



RED PINE DECLINE MONITORING

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Introduction

- Minimum of a decade long decline
- Possible Causal agents
 - Climate change
 - Red pine scale (*Matsucoccus resinosae*)
 - Detected in Rutland and Orange counties in 2015



Photo: State of
New Hampshire



Introduction

- 2019 -The first monitoring site established in Groton State Forest
- Preliminary sampling in VT 2019
 - Shoot blight pathogens
 - *Diplodia pinea*
 - *Sirococcus conigenus*
 - *Pestalotiopsis* sp.
 - Pine weevil gall (*Podapion gallicola*)
 - Spider mites
- Is this decline pattern homogenous across the state?



Methods: Site Locations

- Established 12 sites between 4 regions using only state-owned land

- Northeast

- Groton State Forest (East)
- Groton State Forest (West)
- West Mountain WMA

- Northwest

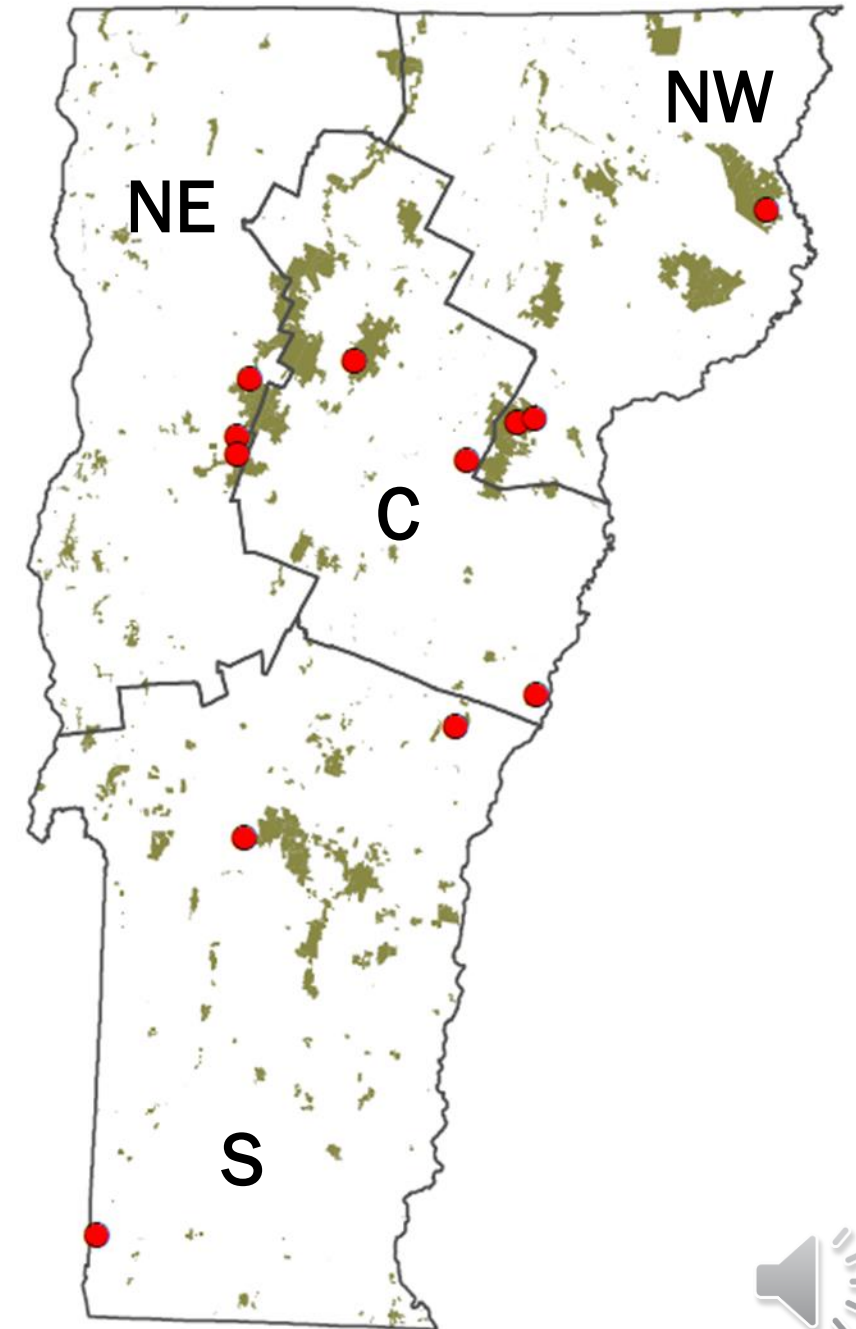
- Camel's Hump –Duxbury
- Camel's Hump –Lincoln
- Camel's Hump –Starksboro

- Central

- LR Jones State Forest
- Thetford Hill State Park
- C. C. Putnam State Forest (Perry Hill)

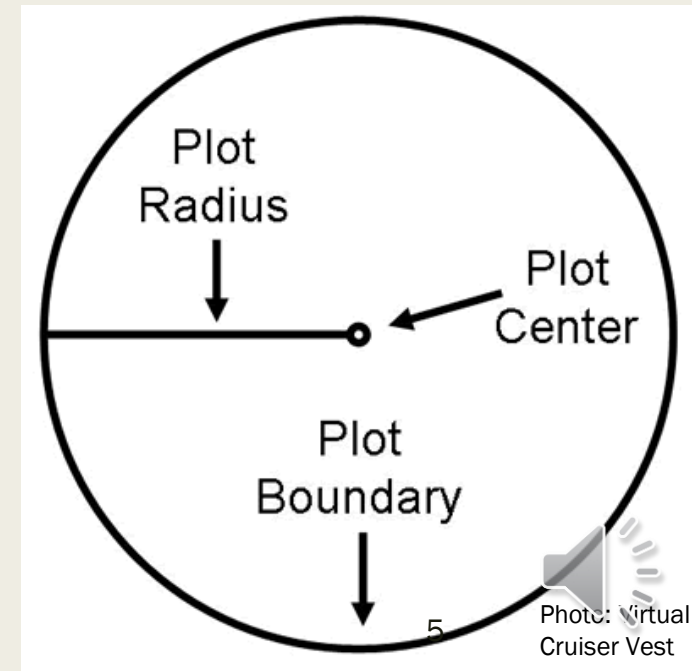
- Southern

- Aitken State Forest
- Charles Downer State Forest
- Whipstock Hill WMA



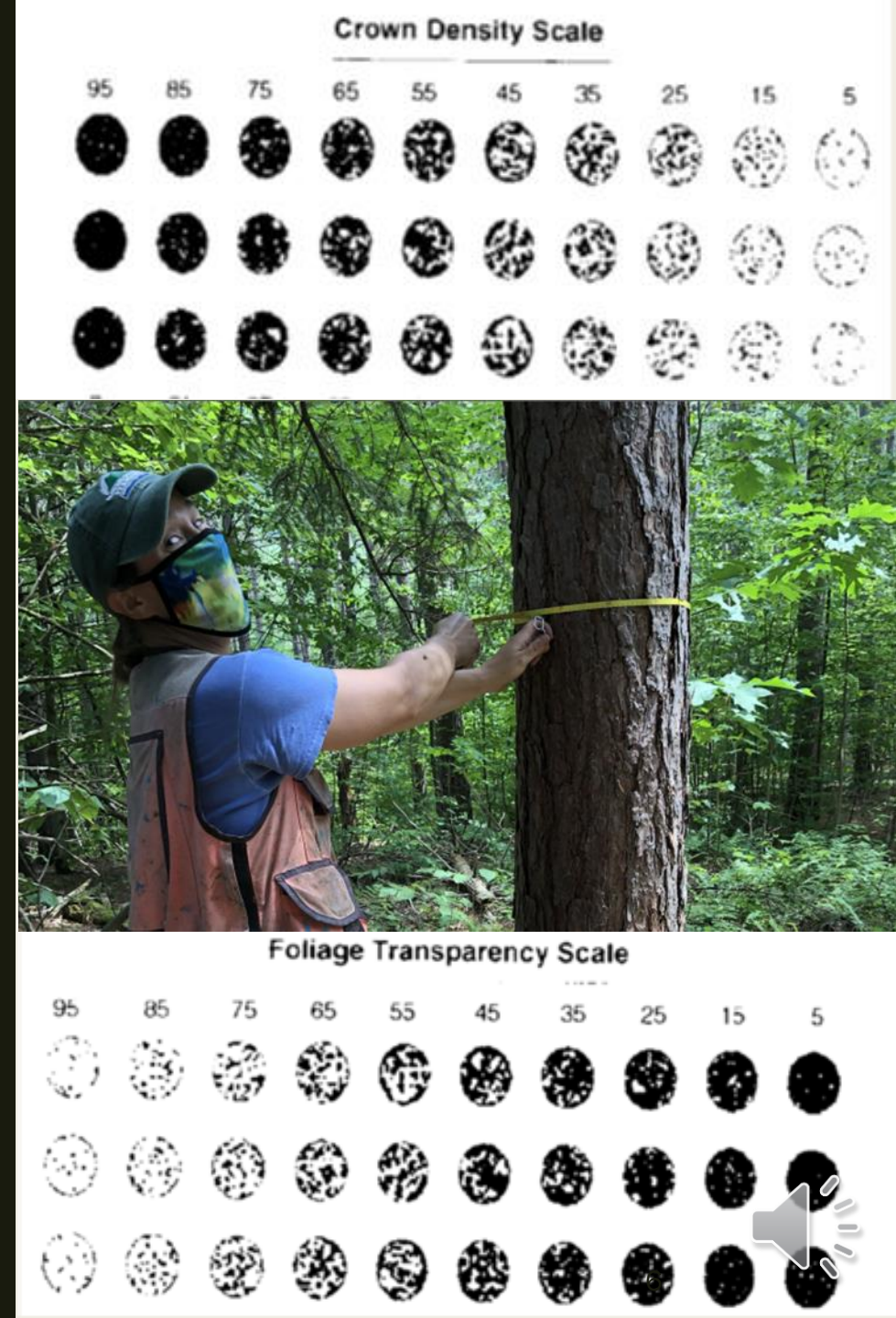
Methods: Plots

- 4 plots/ site
- Each plot has 4(+) trees
 - approx. 20 total trees
- Fixed radius 35 feet
- Min 120 feet between plots
- Goal of having linear plots
 - Not practical



Methods: Plots

- Plot observations only completed **first year**
 - Azimuth
 - Distance from tree to plot center (feet)
 - DBH (inches)
 - Crown position
- Plot observations to be completed **annually**
 - Uncompacted live crown ratio (%)
 - Crown density (%)
 - Dead shoots (%)
 - Dead shoot location (Bottom, Middle, Top, Scattered)
 - Crown transparency (%)
 - Needle discoloration (%)



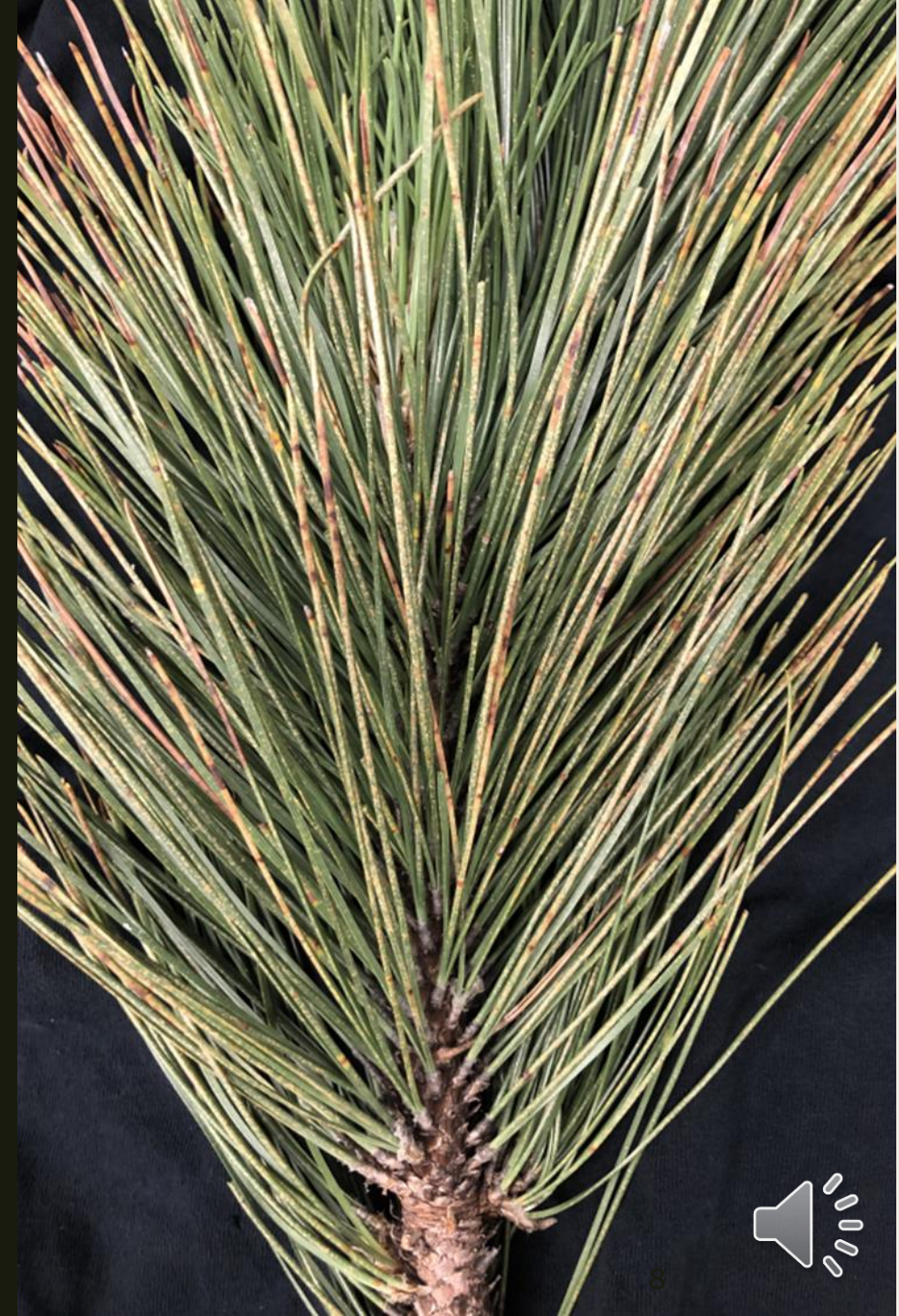
Methods: Timeline

- Observations should be done in **leaf off** conditions
 - Late October-January
 - Mixed hardwood forests/ dense understory
 - Some sites have questionable winter roads
- Site sampling in 2020
 - Repeated as drastic changes occur
- Project timeline – 5 years



Methods: Sampling

- 10/12 sites were sampled in 2020
 - Excluding C.C. Putnam and Aitken SF due to safety restrictions
- Needles, branch tissues
 - Fungal isolation
 - Insect feeding observations
- Cross-sections
 - DBH and BLC
 - Growth comparison



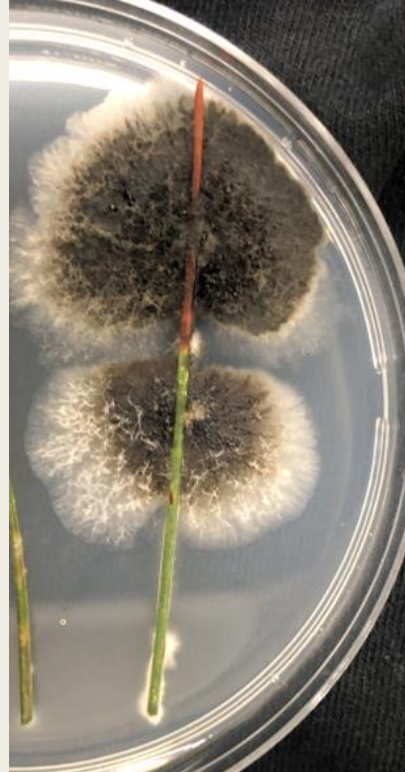
PRELIMINARY RESULTS



Crown Metrics

| Region | DBH (in.) | LCR (%) | Density (%) | Dead Shoots (%) | Transparency (%) | Discoloration (%) |
|-----------------|-----------|---------|-------------|-----------------|------------------|-------------------|
| C | 14.8 | 34 | 48 | 25 | 35 | 25 |
| NE | 15.7 | 34 | 42 | 30 | 52 | 9 |
| NW | 14.5 | 42 | 47 | 14 | 33 | 13 |
| S | 13.2 | 32 | 47 | 13 | 30 | 13 |
| Average | - | - | 46 | 21 | 37 | 15 |
| Standard | - | - | 50 | 10 | 30 | 10 |





DIPLODIA TIP BLIGHT

Sphaeropsis sapinea/ Diplodia pinea





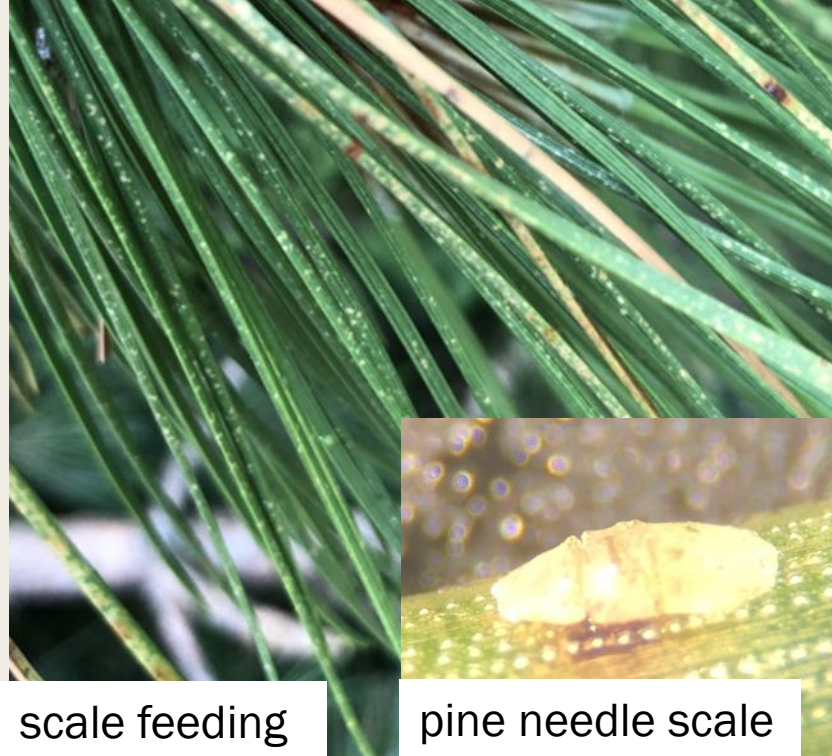
RED BAND NEEDLE BLIGHT

Mycosphaerella pini / *Dothistroma septospora*





scale feeding



scale feeding

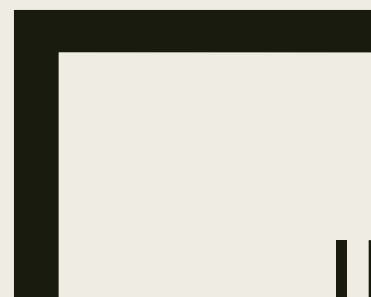
pine needle scale



pine gall weevil



sawfly feeding

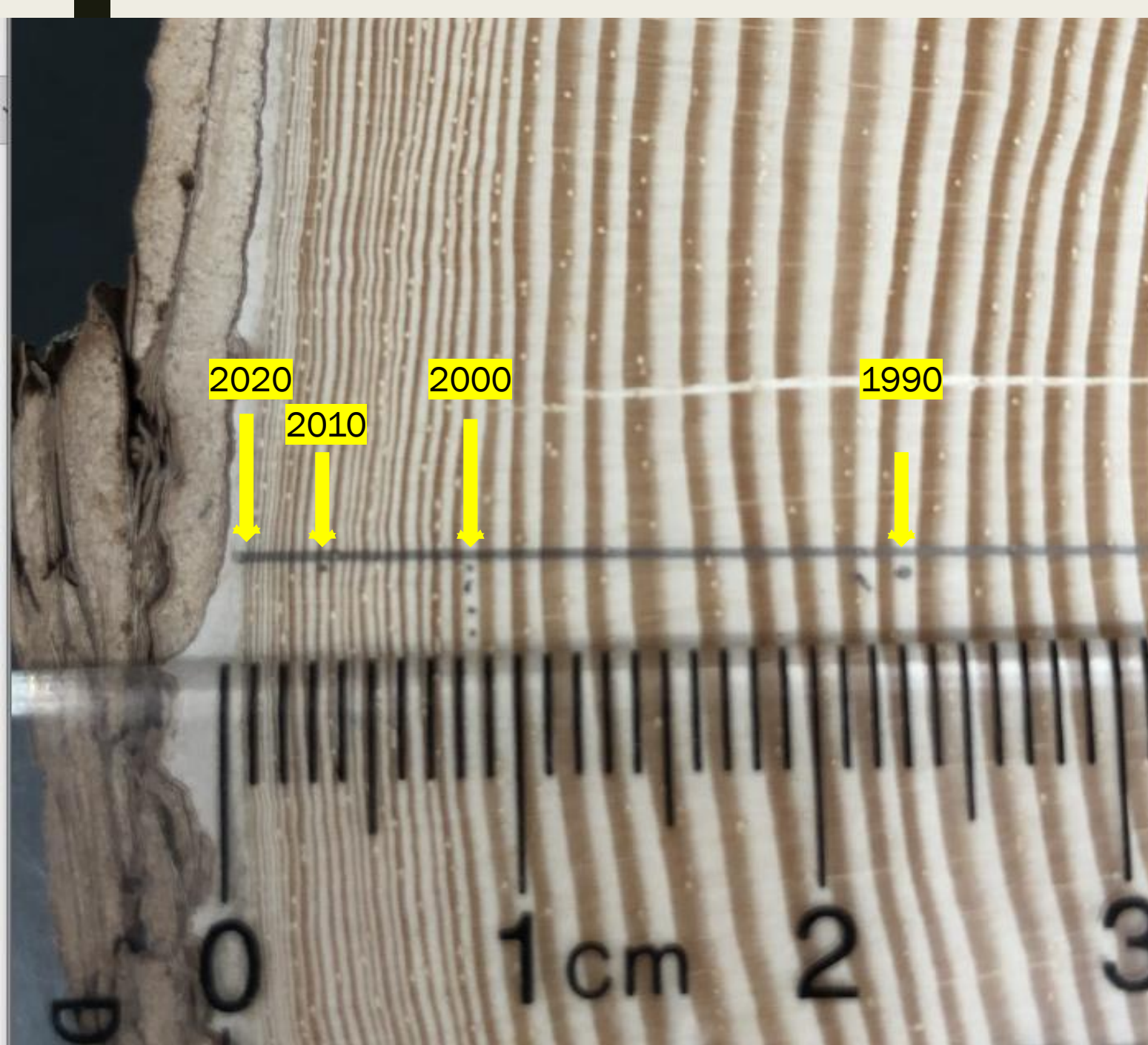


INSECT DAMAGES



Tree Rings Analysis

- Notable abiotic factors in Vermont
 - 2016-2019 drought
 - 2011-2012 tropical storm Irene
 - 2002 drought
 - 1998 ice storm
 - 1997 flash flooding
 - 1973 flood
 - 1938 the Great NE Hurricane
 - 1927 flood



Summary

- Red pine is declining across the state
- Combination of abiotic and biotic stressors
 - Successive years of droughts
 - *Diploida* tip blight
 - Red band needle blight
 - *Sirococcus* shoot blight
 - Pine needle scale
 - Pine gall weevil
 - Sawflies





QUESTIONS?

