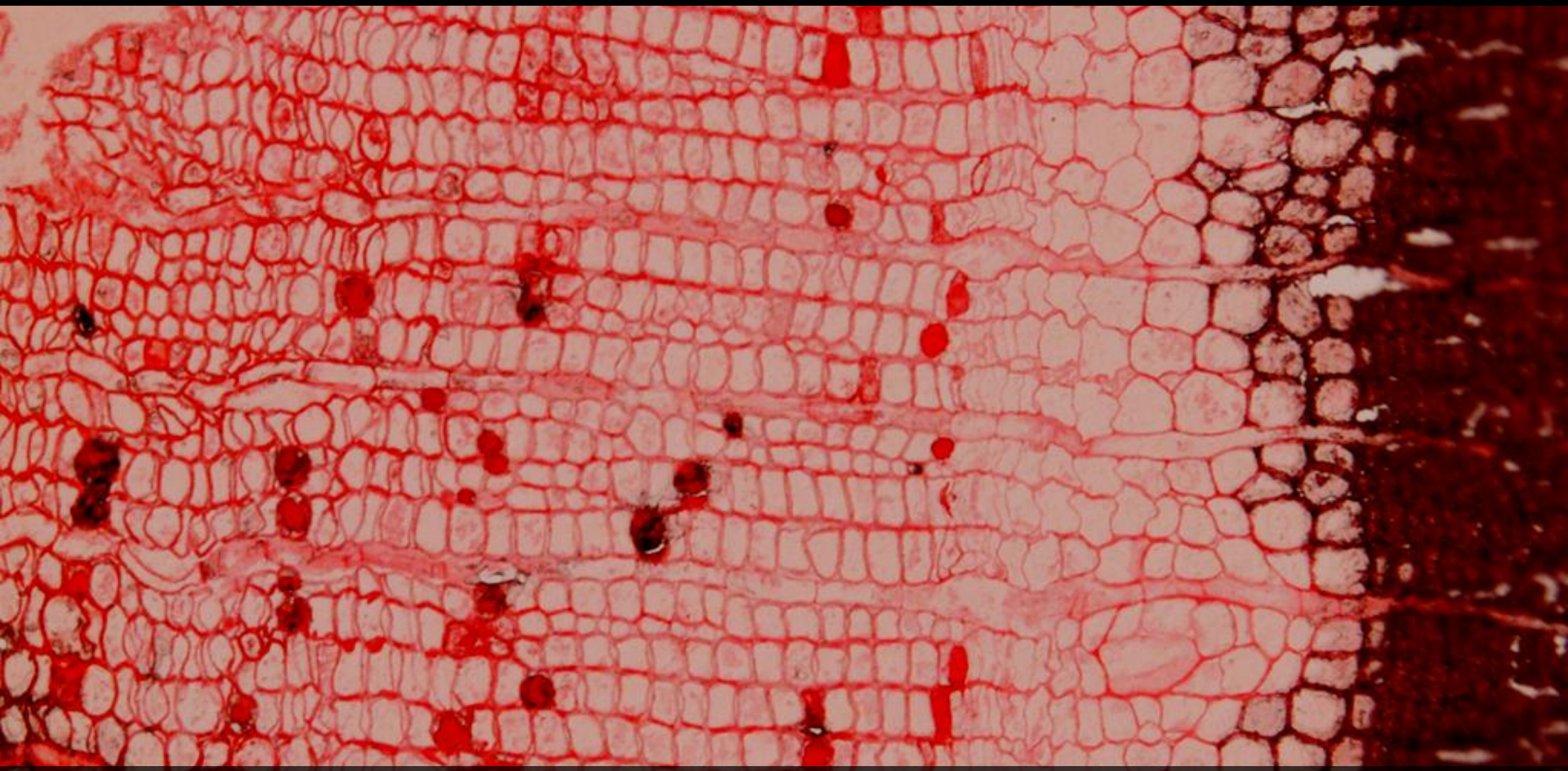
Seasonal wood formation dynamics of slash pine (*Pinus elliottii var. densa*) in the Lower Florida Keys, U.S.A.



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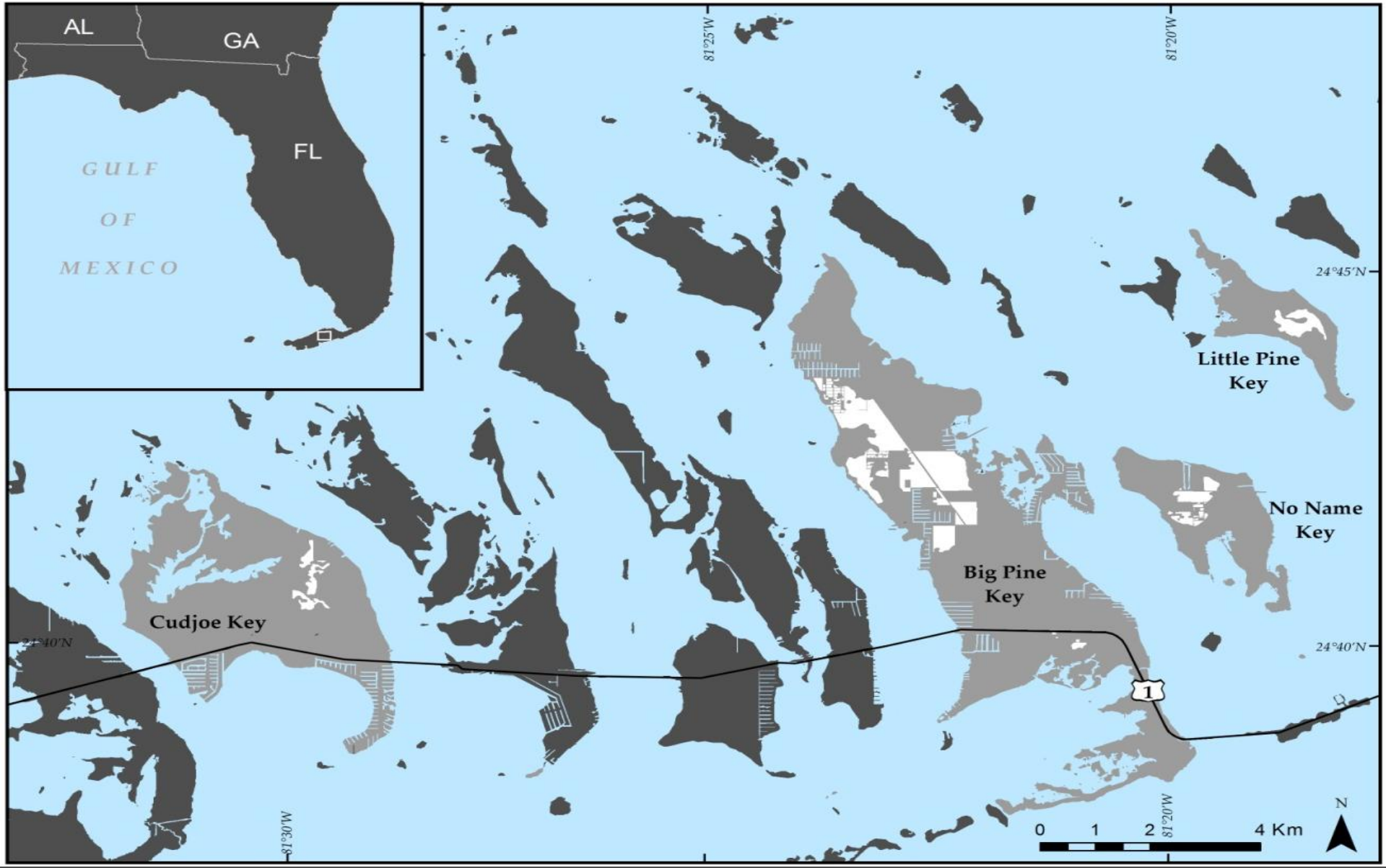
INTRODUCTION

- Recent surge of studies that highlight annual growth rings in tropical and subtropical tree species
- Also identify environmental triggers of seasonal growth
- These data increase confidence and corroborate dendrochronological studies in these areas

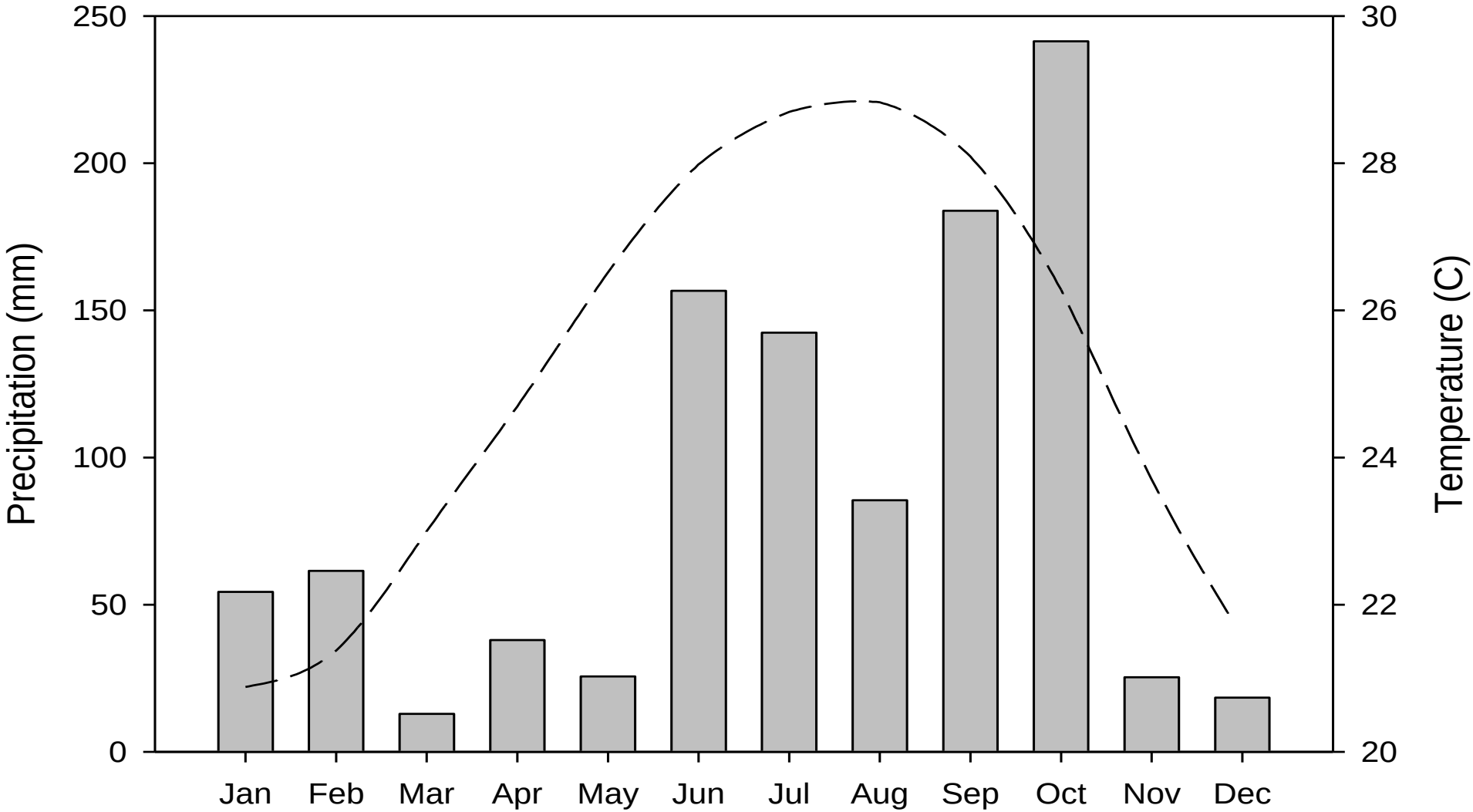
Study Area

- Pine Rocklands: globally endangered ecosystems
- Characterized by single canopy species, subcanopy of hardwoods and palms, variety of endemic herbs
- Once covered 75,000 ha, now 2,268 ha (97% decline from pre-settlement area)
- Mostly contained within NKDR; managed by USFWS
    - NKDR established in 1957

Study Area


AL
GA
FL
GULF
OF
MEXICO
81°25'W
81°20'W
24°45'N
Little Pine
Key
No Name
Key
Big Pine
Key
Cudjoe Key
24°40'N
1
81°30'W
0
1
2
4 Km
N

Study Area


250
200
150
100
50
0
Precipitation (mm)
30
28
26
24
22
20
Temperature (C)
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec

RATIONALE

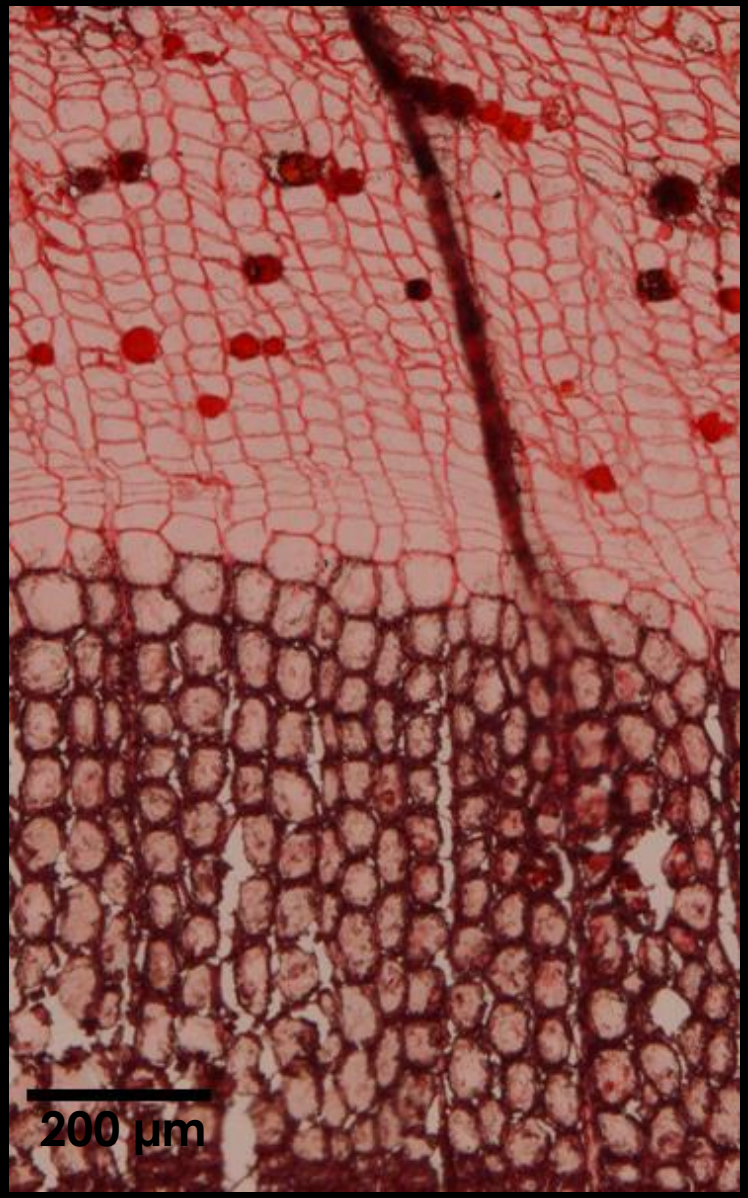
- Growth rings of slash pine are anatomically distinct and consistently annual
- Radial growth influenced by water availability during growing season (Sep-Oct precipitation important for radial growth)
- However, not much is known about the growing season of slash pine
- These data provide greater confidence in growth ring chronologies developed and better understanding of:
    - Climate-radial growth relationships
    - Seasonality of fire scars
- Langdon (1963) installed dendrometer bands on 10 individuals near Ft. Meyers, FL
    - First spring flush occurred in early February
    - 37% (Feb–Apr); 25% (May–Aug); 25% (Sep–Nov); 3% (Dec–Jan)
    - Data suggests that growth never stops, just slows down

OBJECTIVES

Identify the seasonal wood formation dynamics of slash pine

- Determine the timing of earlywood/latewood growth and cambial reactivation, and dormancy period (length).
- Observe occurrence and timing of density fluctuations (false rings)

Observe correspondence between seasonal wood formation dynamics and environmental controls



METHODS: FIELD

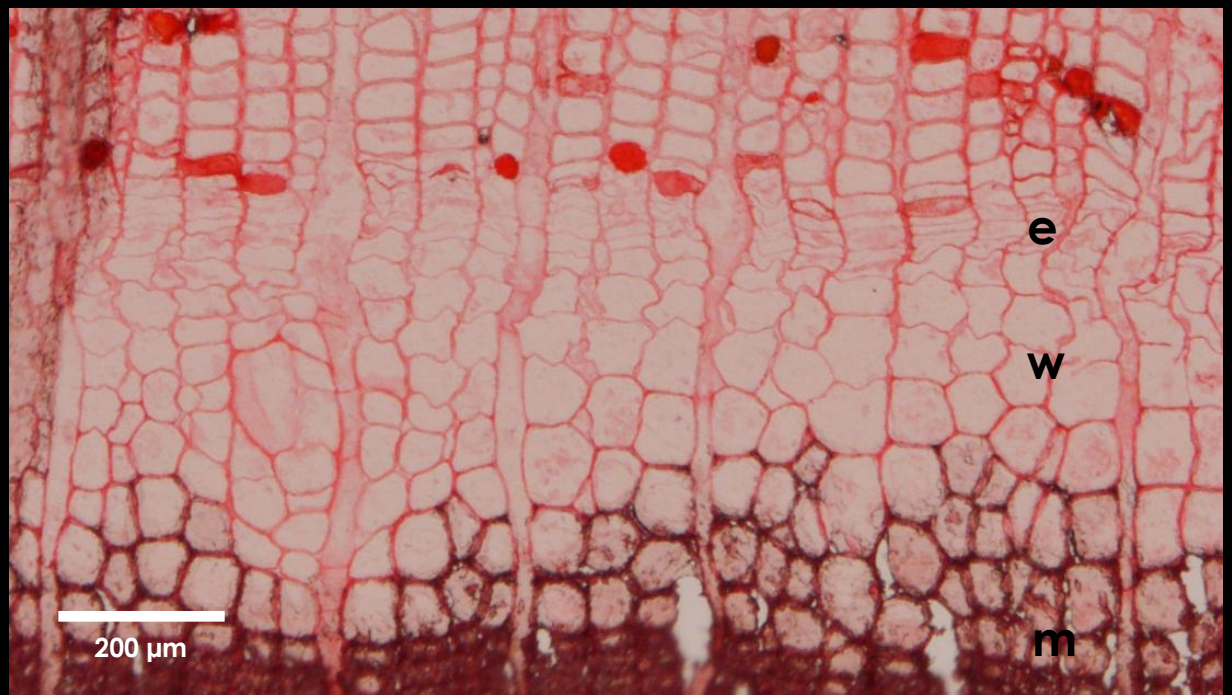
- 6 mature trees selected from pine savanna within NKDR on Big Pine Key
- Outermost layers of bark shaved off
- Microcores (4 mm x 10 mm) extracted each month 3/10–3/11 with modified increment hammer
    - Cores extracted in zigzag pattern within a zone 30 cm above and below breast height (at least 5 cm apart)

METHODS: LAB

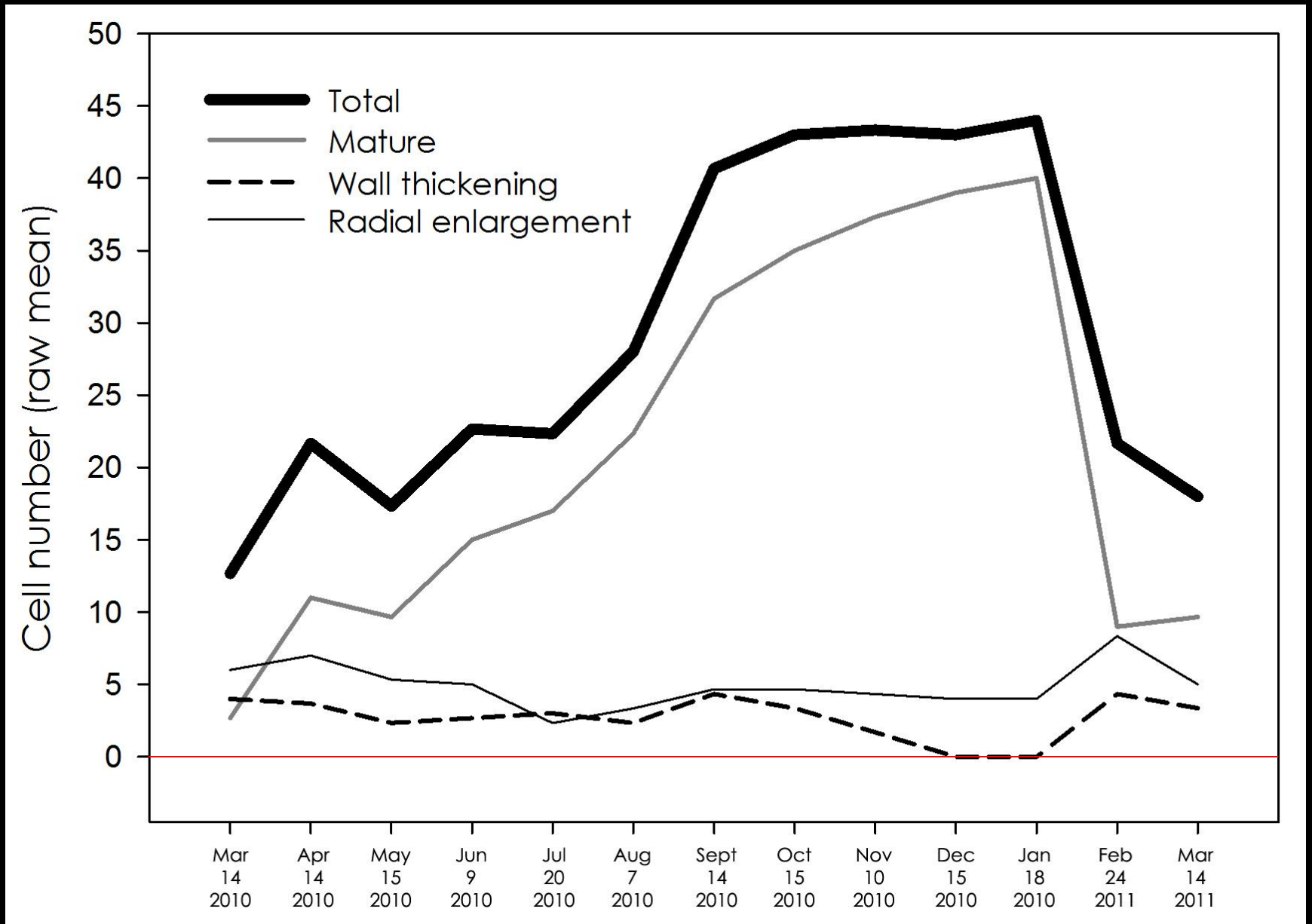
- Samples –
  - **fixed** in FAA preservative solution (Formalin-Acetic-Alcohol)
  - **dehydrated** in graded ethanol series
  - **embedded** in Technovit 7100 plastic historesin (glycolmethacrylate)
  - **sectioned** with rotary microtome (7–10 μm)
    - Tungsten-carbide blade
  - **stained** with Safranin-O
  - **observed** under compound light microscope
- Daily weather data from USFWS station on Big Pine Key
  - Precipitation, temperature, solar radiation, POTET

METHODS: LAB

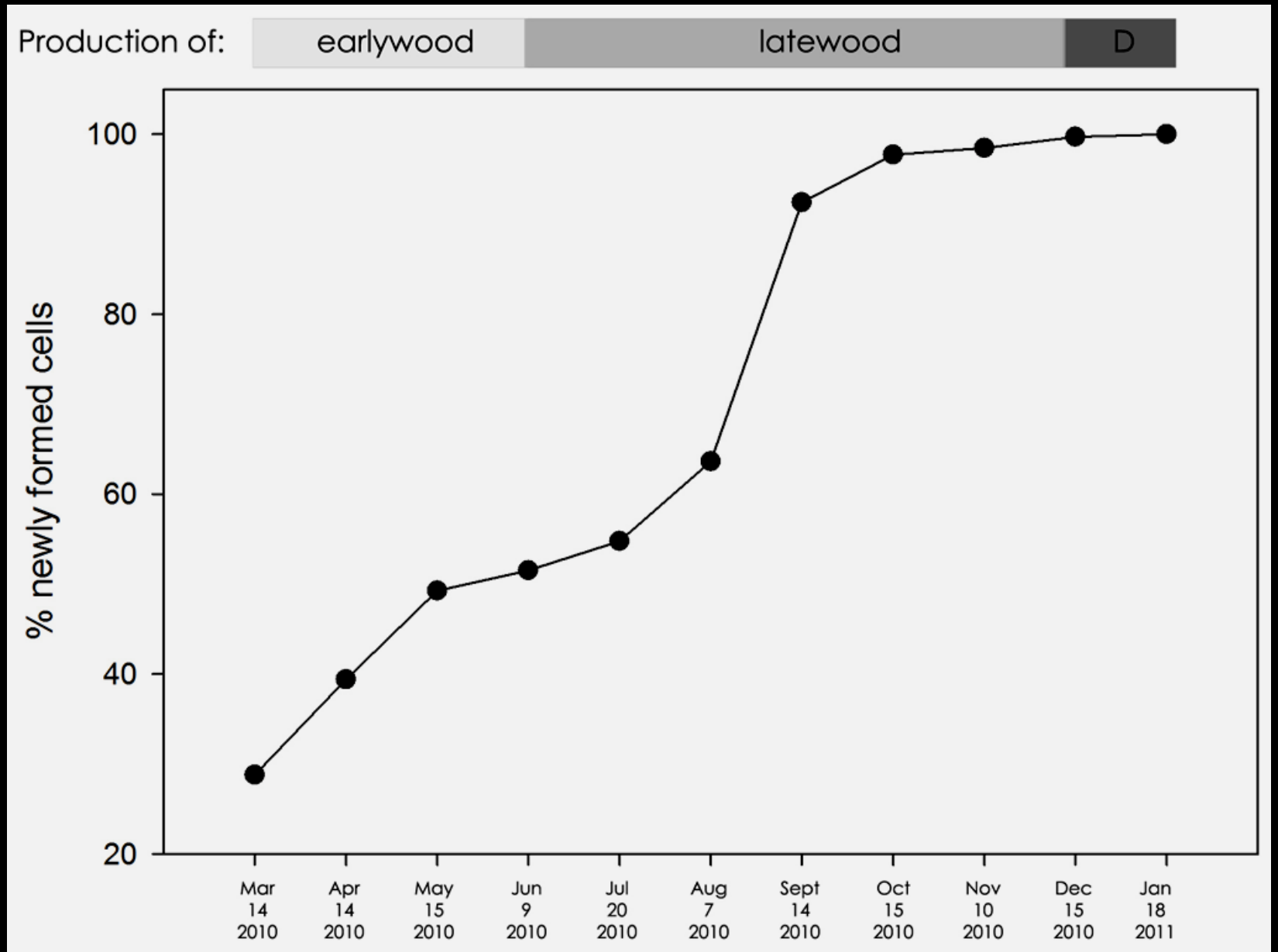
- Cell measurements for BYR3 –
  - For each sample, #of xylem cells counted along 3 radial files:
    - radial enlargement phase (n_e) (fusiform cambial cells)
    - cell wall thickening phase (n_w) (tracheids w/ primary walls)
    - mature cell phase (n_m) (tracheids w/ secondary walls)



RESULTS: CELL

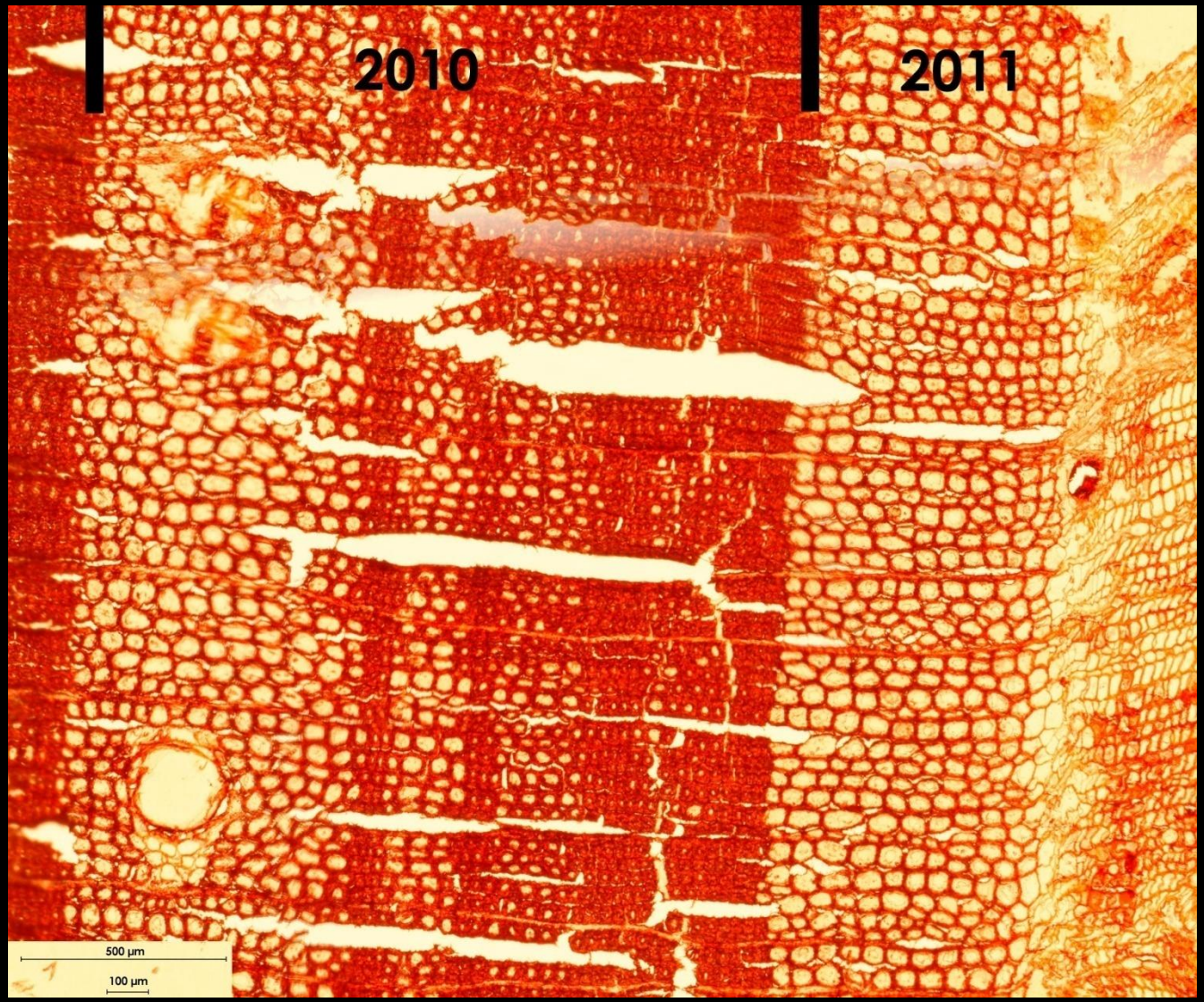


RESULTS: EW–LW TIMING

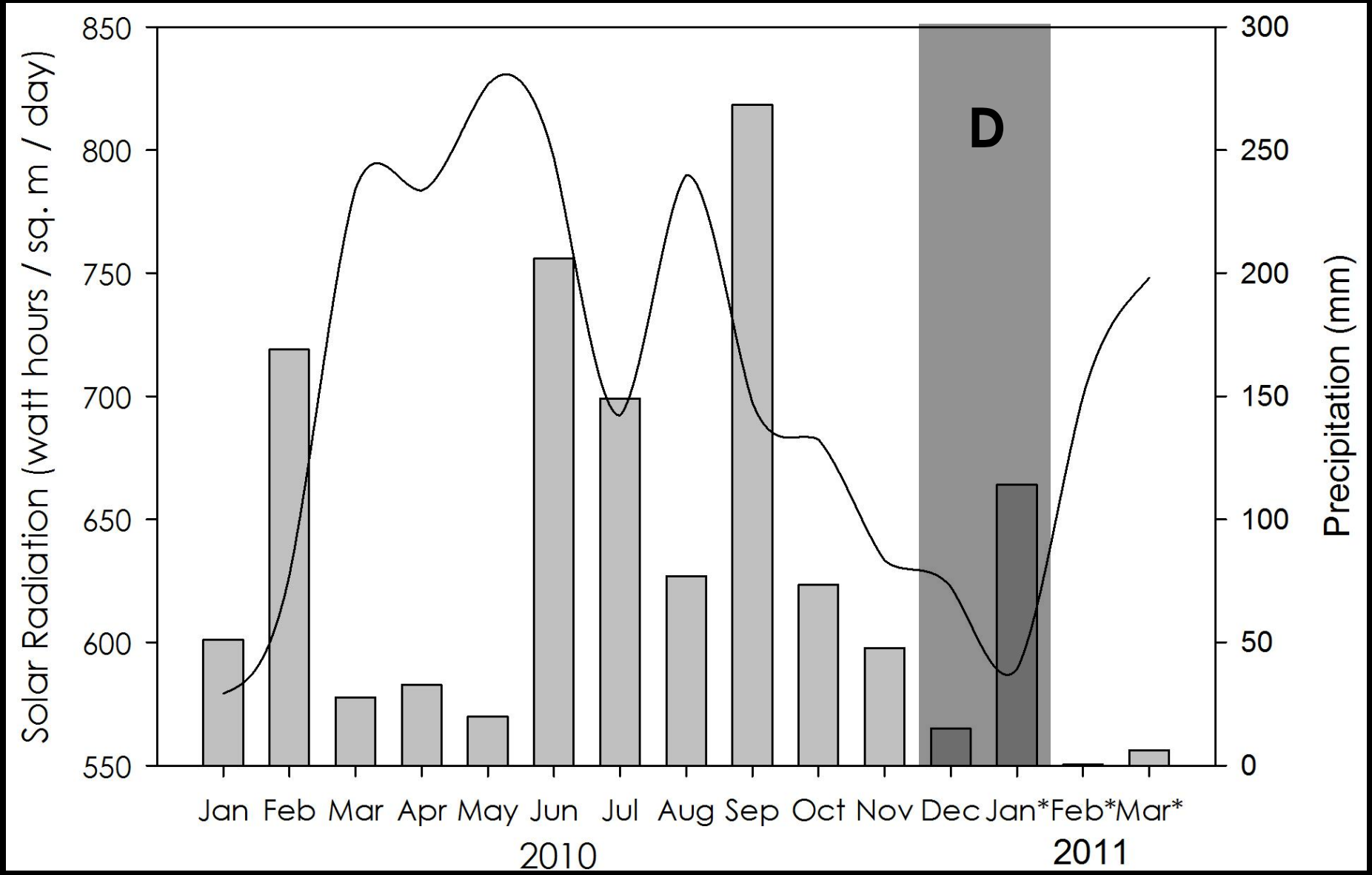


Results: False Rings

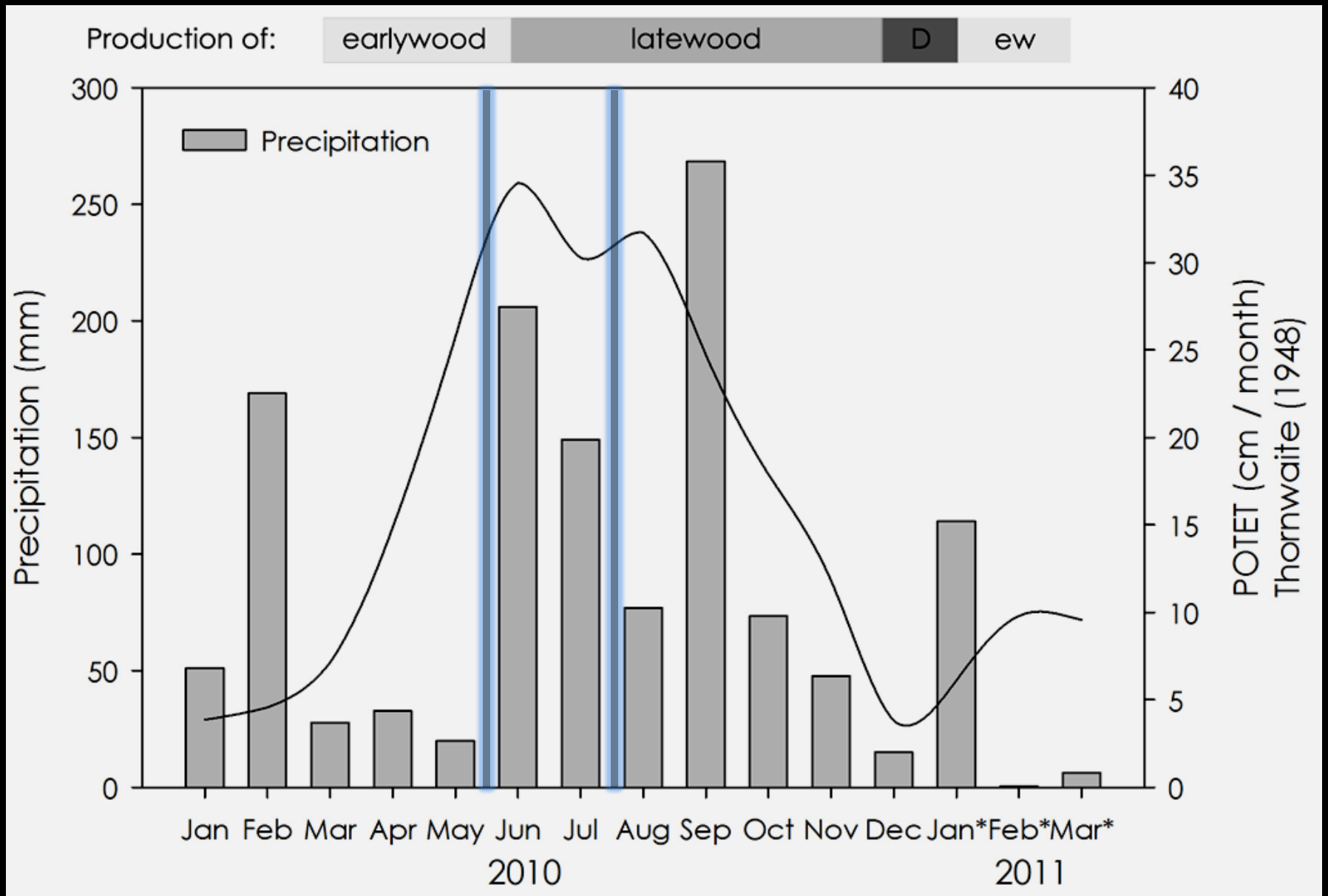
February 24, 2011



RESULTS: ENVIRONMENT + DORMANCY



Results: Environment + False Rings

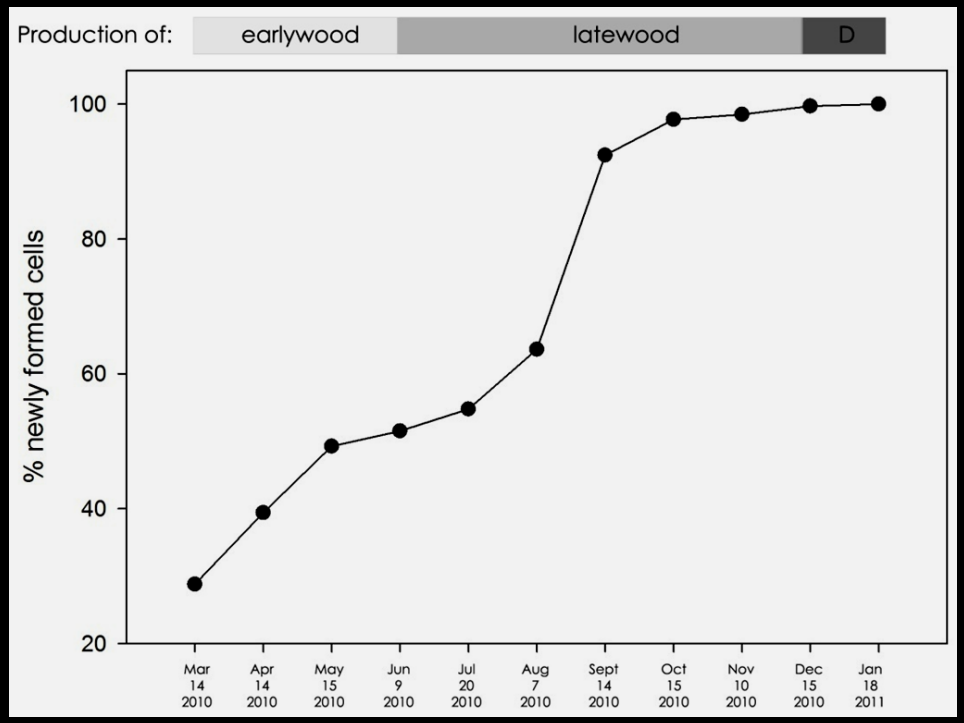


DISCUSSION/CONCLUSIONS

Identify the seasonal wood formation dynamics of slash pine

- **Determine the timing of earlywood/latewood growth and cambial reactivation, and length of dormancy period.**

- EW formed between Mar and Jun 2010
- LW formed between Jun and Nov 2010
- Dormant cambium observed between Dec 2010 and Jan 2011
  - By Nov 2010 , only 1 cell row in wall thickening phase
  - So, dormancy likely existed between shortly after Nov 2010 to shortly after Jan 2011 (~ 2 months) in this individual



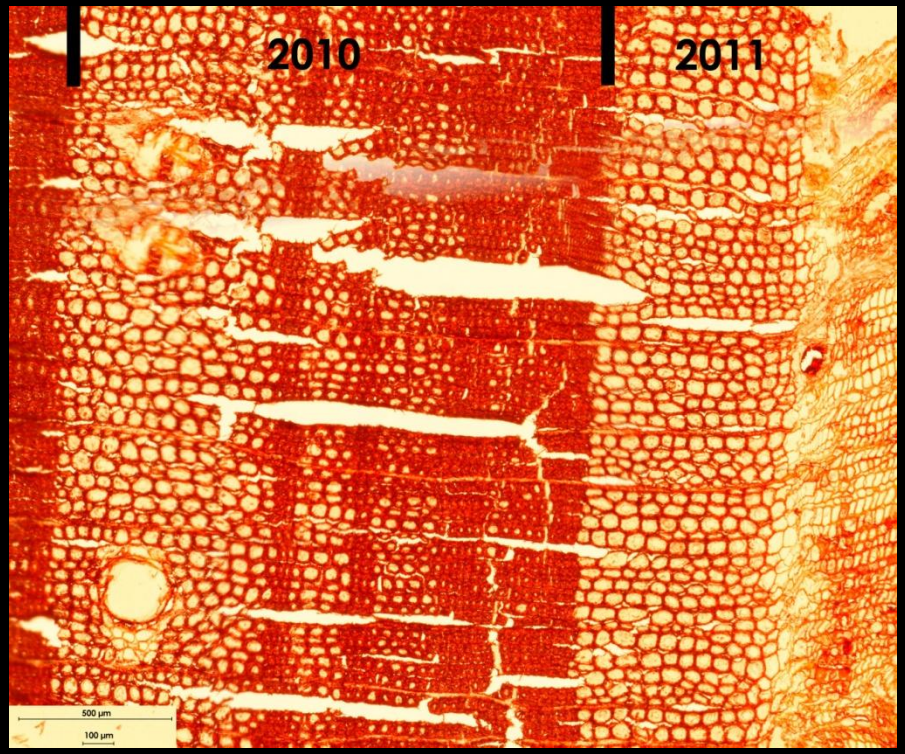
Discussion/Conclusions

Identify the seasonal wood formation dynamics of slash pine

- **Observe occurrence and timing of density fluctuations (false rings)**

- 2 false rings formed in this individual
  - One between May and Jun samples, one between Jul and Aug

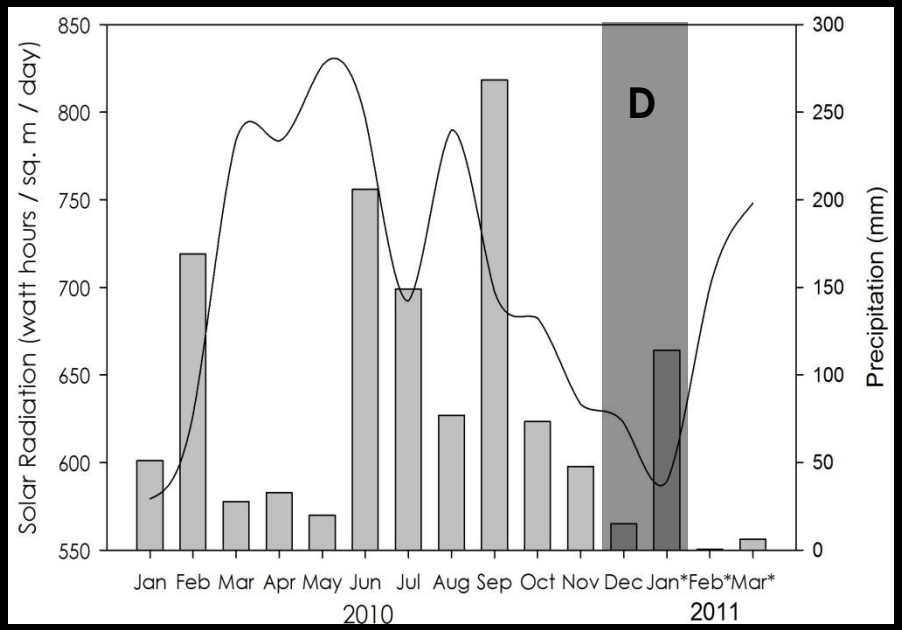
February 24, 2011

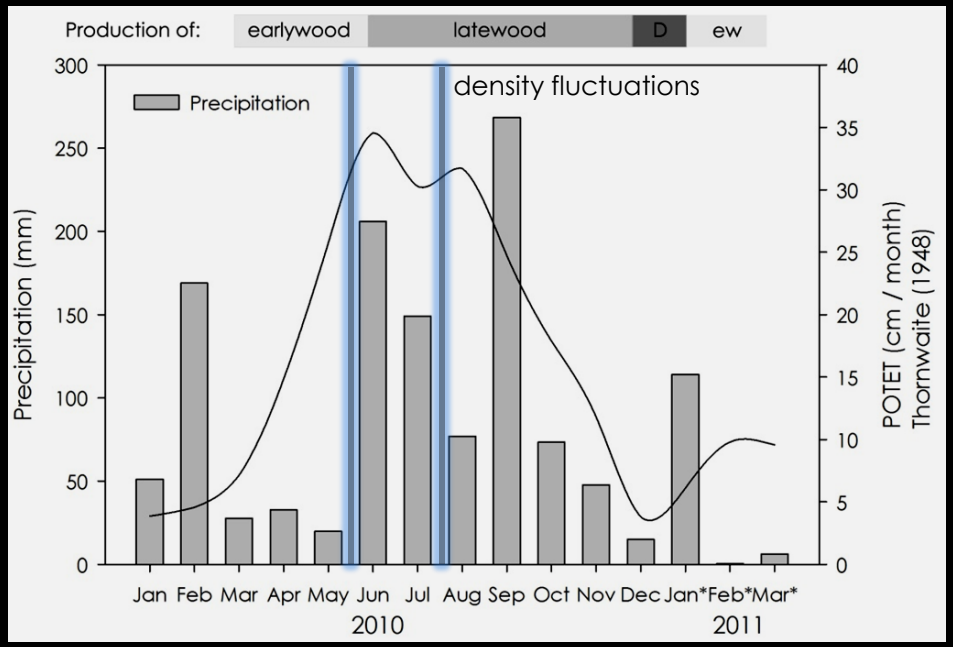


DISCUSSION/CONCLUSIONS

Observe correspondence between seasonal wood formation dynamics and environmental controls

- **Dormancy and cambial reactivation** - possibly controlled by threshold of decreased/increased solar radiation and/or precipitation
- **False Rings** - possibly caused by lack of available moisture during summer





Acknowledgements

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Questions?