# The Effects of Elevated Ozone and Fluctuating Moisture Supply on *Pinus taeda* Seedlings Inoculated with Ophiostomatoid Fungi

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Presented by Adam Trautwig

# Agenda

- Background
- Methods
- Results
- Questions

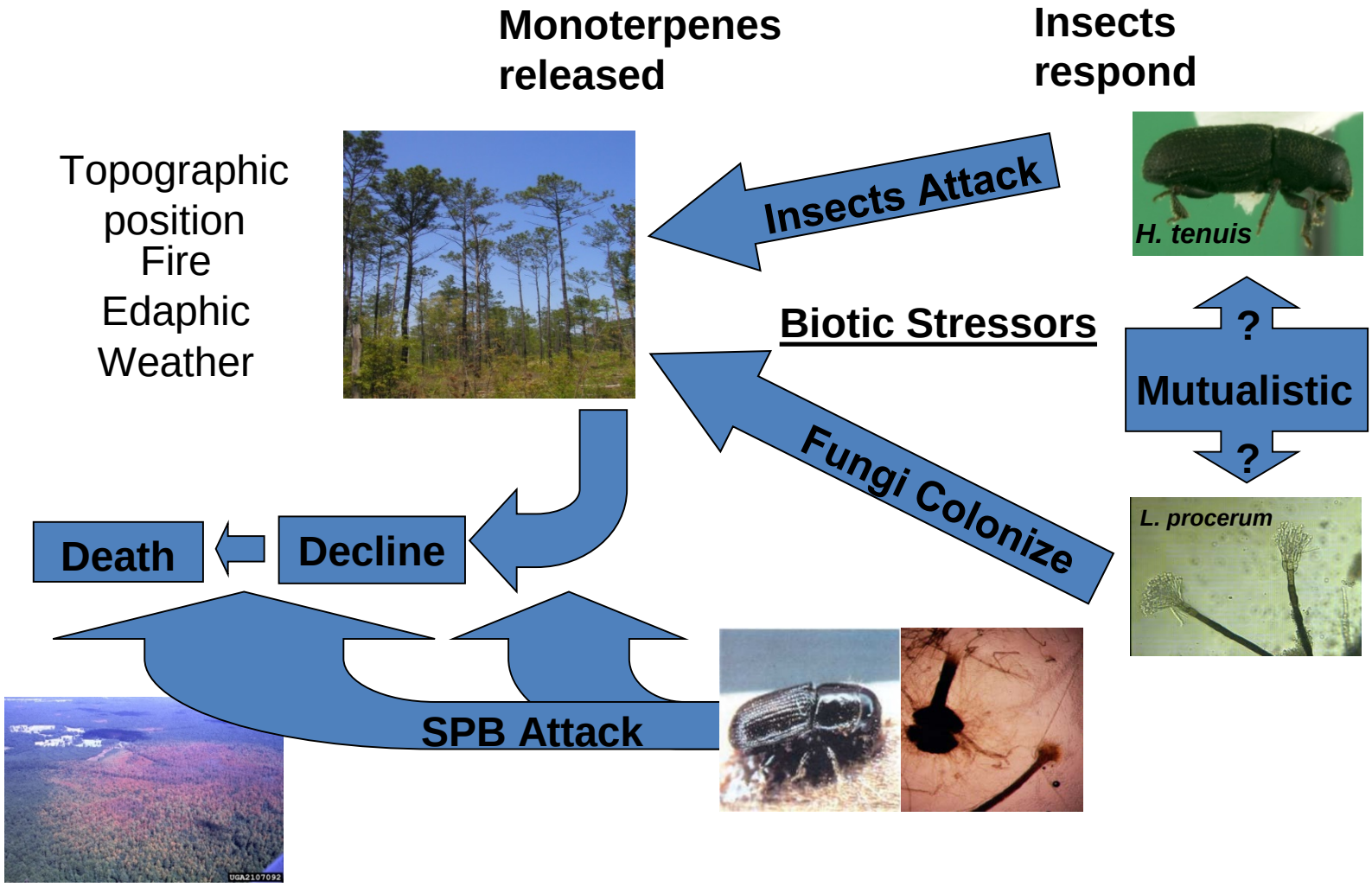



# Loblolly Pine (*Pinus taeda* L.)


www.forestry.Alabama.gov

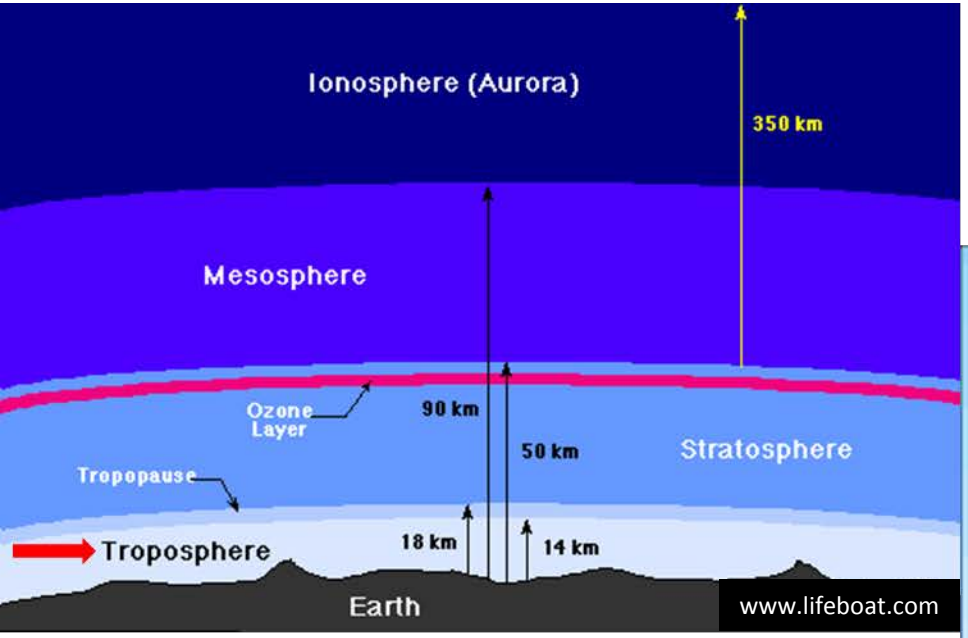
www.Wikipedia.org

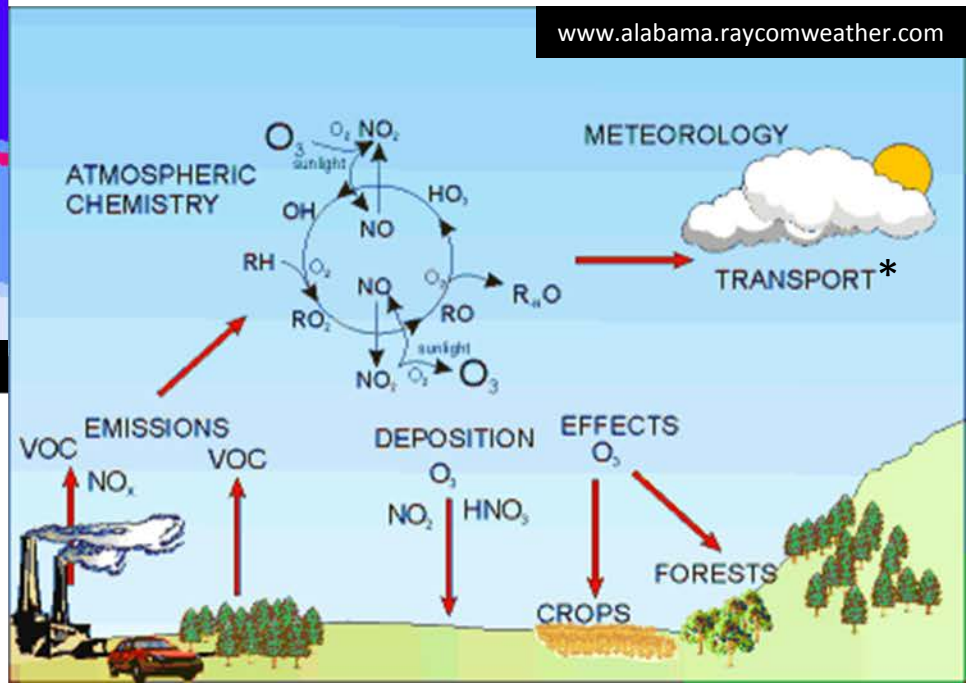
# Southern Pine Decline




Eckhardt (2003)

# Tropospheric Ozone



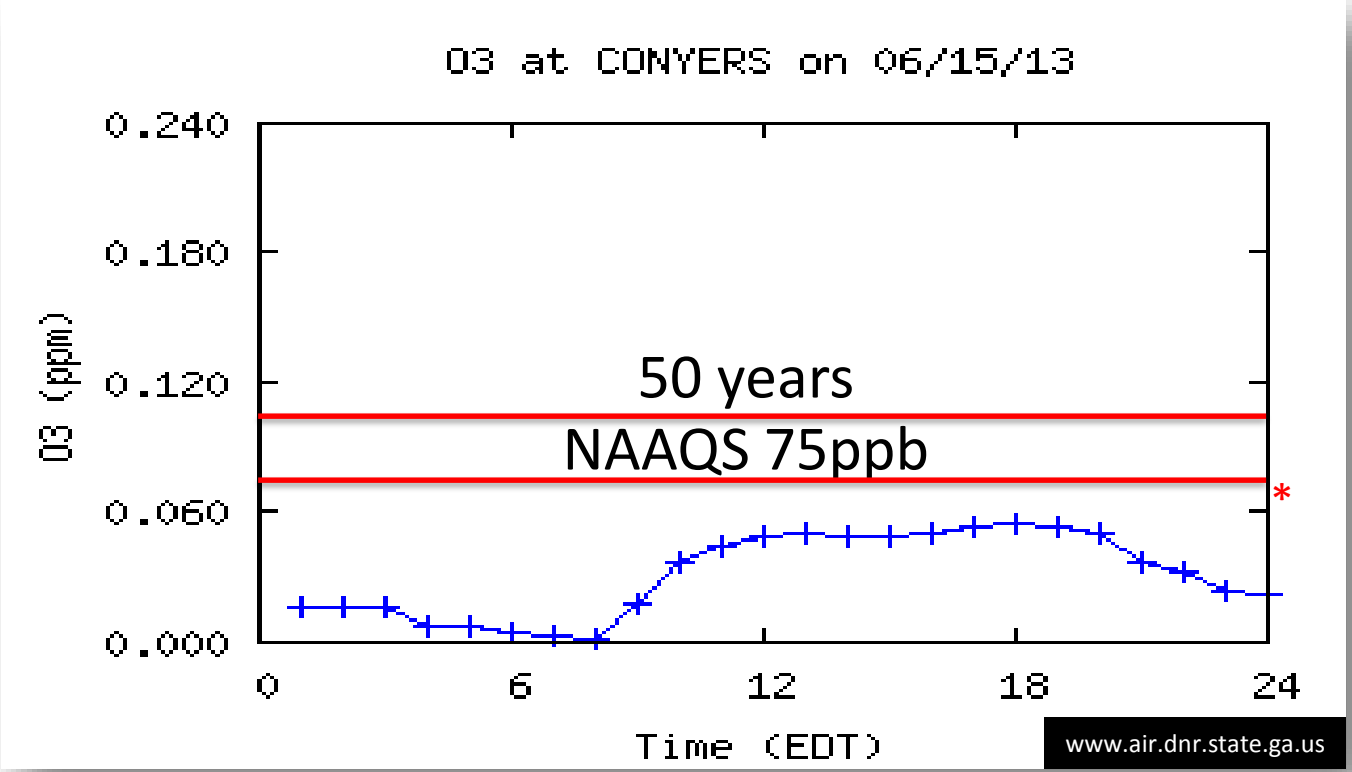




Temperature – BVOC

Population – $NO_X$

Temp + BVOC + $NO_X$ = Ozone

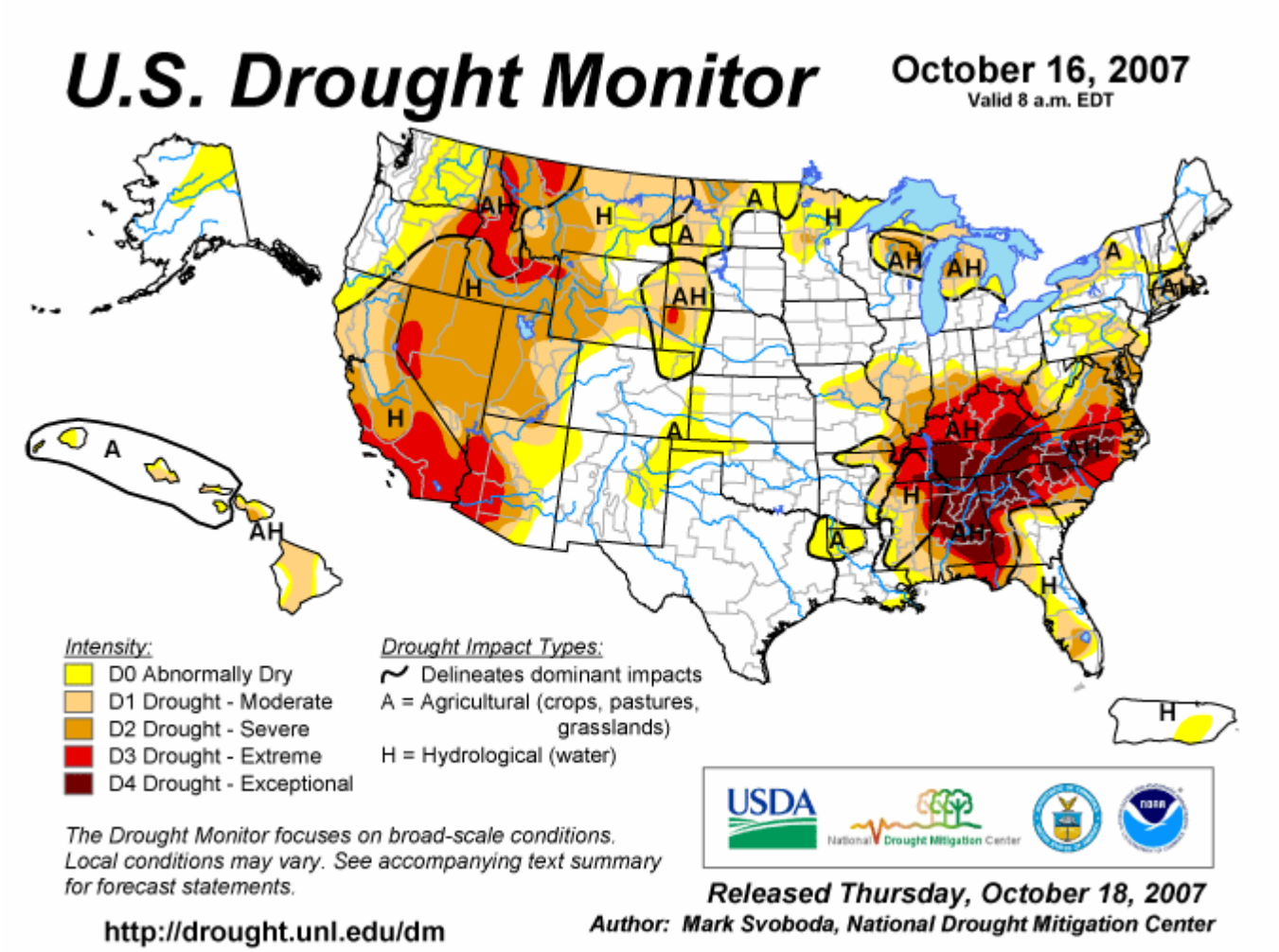
# Ozone Reference



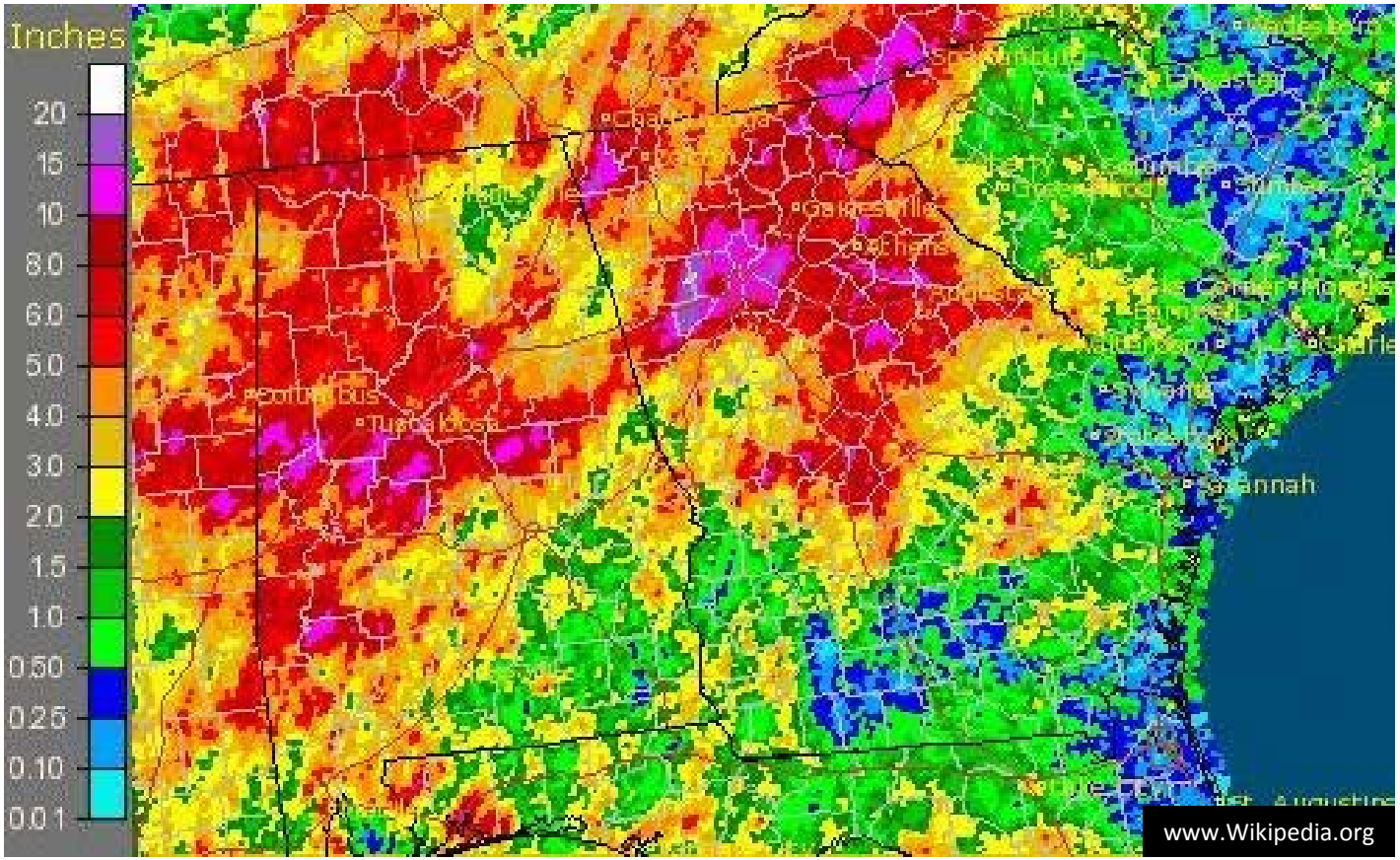

Saturday June 15th 2013

Metro-Atlanta ~60ppb

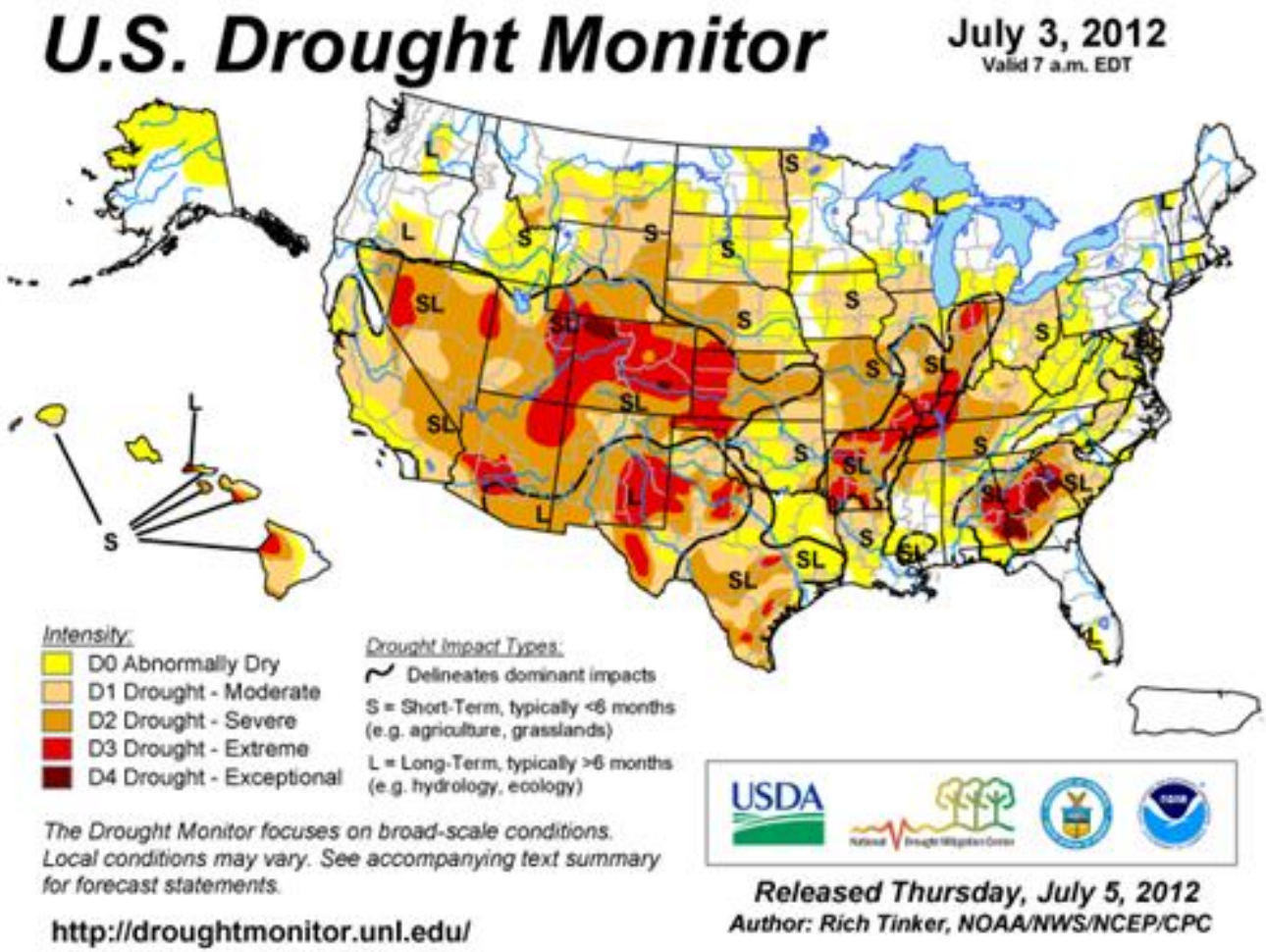
# 2007 Drought



# 2009 September Floods



# 2012 Drought



# Altered Precipitation

## Observed JJA Precipitation Since 1950

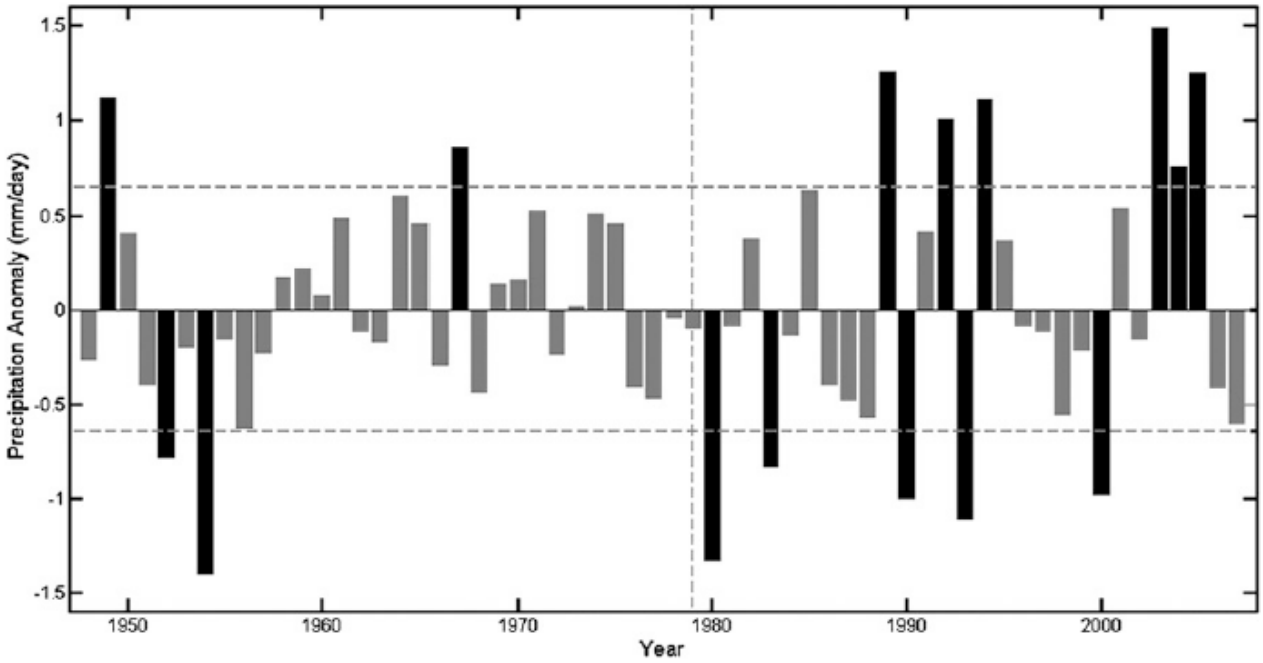



FIG. 1. Observed JJA precipitation anomaly over the SE United States for a 60-yr period (mm $day^{-1}$). Horizontal dashed lines represent 1 standard deviation of the summer rainfall.

Li et al. 2011 from *Journal of Climate*

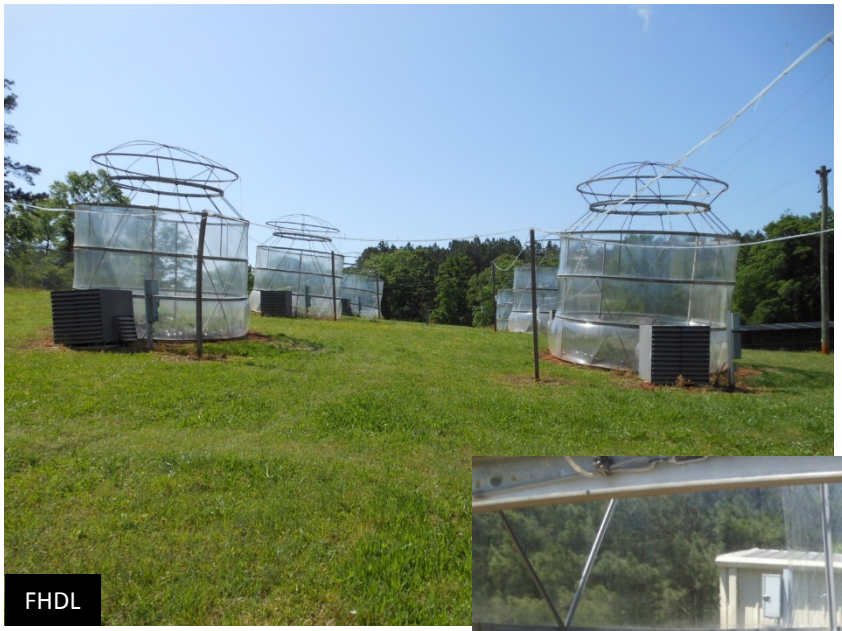
# Objectives

**2013**: Determine if elevated **tropospheric ozone** concentrations will decrease loblolly pine vigor, increasing susceptibility to SPD associated fungi

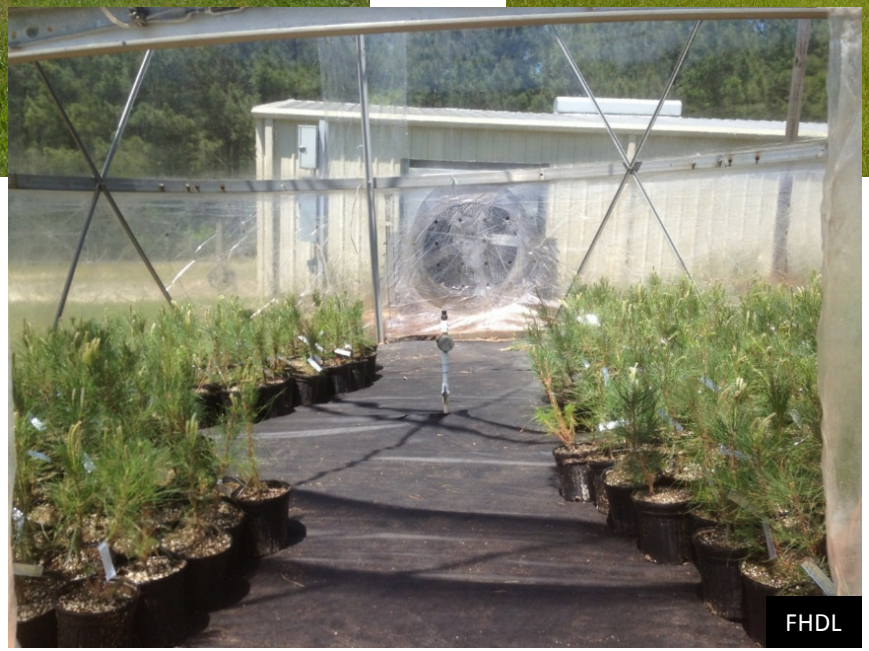
**2014**: Determine if **altered precipitation (irrigation)** patterns will decrease loblolly pine vigor, increasing susceptibility to SPD associated fungi

# Auburn University Atmospheric Deposition Site


# Open-Top Chambers




Open
2013
Ozone





Capped
2014
Drought

# Materials and Methods



4 families of *Pinus taeda*:

2 tolerant to fungi (T1 & T2)

2 susceptible to fungi (S1 & S2)

Singh *et al*. 2014

Inoculation Treatments:

*Leptographium terebrantis* (LT)

*Grosmannia huntii* (non-native, GH)

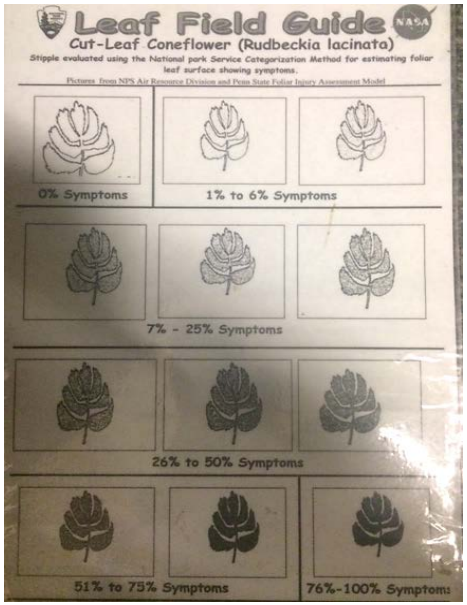
Wound + sterile media (WM)

Wound only (W)

No wound (NW)

# Materials and Methods









# Materials and Methods


CF – Charcoal filtered (0.5 x NF)

NF – non-filtered (ambient)

2X – twice NF (2 x NF)

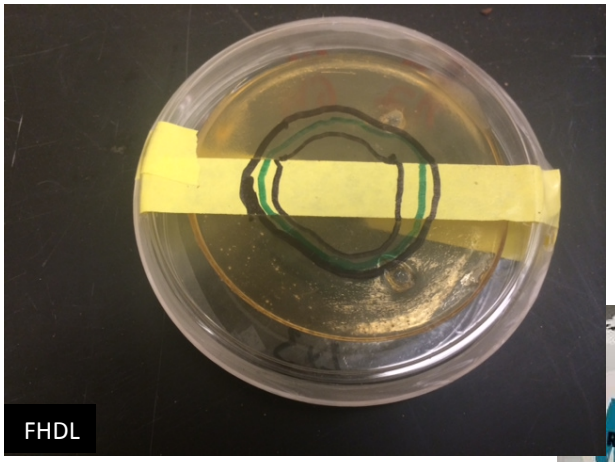
So if NF = 20 ppb,

CF ~ 10 and 2X ~ 40

~0.5 in (1.2 mm) irrigation/day unless already saturated from ambient rainfall

9 OTCs – 3 of each ozone treatment

# Materials and Methods



# Materials and Methods


<u>3 Irrigation Treatments</u>:

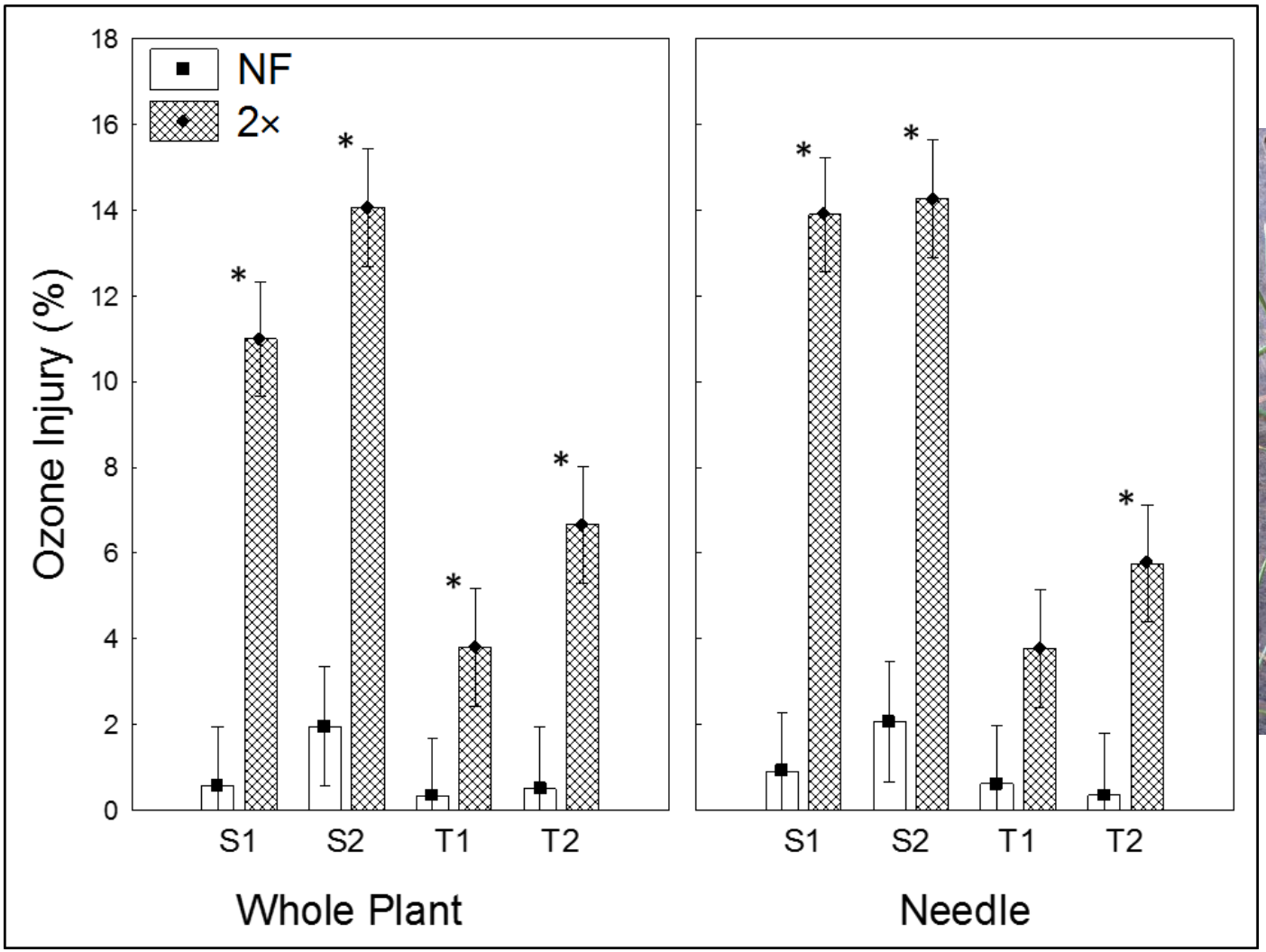
3D – Mon, Wed, Fri

4D – Sun, Tue, Thu, Sat

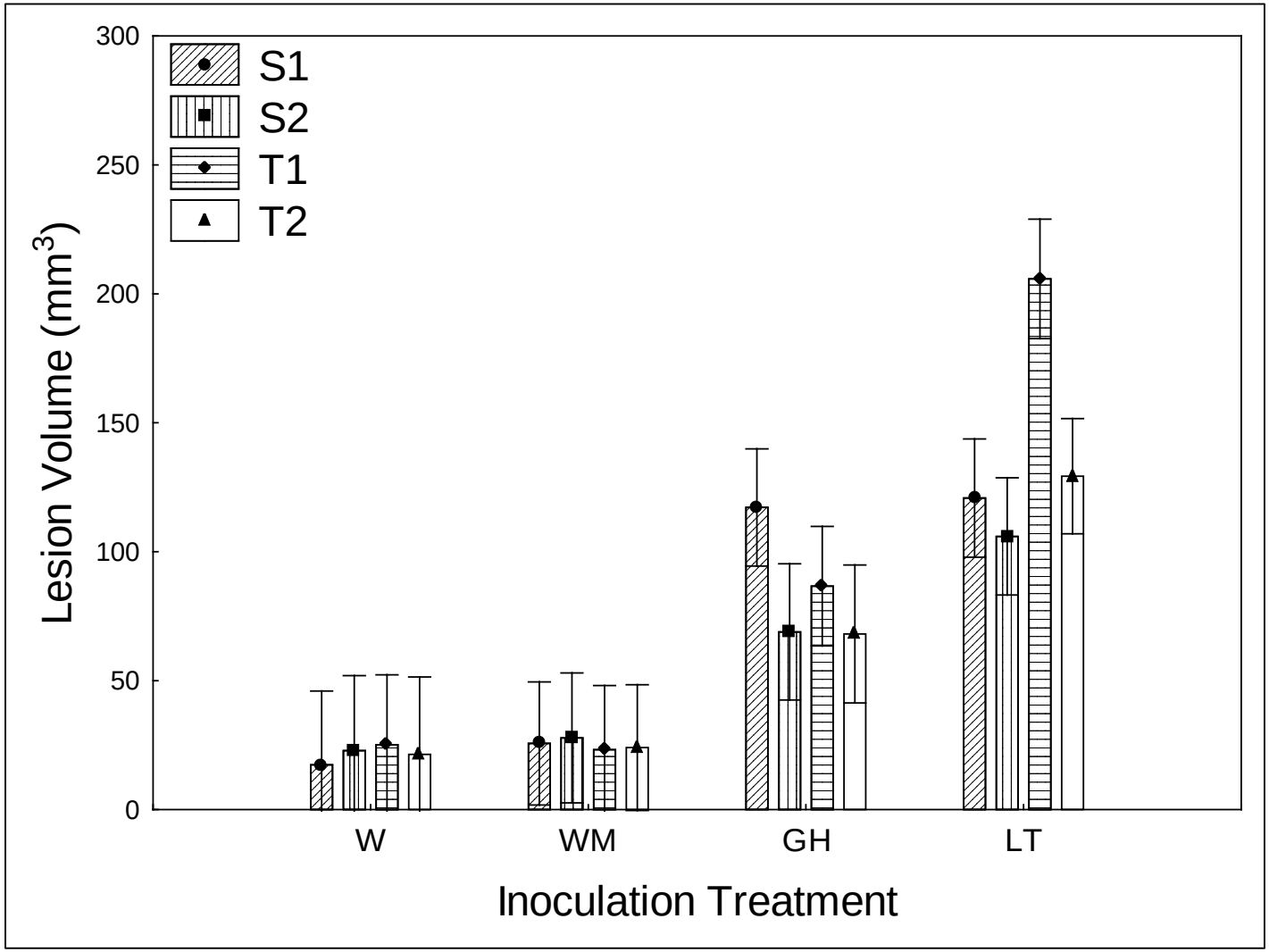
7D – All days

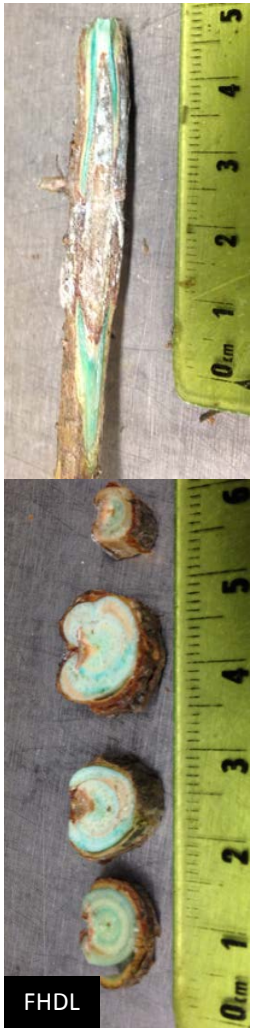
All amounts were approximately the same

# Visible Ozone Injury

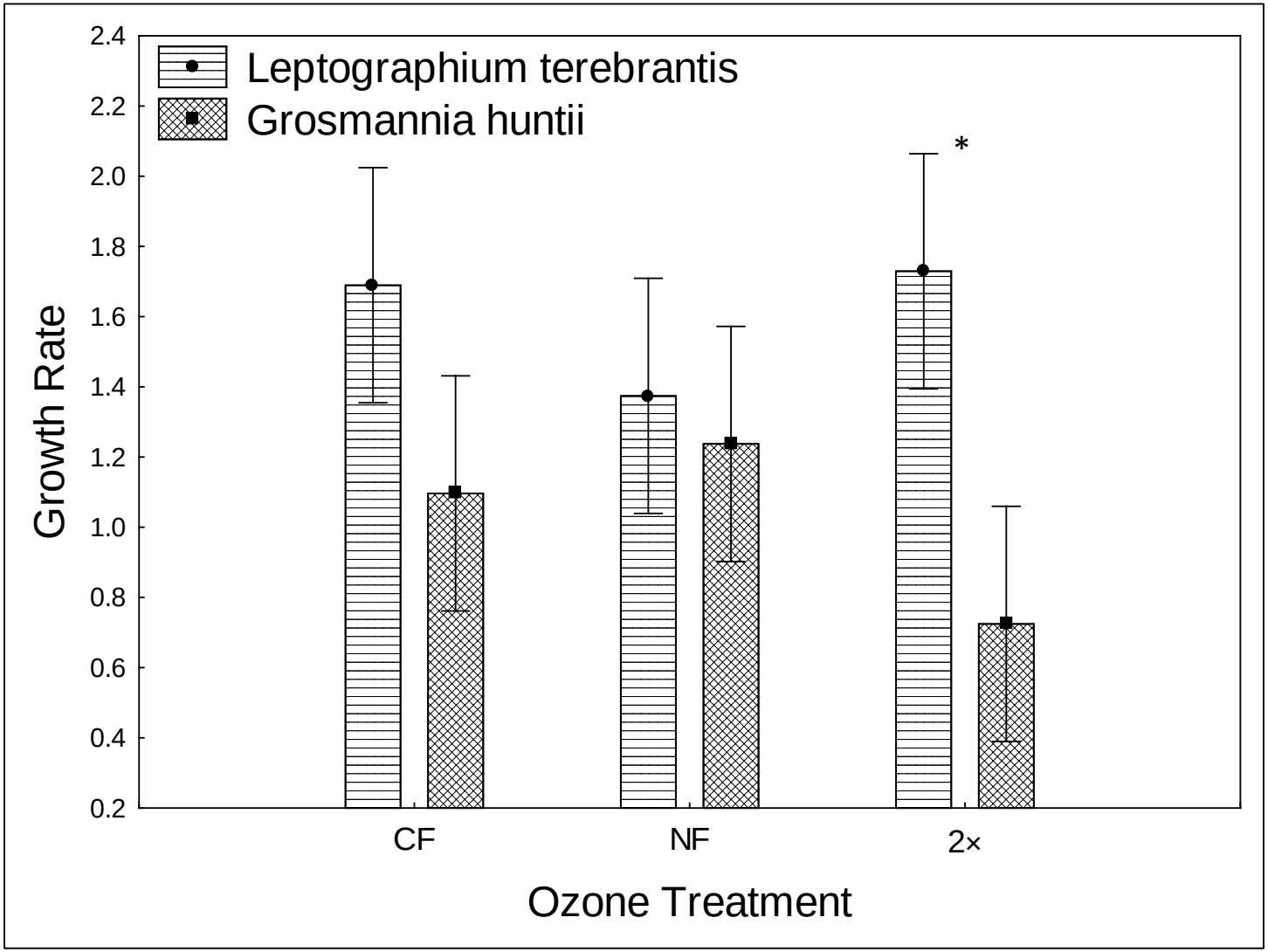


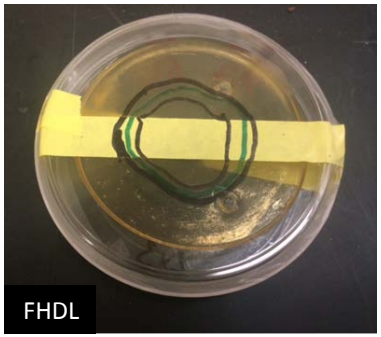

# Lesion Volume



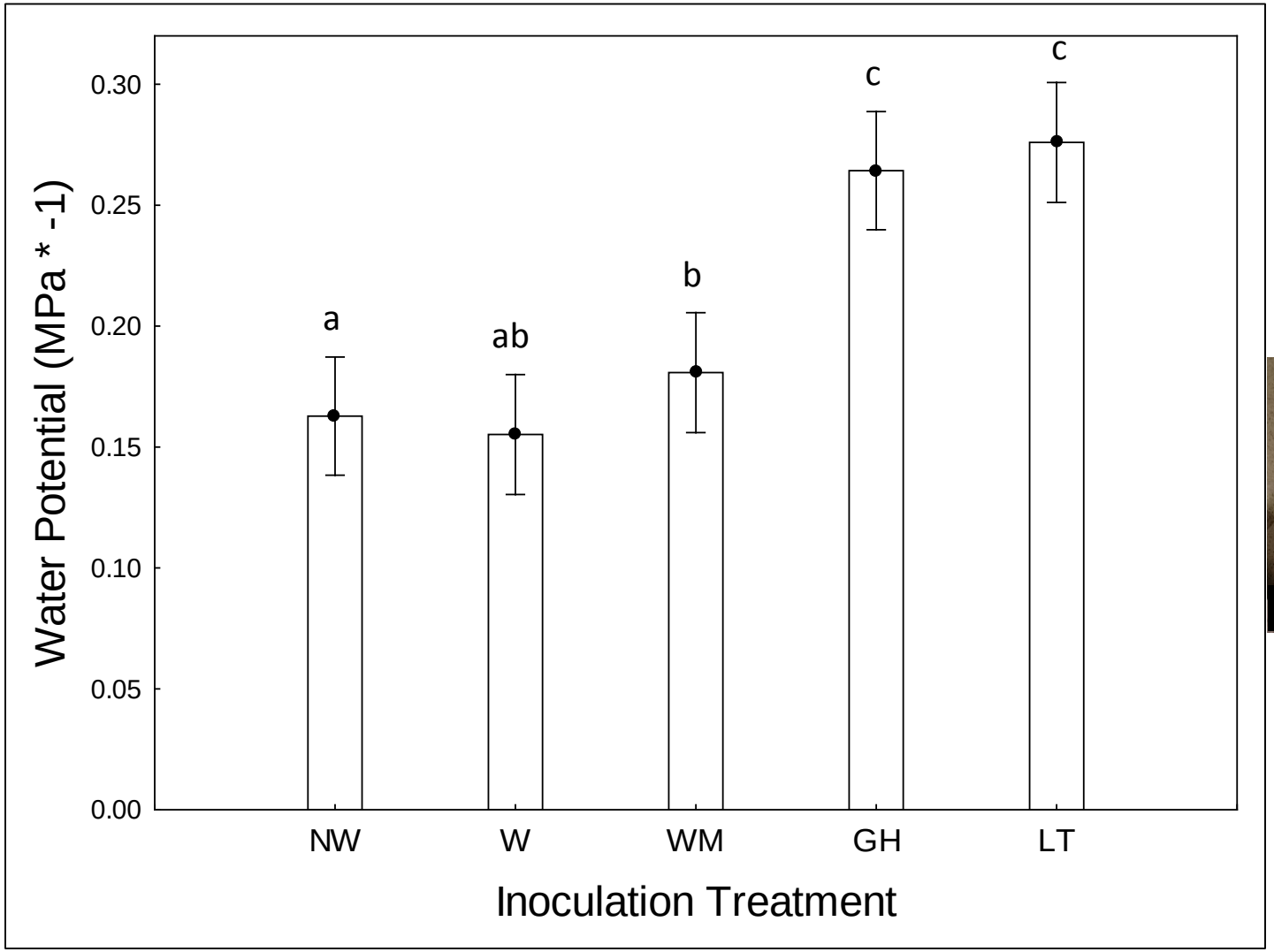



# Fungal Growth Study

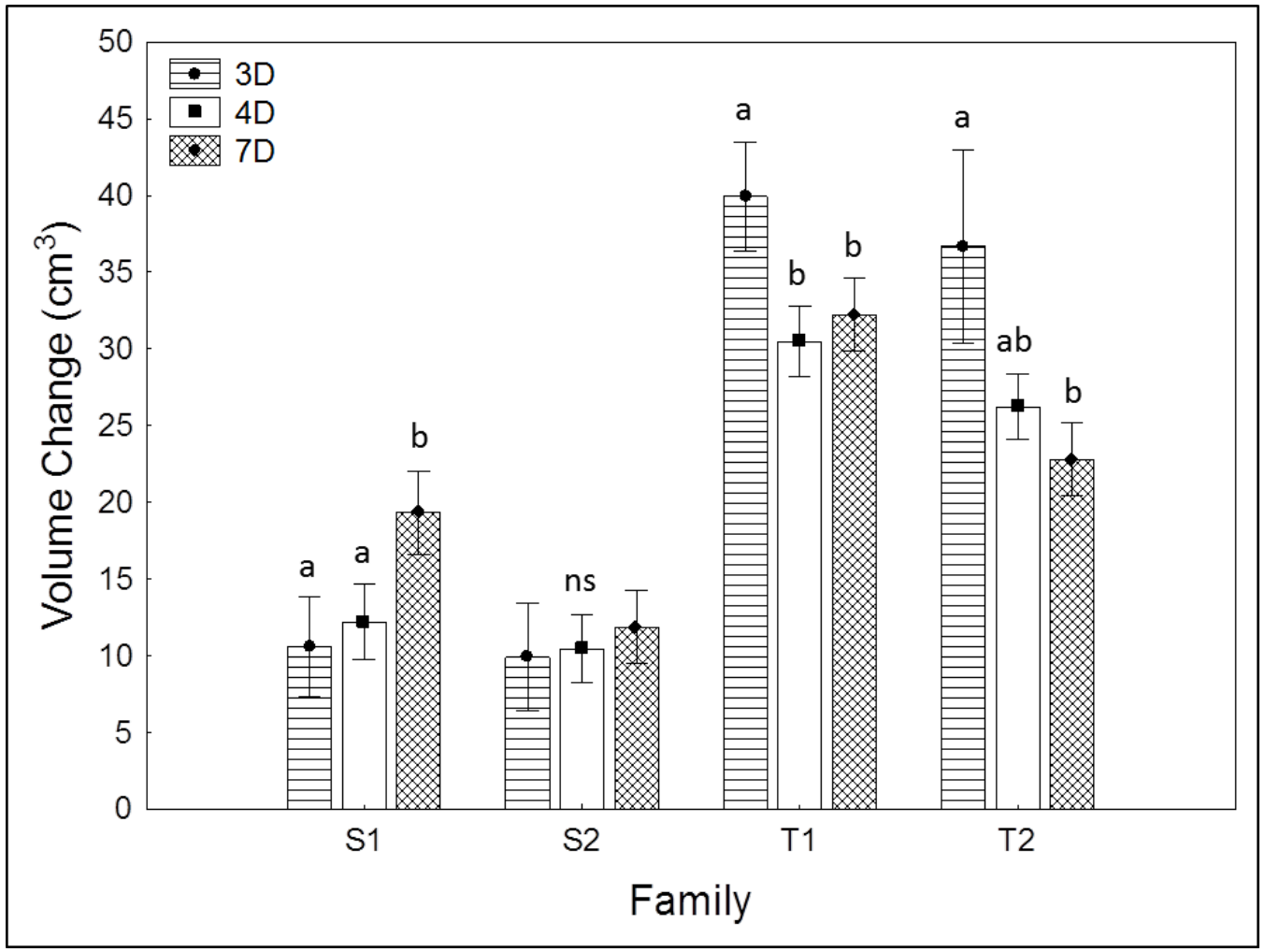


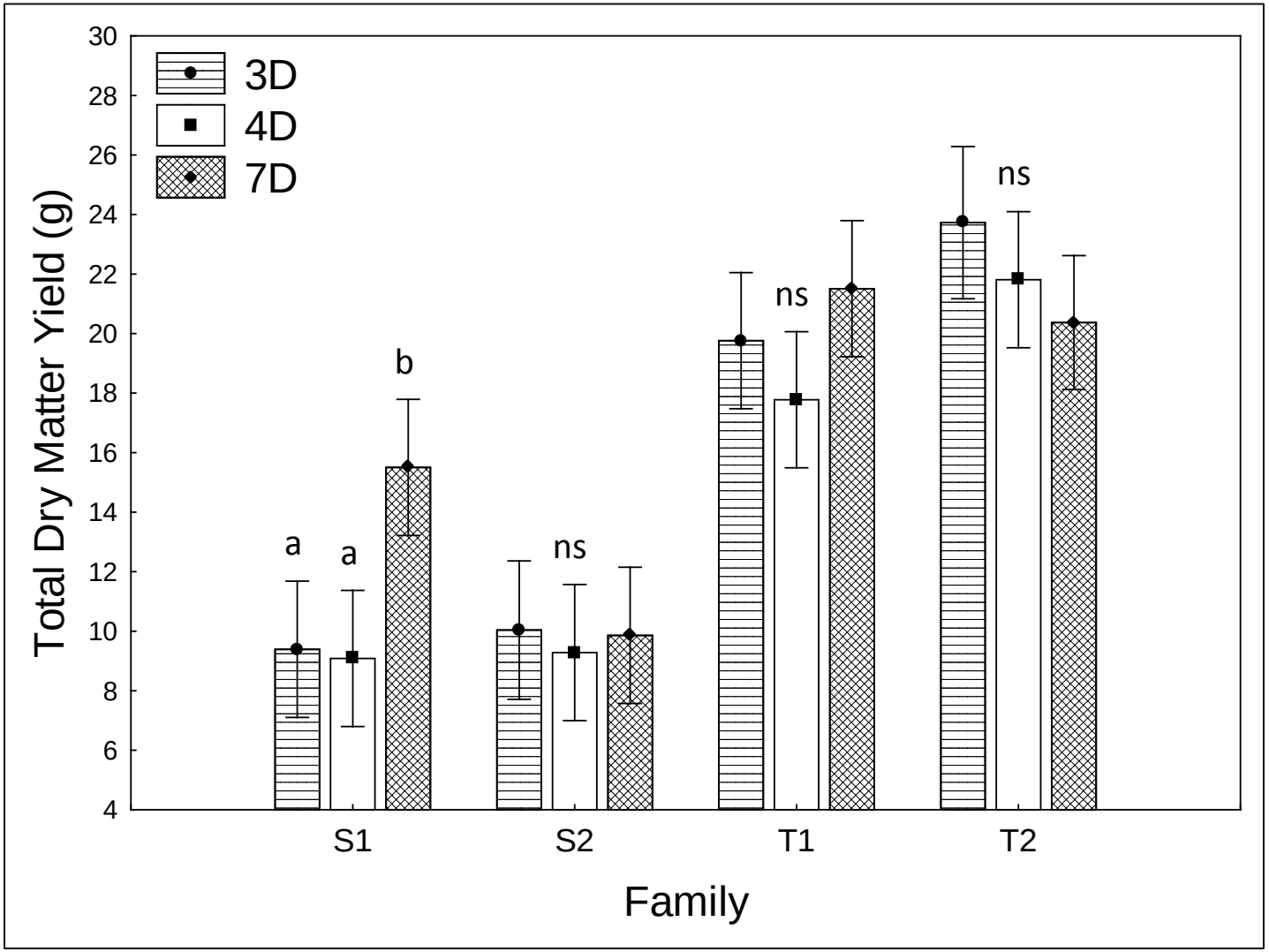
# Midday Water Potential

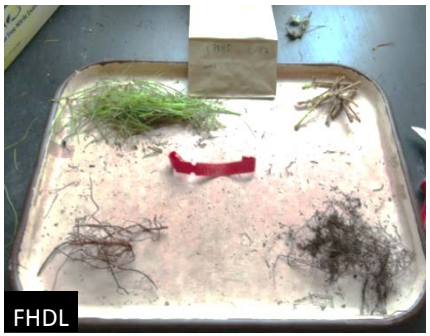



# Seedling Volume Change

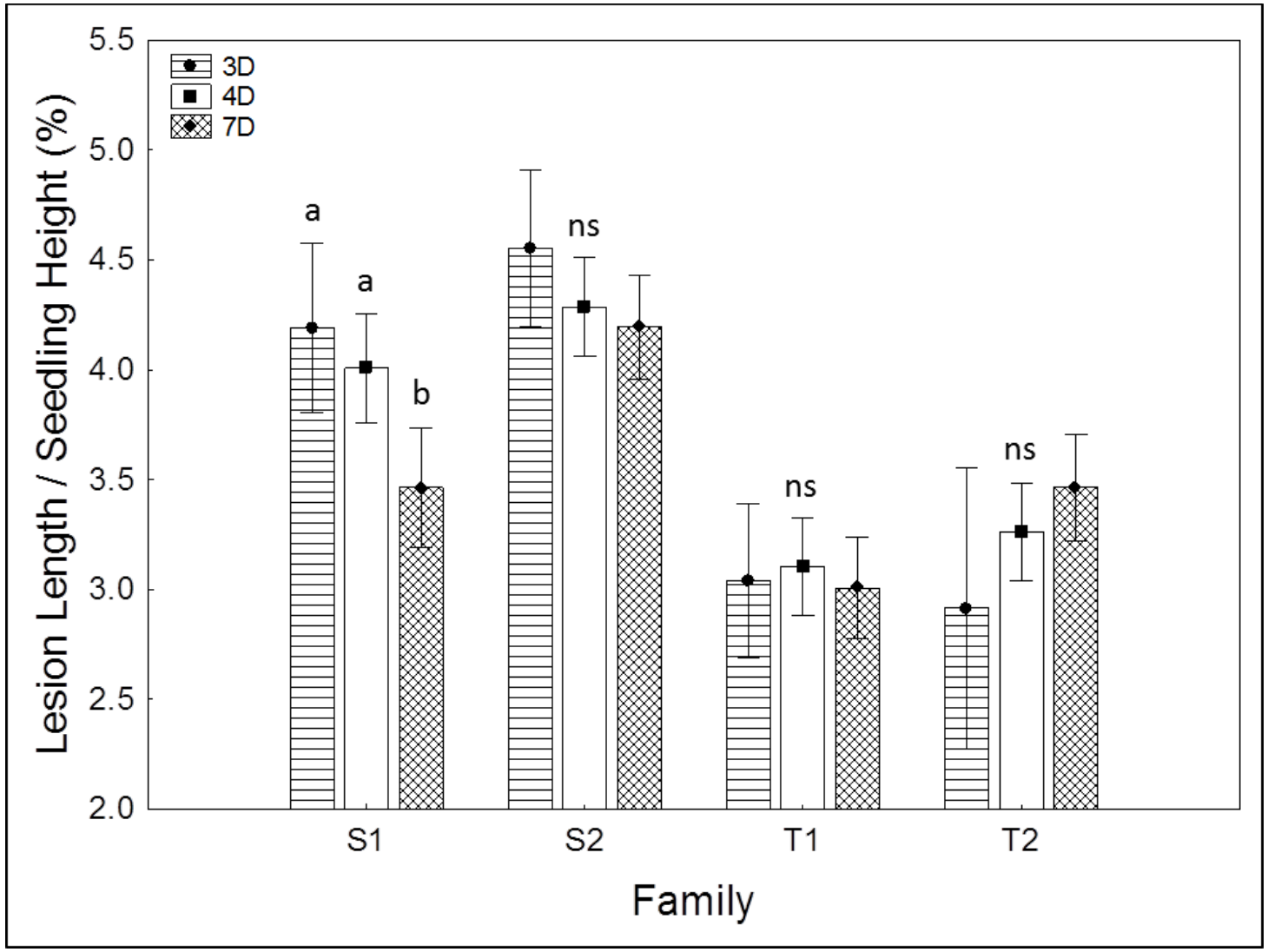


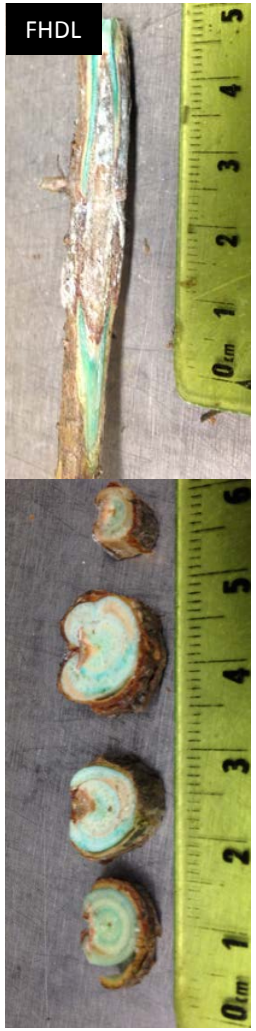

# Whole Plant Dry Matter Yield



# Lesion Length/Seedling Height



# Tropospheric Ozone Conclusions

- Families tolerant to SPD associated fungi are also more tolerant to ozone exposure.
- Exposure to ozone makes seedlings more susceptible to wounds/injury, but this was not specific to LT or GH.
- Seedlings would likely succumb to reduced water uptake (inoculation), decreased chlorophyll content (ozone) and inhibited phloem function (both) over longer periods.

# Altered Precipitation Conclusions

- Moisture stress may dictate plant water status rather than SPD associated fungi.
- No increase in susceptibility to SPD associated fungi with fluctuating moisture supply
- Some families (S1) of loblolly pine may be sensitive to changes in moisture availability while others may not.

# Acknowledgements

Advisors and Committee Member
Forest Health Dynamics Lab
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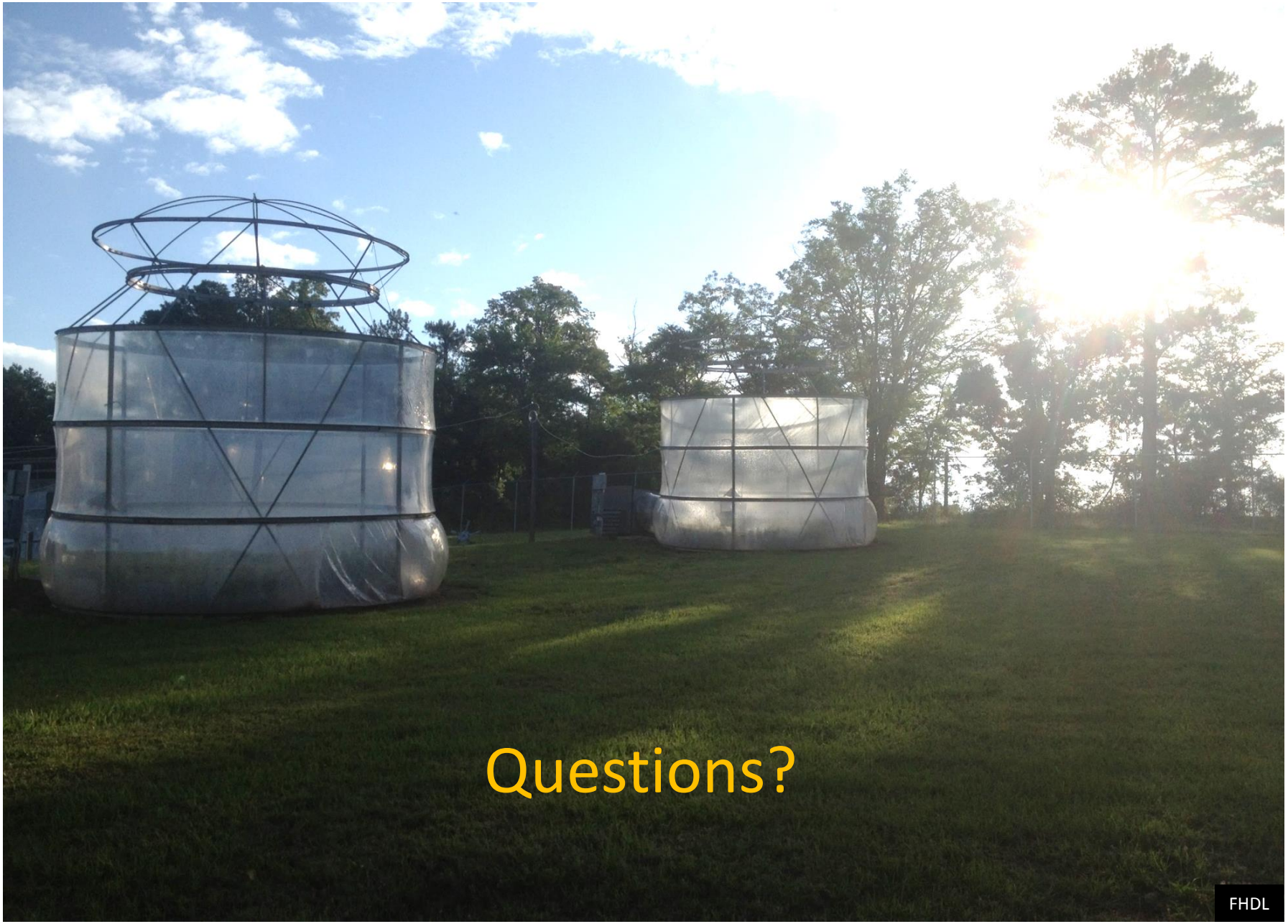
AU Atmospheric Deposition Site Staff
Alabama Agricultural Experimental Station – HATCH
Forest Health Cooperative
Rayonier & Arborgen


Questions?
FHDL