Environmental triggers and seasonal changes in the mycobiome on symptomatic and asymptomatic loblolly pine needles

USFS Component - Mitigating needle blight: A growing economic threat to pine forests

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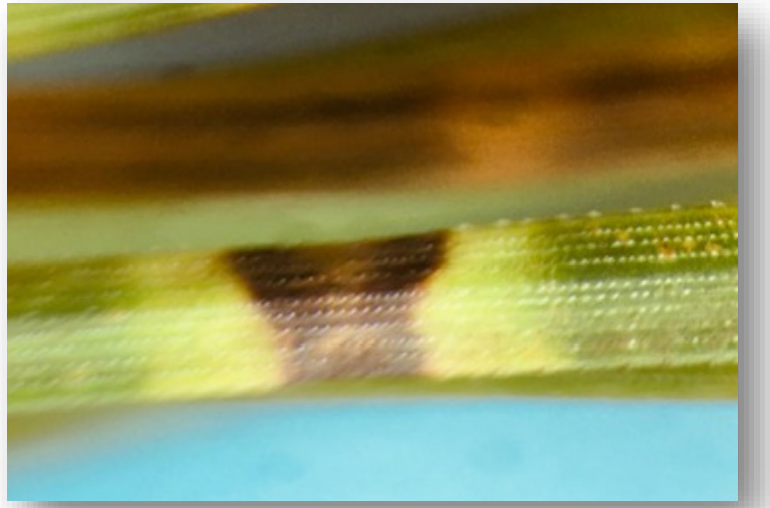
Brown Spot Needle Blight Assessment Workshop
August 13-14, 2024
Holiday Inn Express & Suites, Cullman, AL

- **Brown spot needle blight**, caused by a fungal pathogen (*Lecanosticta acicola*), which typically affects longleaf pine at the early stage of development, has been associated with **significant damage and mortality on loblolly pine** in the past few years.

- Concerns about new emerging **threat to loblolly pine stands in commercial plantations** have increased, especially in parts of the region where, the viable pathogen is available all year.

Lecanosticta acicola

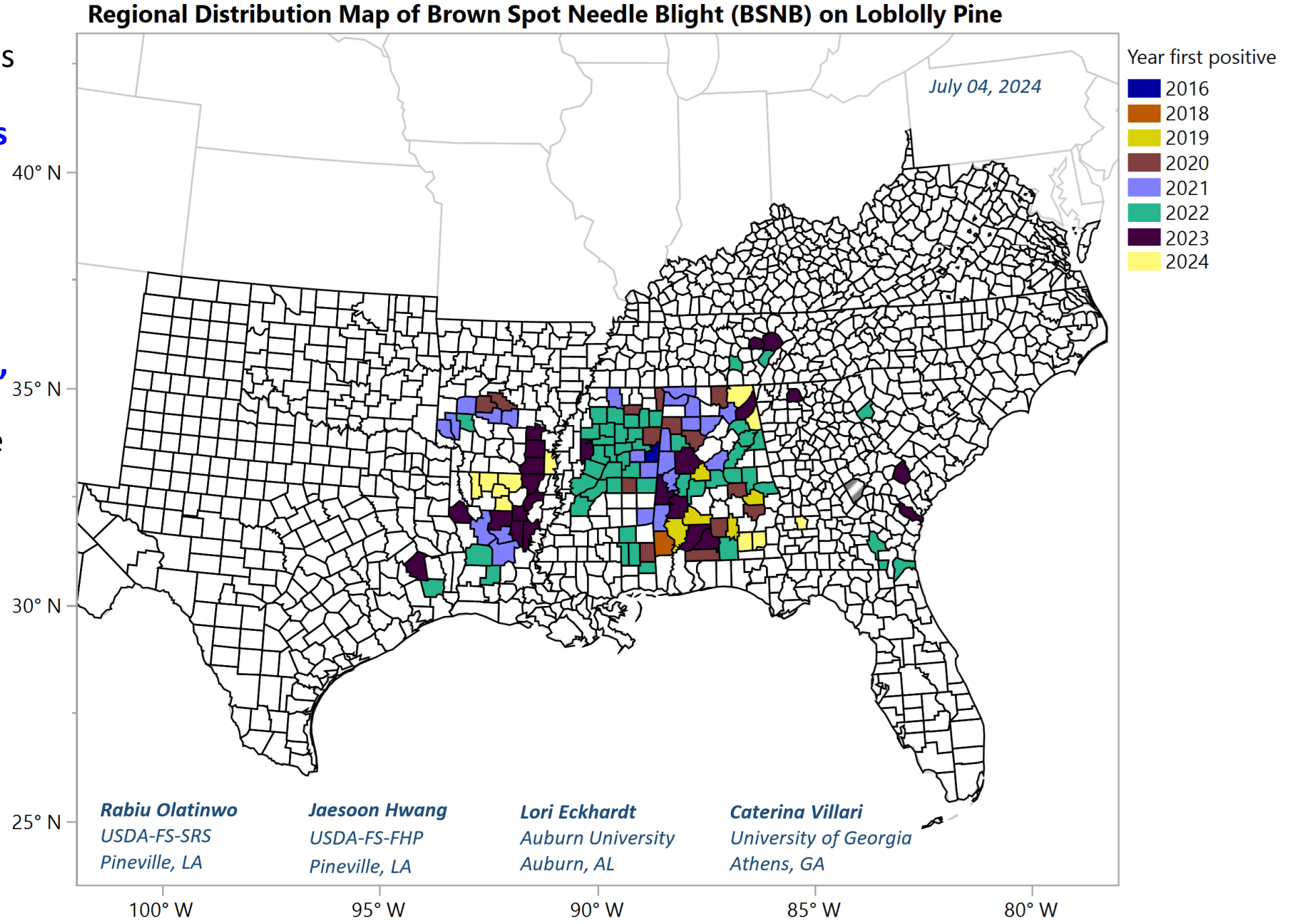


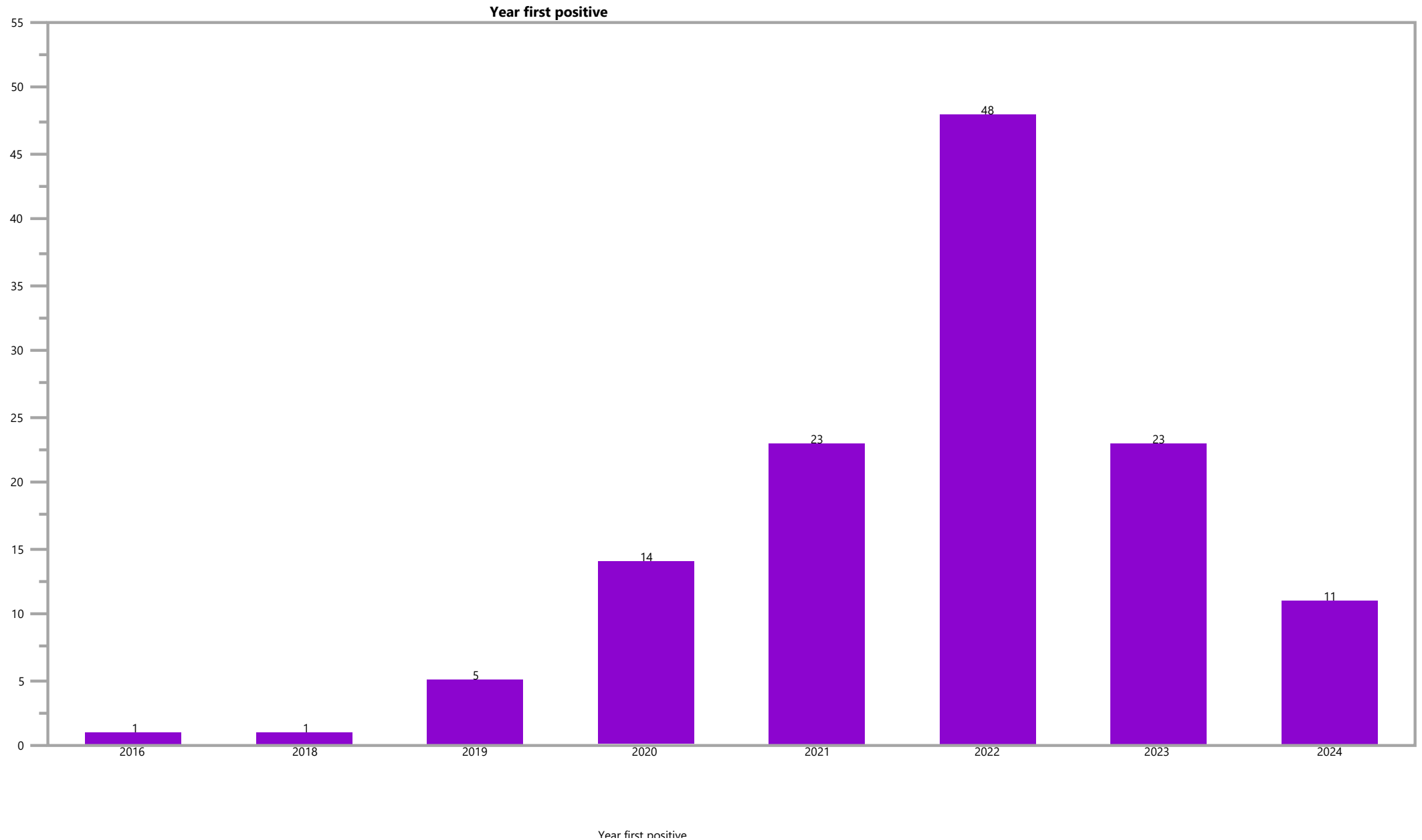
Infected pine needle with symptom

BSNB on loblolly pines has been confirmed in **116 counties from nine states** (AL, AR, FL, GA, LA, MS, SC, TN, and TX)

Most severe cases were reported from **AL, AR, LA, and MS** with landscape scale damages on mature trees and/or localized damages on younger trees in commercial stands.

Mortality and growth loss have been observed from the younger trees after repeated infections over multiple growing seasons.




Year first positive
55
50
45
40
35
30
25
20
15
10
5
0
1
1
5
14
23
48
23
11
2016
2018
2019
2020
2021
2022
2023
2024
Year first positive
No of counties

NPRN – Research Projects

Mitigating Needle Blight: A Growing Economic Threat to Pine Forests

Auburn University, AL
Lead PI – Dr. Lori Eckhardt

Characterize **biotic and abiotic factors driving emergence** in brown spot needle blight on Loblolly pine in the southeastern USA

Colorado State University, CO
Lead PI – Dr. Jane Stewart

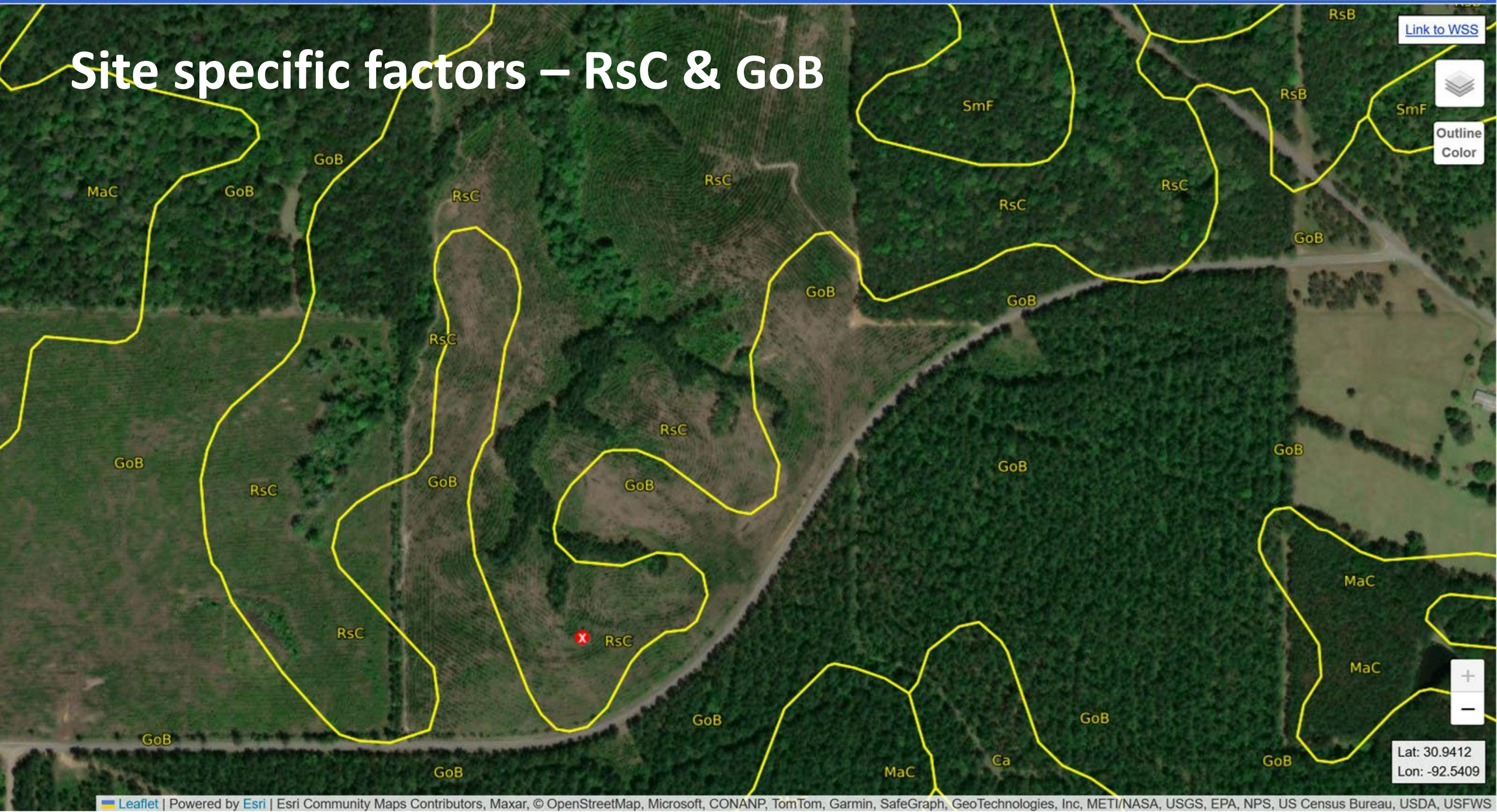
- Long-term study **plots at 6 sites** in Central Louisiana in 2023
- Plot evaluations and **tree health assessments** conducted in Oct. 2023 and July 2024
- Loblolly pine samples were collected for **mycobiomes analysis** at CSU and **isolates identification** in USFS Pineville LA
- Plant and soil **nutrients analyses** in Pineville LA

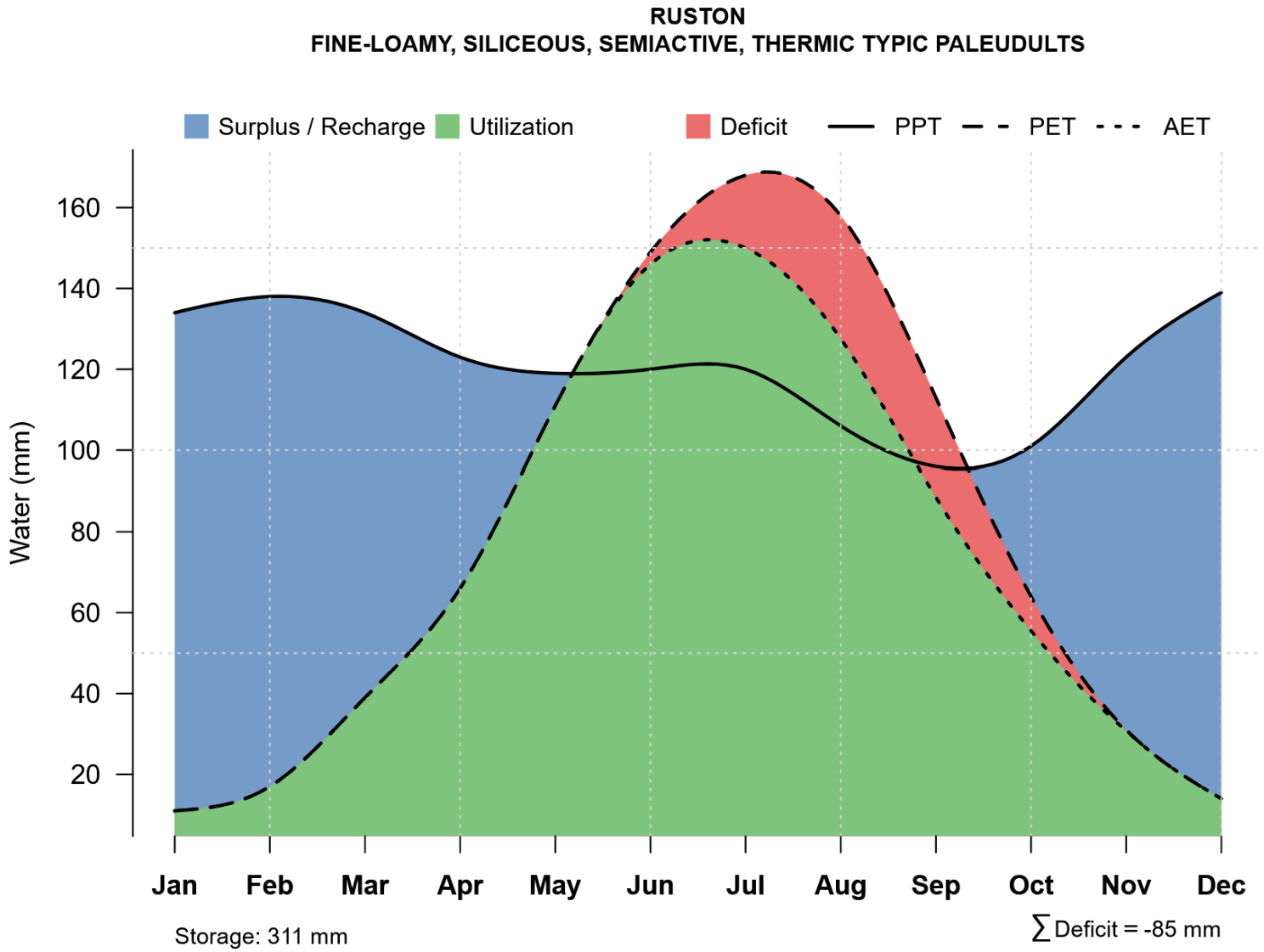
Site specific factors:

Site #3


Site #3
Planted 2018
Arial view on Apr 27, 2023
Powered by Esri

Site specific factors – RsC & GoB





Ruston fine sandy loam, 3 to 8 percent slopes (RsC)

▲ Map Unit Composition

85% - ***Ruston***
Geomorphic Position: *interfluves / Backslope*

8% - ***Savannah***
Geomorphic Position: *terraces*
Horizon data n/a

5% - ***Smithdale***
Geomorphic Position: *interfluves / Backslope*
Horizon data n/a | View Similar Data

2% - ***Malbis***
Geomorphic Position: *interfluves / Backslope*
Horizon data n/a | View Similar Data

▲ Map Unit Data

Map Unit Key: *569987* *[Graphical Summary]*

National Map Unit Symbol: *2wdl1*

Order of Mapping: *Order 2* ?

Map Unit Type: *Consociation* ?

Farmland Class: *Not prime farmland*

Available Water Storage (0-100cm): *14.54 cm*

Flood Frequency (Dominant Condition): *None*

Flood Frequency (Maximum): *None*

Ponding Frequency: *0*

Drainage Class (Dominant Condition): *Well drained* ?

Drainage Class (Wettest Component): *Well drained* ?

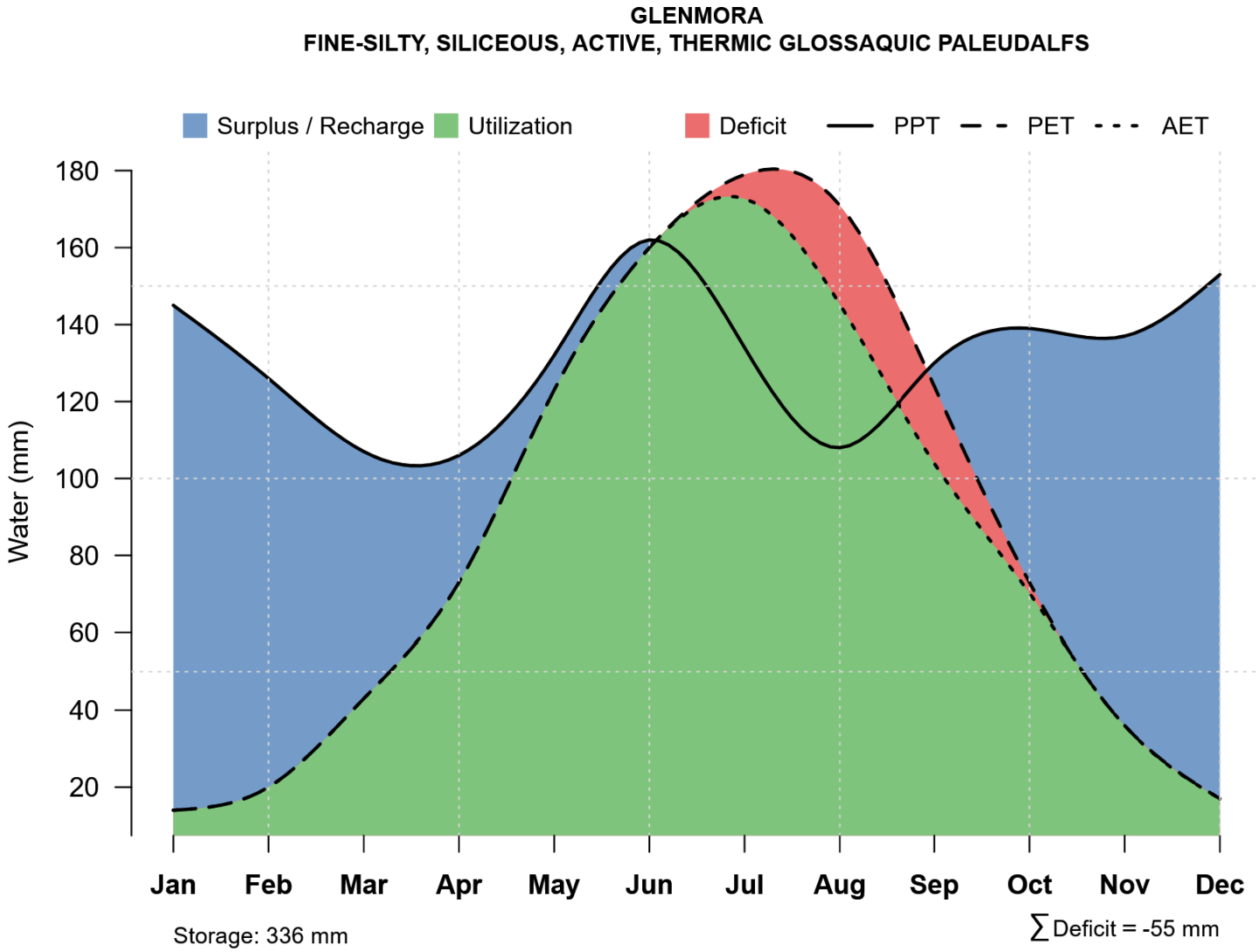
Proportion of Hydric Soils: *0%* ?

Min. Water Table Depth (Annual): *n/a*

Min. Water Table Depth (April-June): *n/a*

Min. Bedrock Depth: *n/a*

Soil variability



Soil variability

Glenmora silt loam, 1 to 3 percent slopes (GoB)

▲ Map Unit Composition

90% - ***Glenmora***
Geomorphic Position: *terraces*

5% - ***Messer***
Geomorphic Position: *flats*
Horizon data n/a

3% - ***Caddo***
Geomorphic Position: *depressions*
Horizon data n/a | View Similar Data

2% - ***Kinder***
Geomorphic Position: *depressions*
Horizon data n/a

▲ Map Unit Data

Map Unit Key: *569957* *[Graphical Summary]*

National Map Unit Symbol: *2vv48*

Order of Mapping: *Order 2* ?

Map Unit Type: *Consociation* ?

Farmland Class: *All areas are prime farmland*

Available Water Storage (0-100cm): *19.13 cm*

Flood Frequency (Dominant Condition): *None*

Flood Frequency (Maximum): *None*

Ponding Frequency: *0*

Drainage Class (Dominant Condition): *Moderately well drained* ?

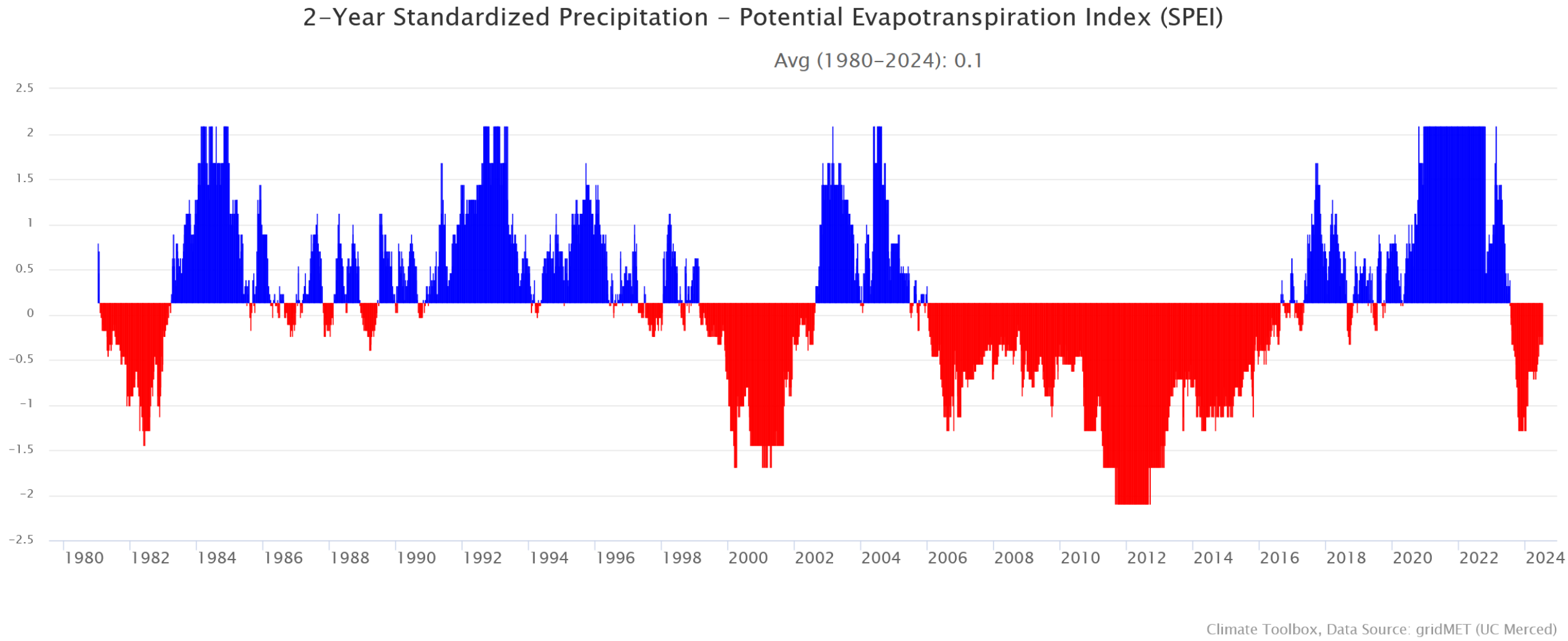
Drainage Class (Wettest Component): *Moderately well drained* ?

Proportion of Hydric Soils: *5%* ?

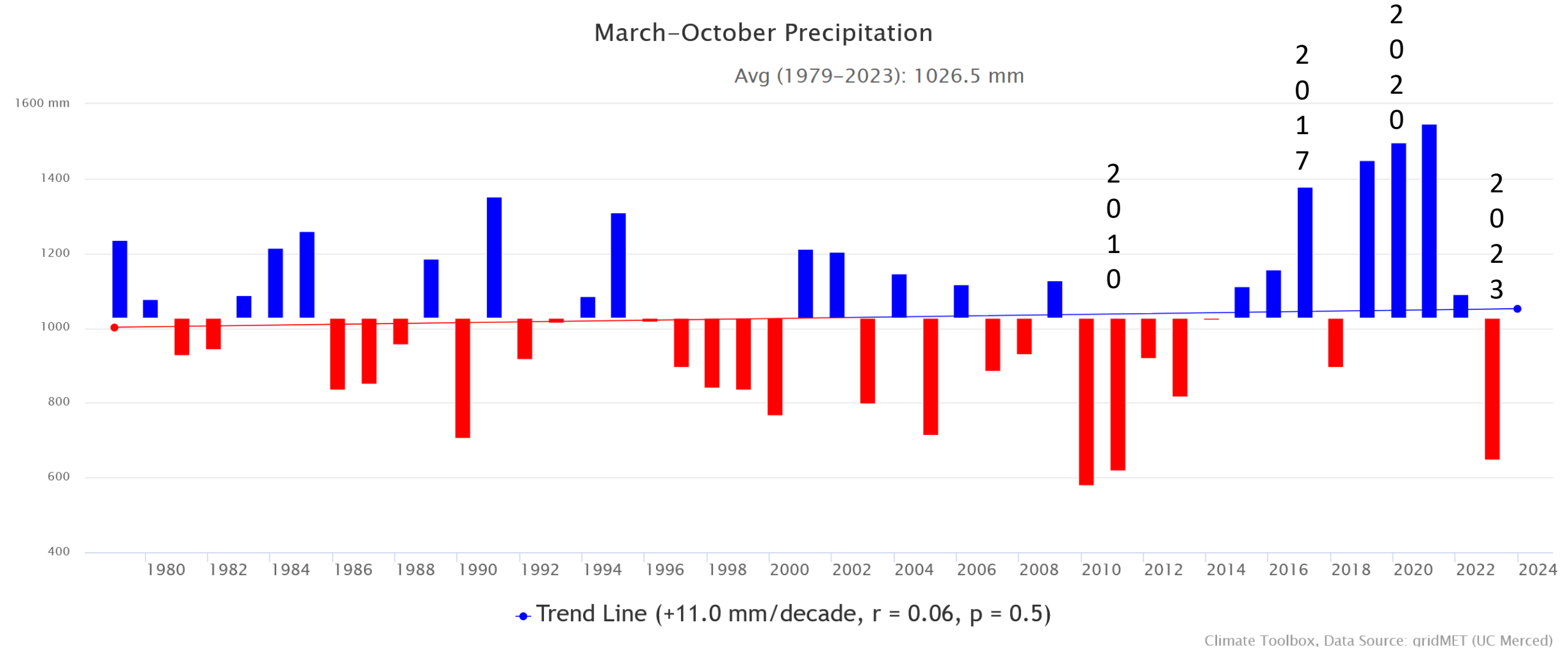
Min. Water Table Depth (Annual): *76 cm*

Min. Water Table Depth (April-June): *76 cm*

Min. Bedrock Depth: *n/a*



Climate variability



Climate variability

Variability in growth

Key observations (US Forest Service – FHP/SRS)

- Severe infestation at **industry plantations** in LA. Worst cases often reported in **younger age-classes (3 to 10-year-old)** but is observed in older trees.

- Often at its **worst on poorly drained sites**; clay, silty loam, fine sandy loam, sites with shallow A horizon.

- Poor growing conditions (**compacted, waterlogged soils**) worsen situation for susceptible trees.

Nutrition - Preliminary results

1. Plant tissue and soil samples were collected twice, in **October 2023 and July 2024** for nutrition analyses at six sites.

2. Overall, **soil pH is very low** across all the sites and **iron concentrations are high**.

3. Foliar nutrition is **deficient to low in general**, except zinc and iron, which are borderline low

4. Manganese is **excessively high.** Waterlogging -> manganese toxicity -> need breeding for tolerance to waterlogging.

Summary

- Soil **nutrients deficiency or toxicity** may play role; unknown to what extent as this point.

- Role of **pine genetics**? Only anecdotal evidence in loblolly thus far. Investigation is ongoing (NPRN project).

- What impact does **site*weather*cultural*genetics** in combination play? (Focus of the NPRN projects).

Acknowledgements

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