



# **Seeing the Forest as More than Just Trees: Assessing and Characterizing Historical Oil & Gas Pipeline Release Sites Using Atypical Boreal Forest Assessment Methods**

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**EARTHMASTER**  
ENVIRONMENTAL STRATEGIES INC



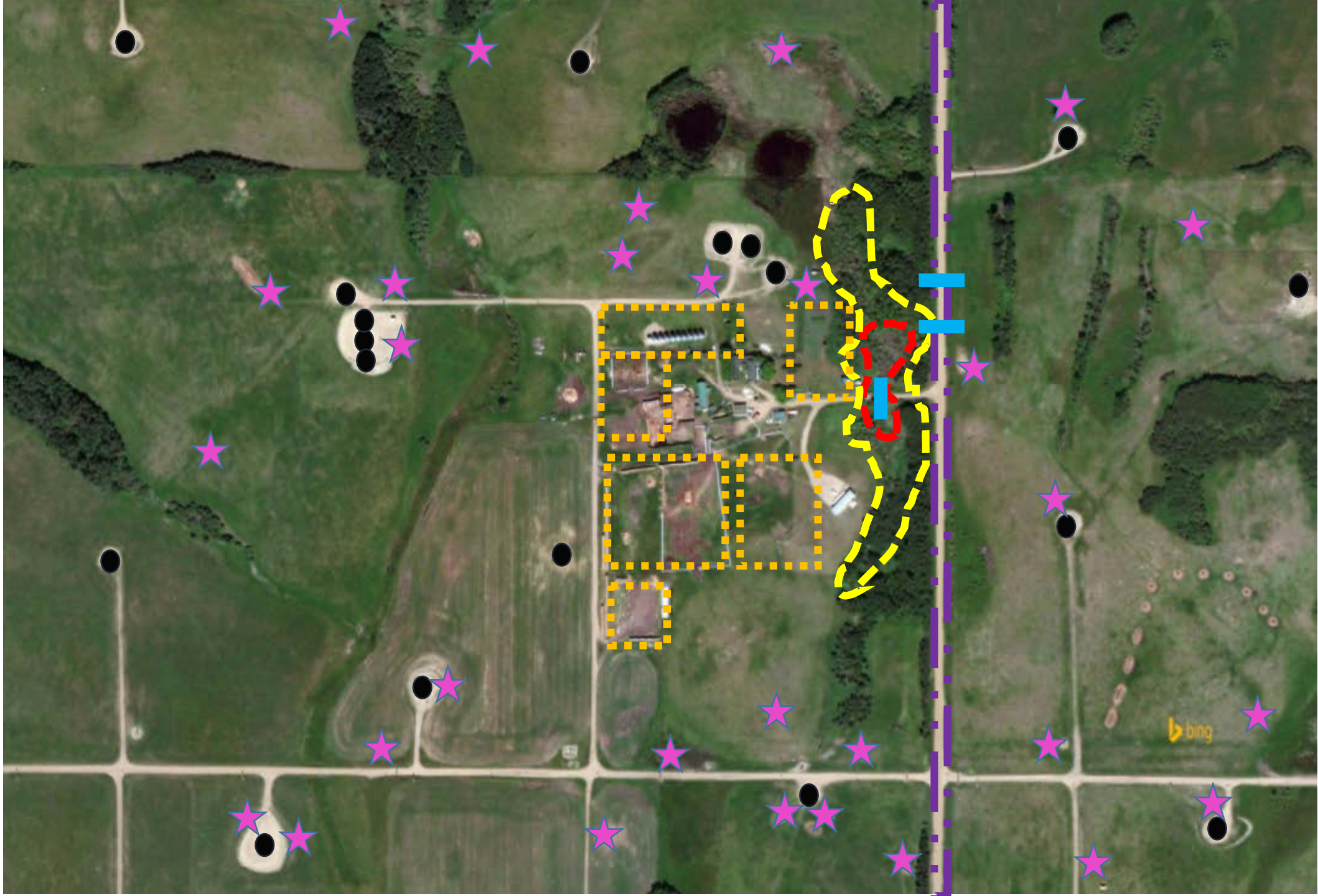
## A Canadian environmental technologies company:

- Based in Calgary, Alberta.
- Founded in 1998.
- Specializes in providing environmental services to the commercial/industrial and upstream oil & gas industries in Western Canada.
- Team of environmental consultants consisting of professional agrologists, biologists, chemists, ecologists, engineers, geoscientists, soil scientists, plant scientists, aquatic specialists, and foresters.
- Co-developed commercial phytoremediation systems (PEPSystems®) to treat contaminated soil in an eco-friendly and responsible manner.



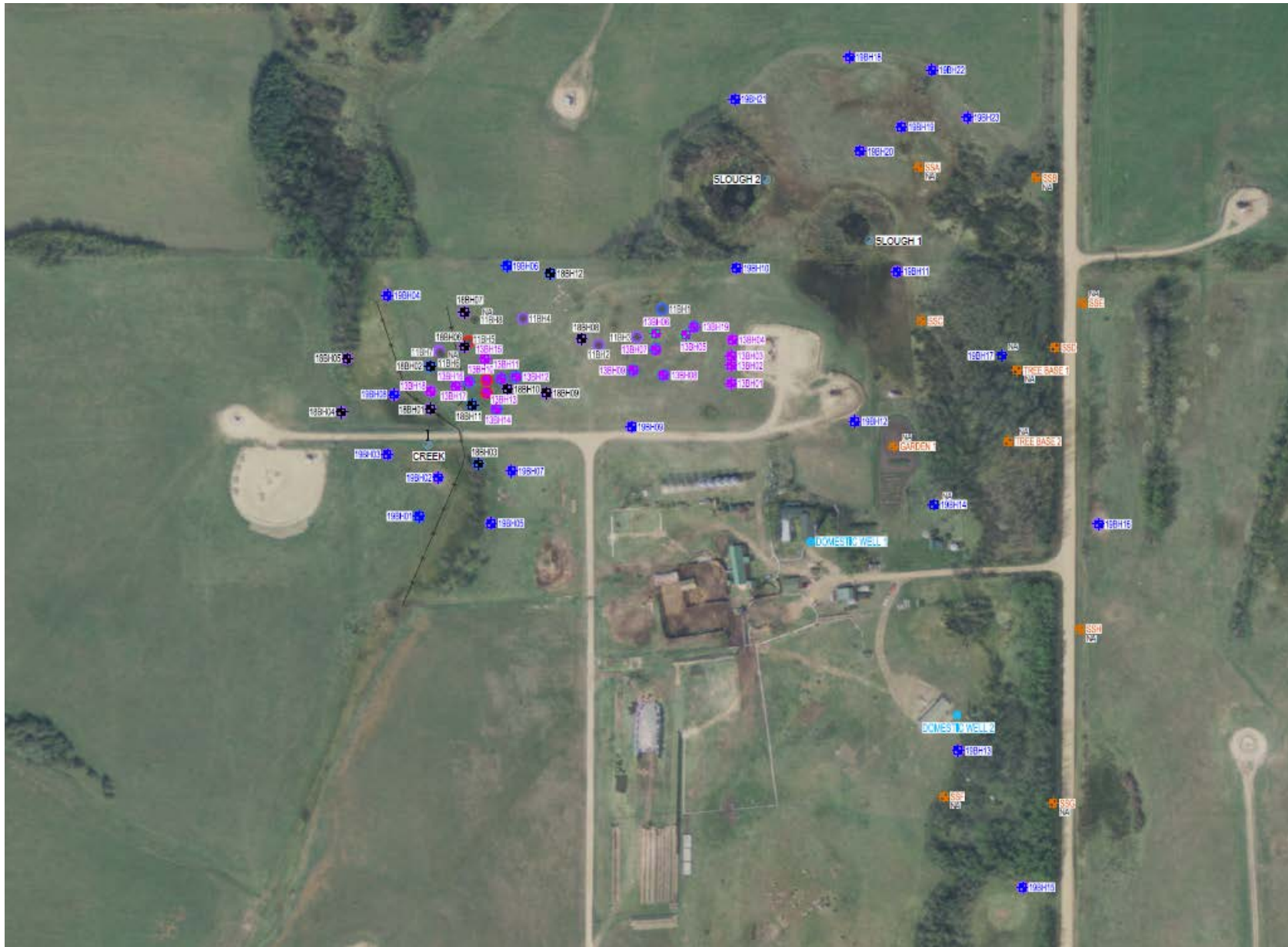
Earthmaster was asked to evaluate a forested area:

- Trees showed visible signs of stress and mortality
- Area of tree stress extended beyond area of landowner concern
- Located next to a livestock operation
- Historical impacts from former agricultural activities
- Significant municipal road upgrading had recently occurred
- Recent surface hydrology adjustments
- Numerous well sites in proximity
- 30+ reported historical releases
- Previous electromagnetic surveys could not clearly link elevated EC levels in soil to the stressed treed area
- Historical soil and water sampling

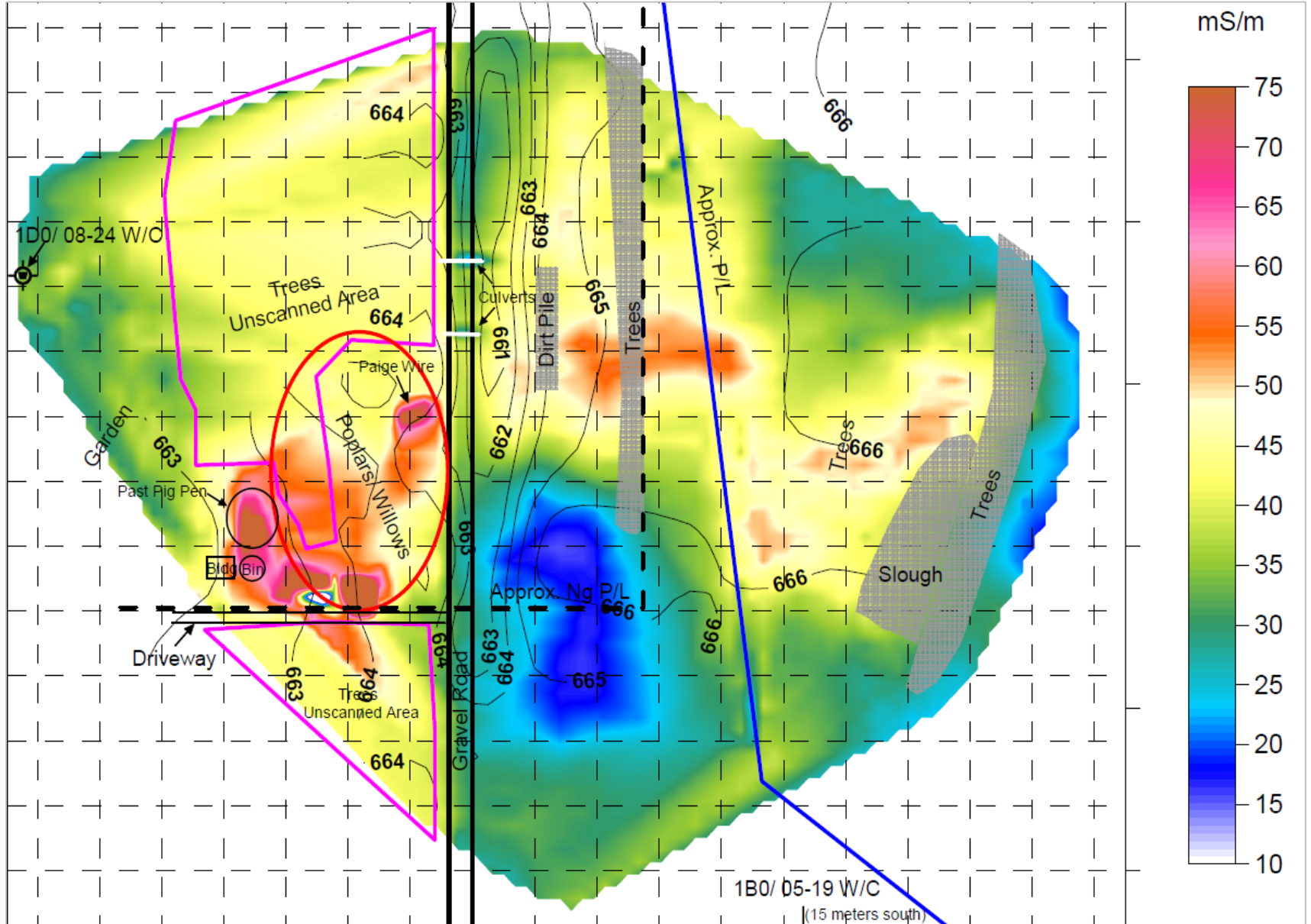




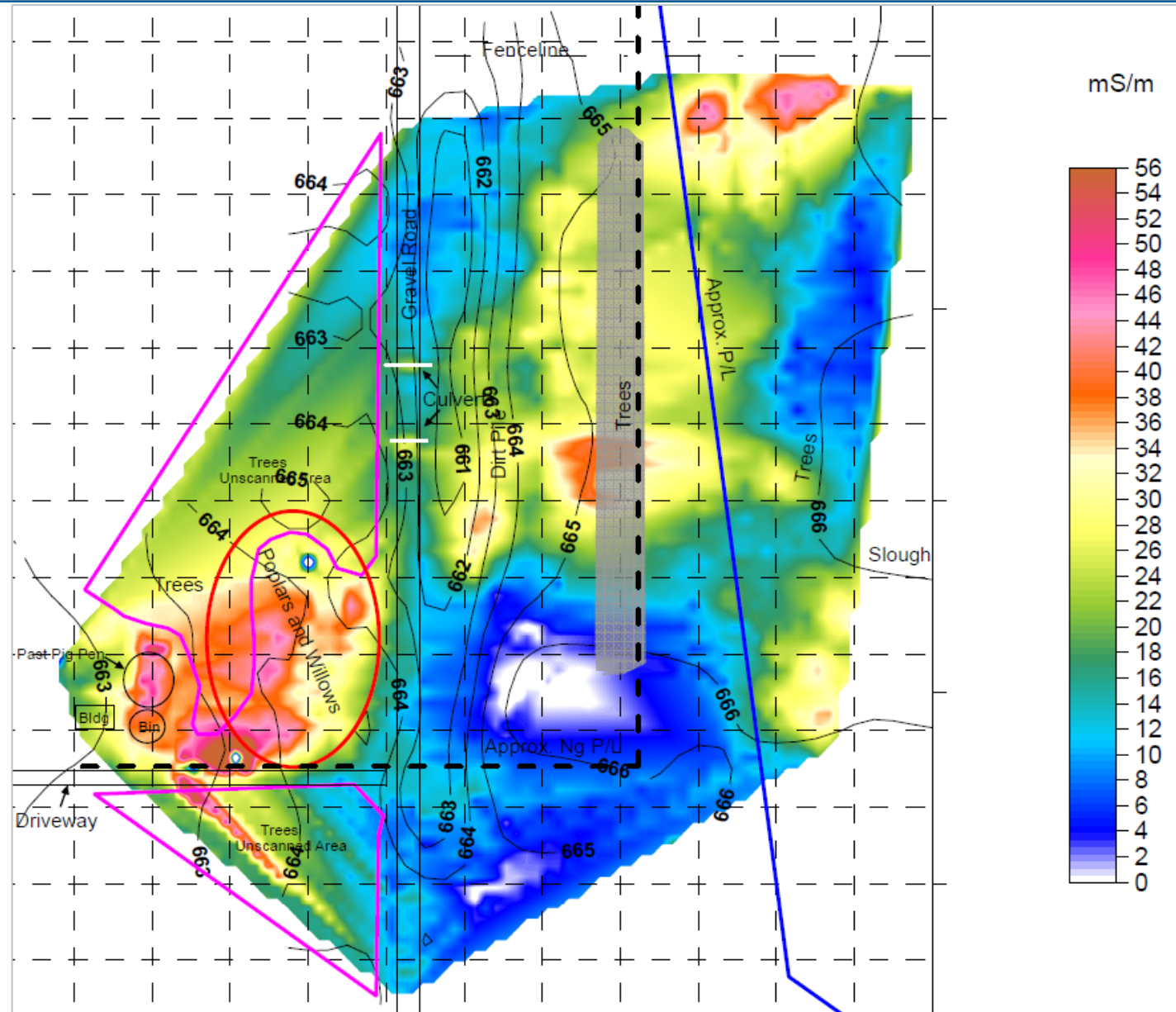
# Historical Soil, Surface, and Groundwater Sampling



# EM 31 Survey Results - 2015



# EM 38 Survey Results - 2015





# On Site Assessment – Inside Area of Concern





# On Site Assessment – Outside Area of Concern





# On Site Assessment: Terrestrial



Background  
Area

Region:  
Central Parkland

Ecosite:  
d1.4 or d1.5 low-  
bush cranberry  
Aw



North Area

South Area

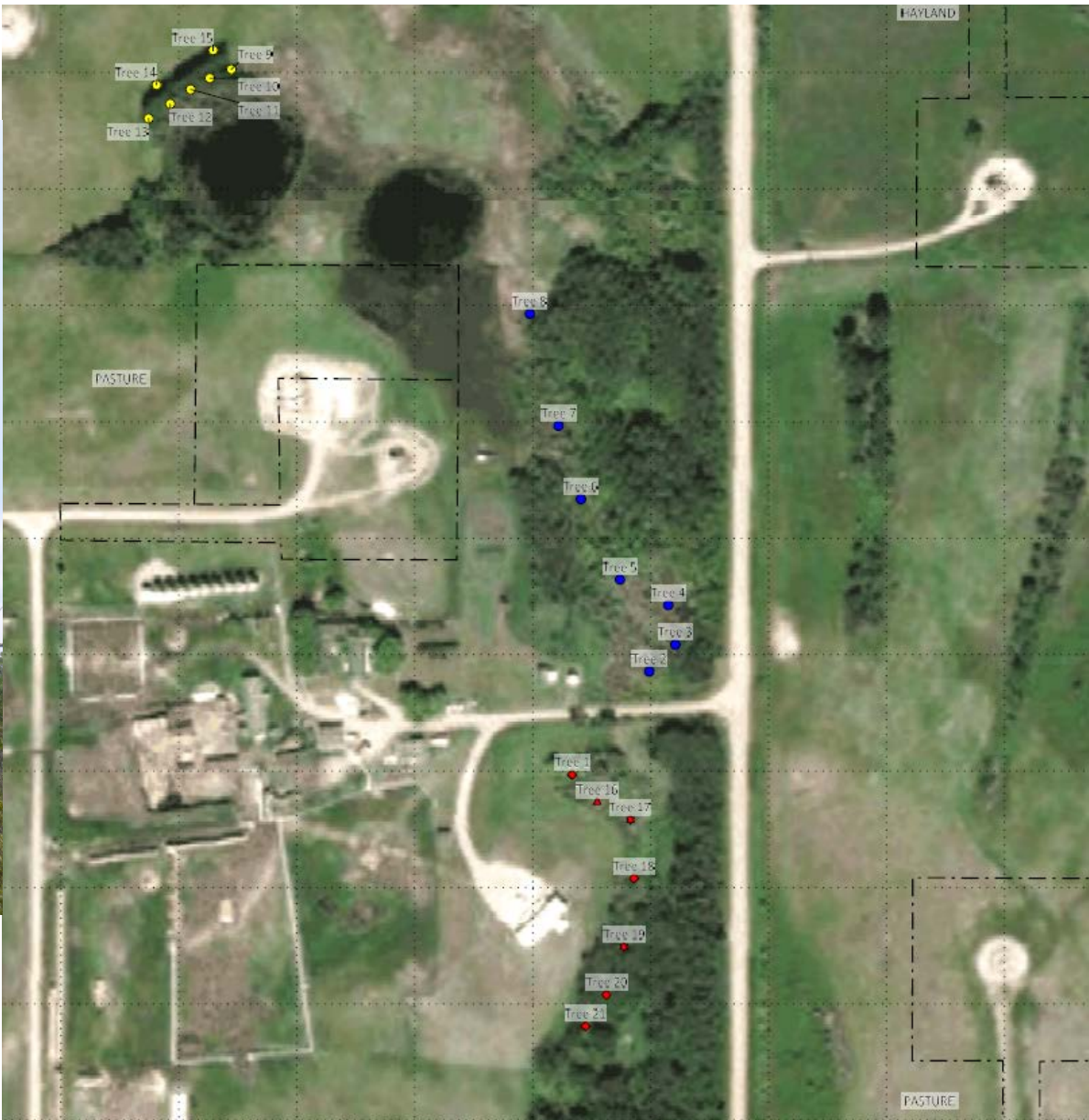


# On Site Assessment: Surface Water Hydrology





# On Site Assessment: Individual Tree Assessment





# On Site Assessment: Individual Tree Assessment





# On Site Assessment: Entomology

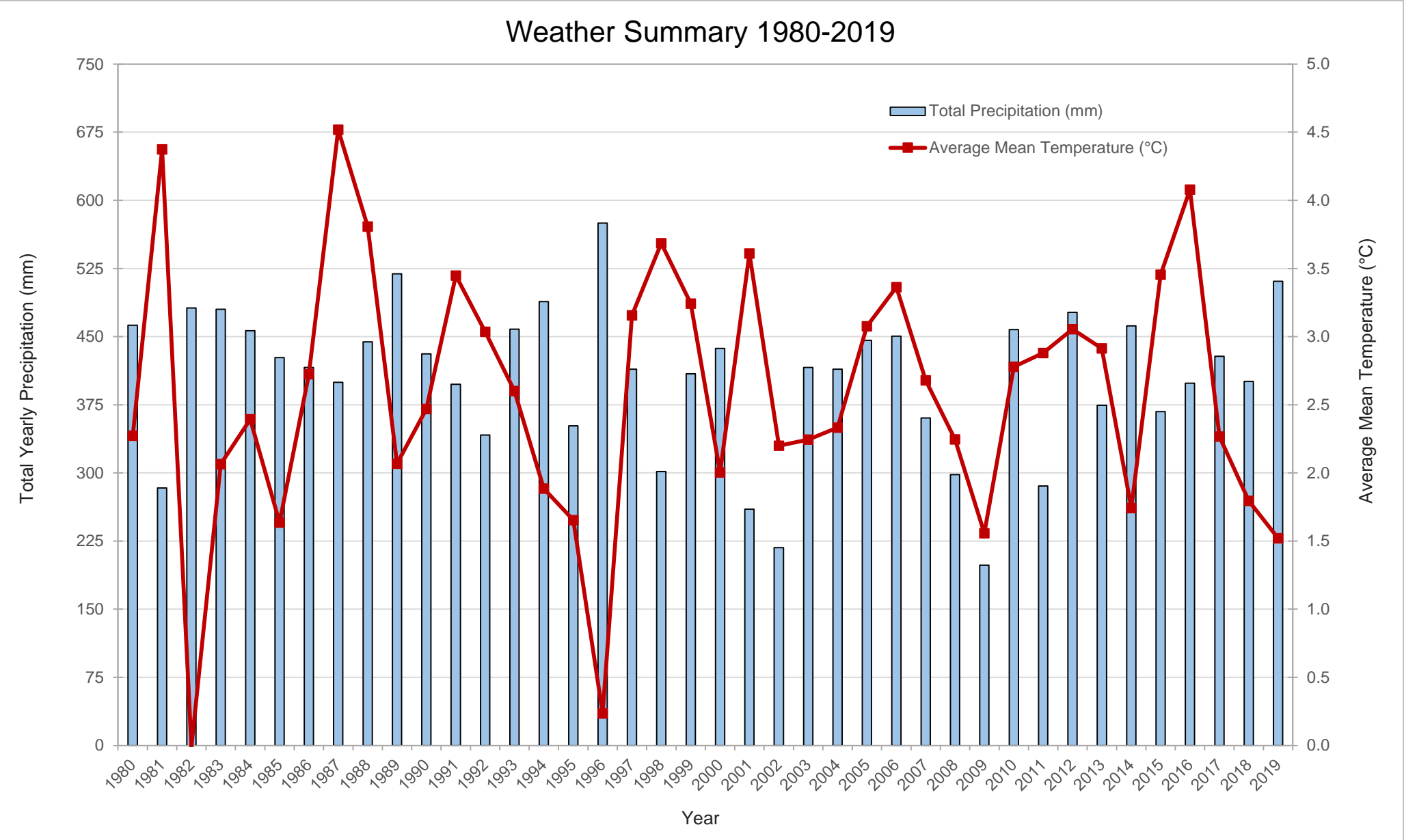




# On Site Assessment: Pathology



# On Site Assessment: Climatology

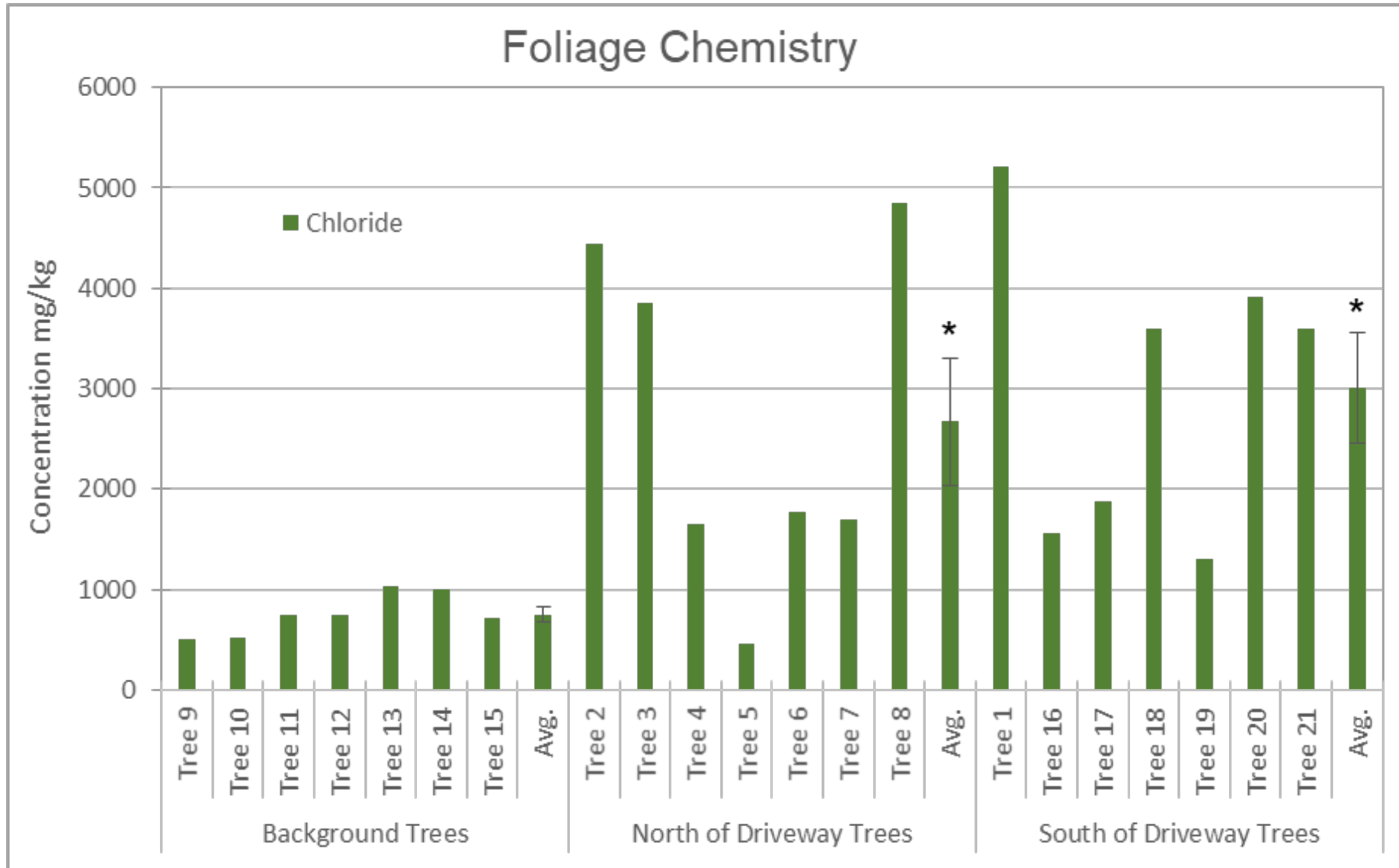




# Foliage Assessment



# Foliage Assessment



Chemistry results:

Background:  
498 – 1,030 mg/kg

North Area:  
466 – 4,850 mg/kg

South Area:  
1,310 – 5,210 mg/kg

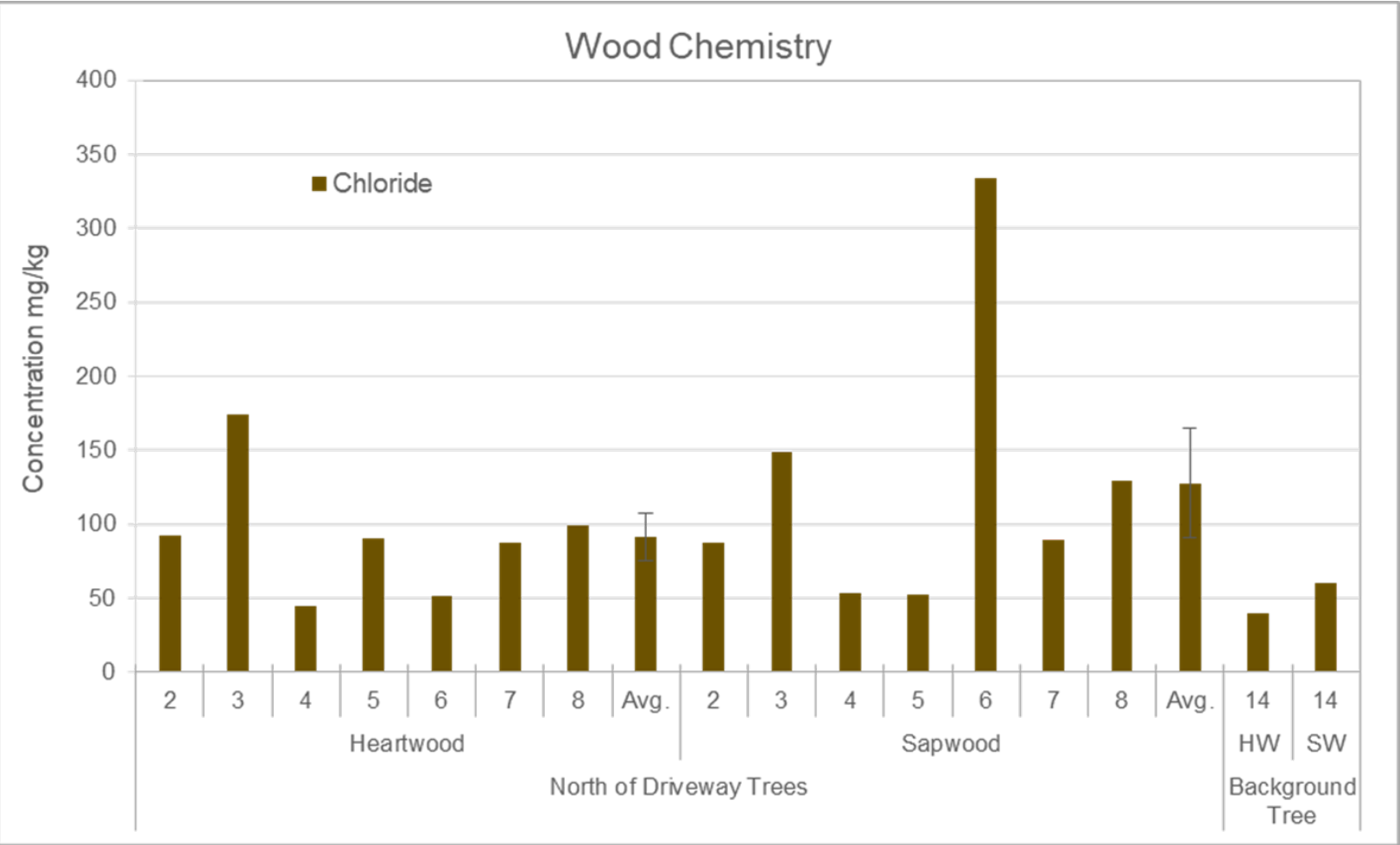


# Wood Assessment





# Wood Assessment



Chemistry results:

Background Trees:

- Heartwood: <40 mg/kg
- Sapwood: 60 mg/kg

North Area Trees:

- Heartwood: 51-174 mg/kg
- Sapwood: 52-334 mg/kg



# Dendrochronology



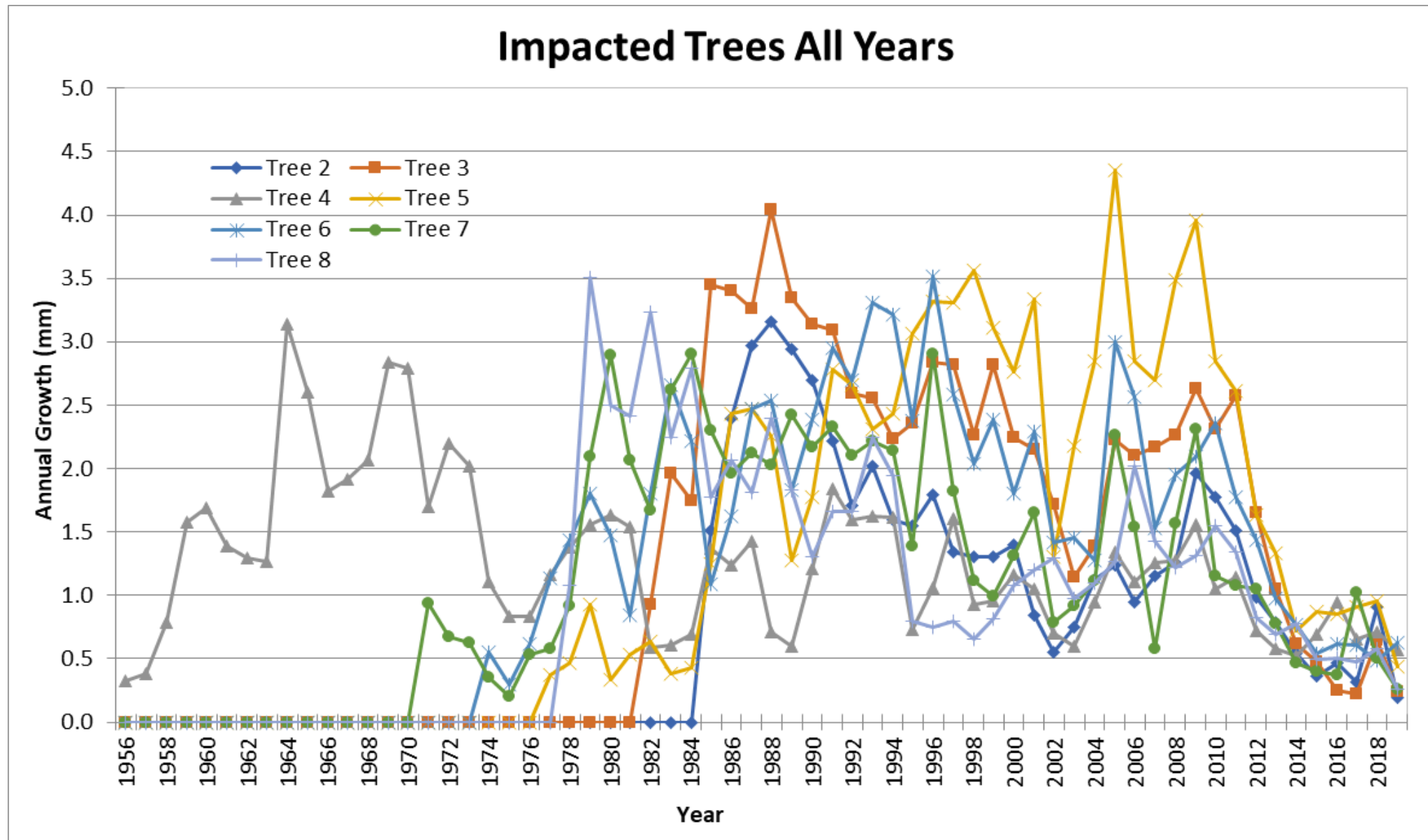


# Dendrochronology

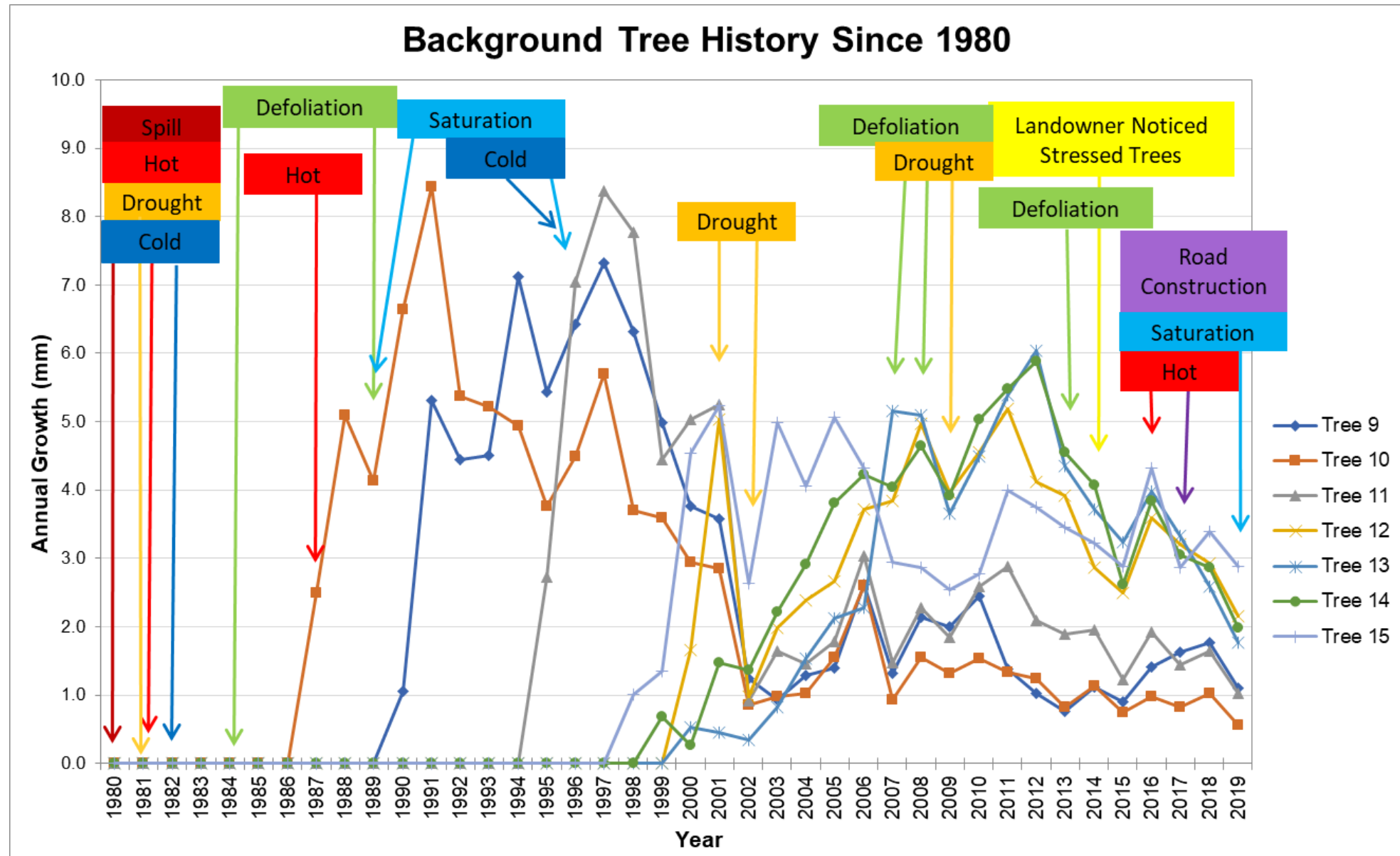




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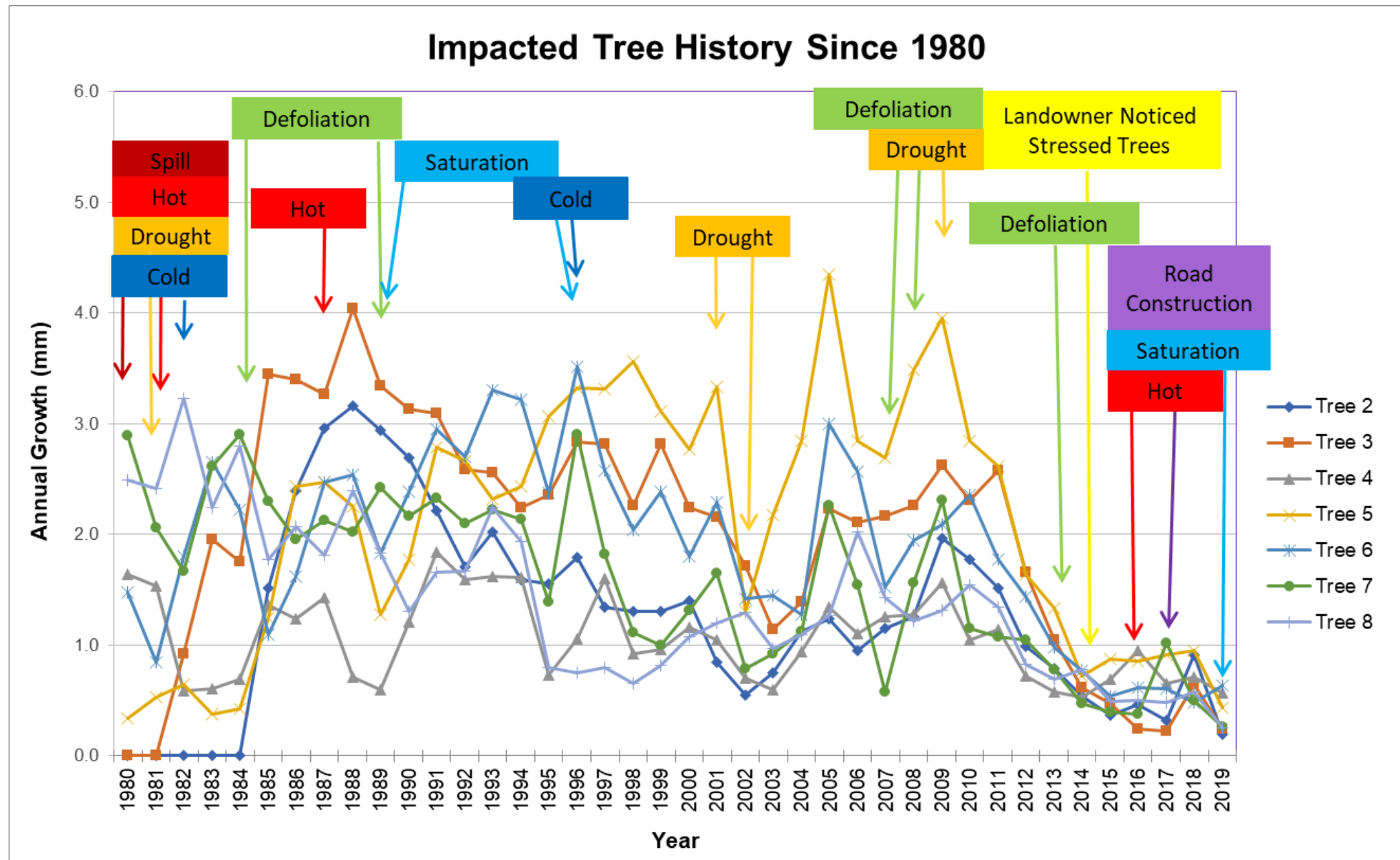


# Dendrochronology



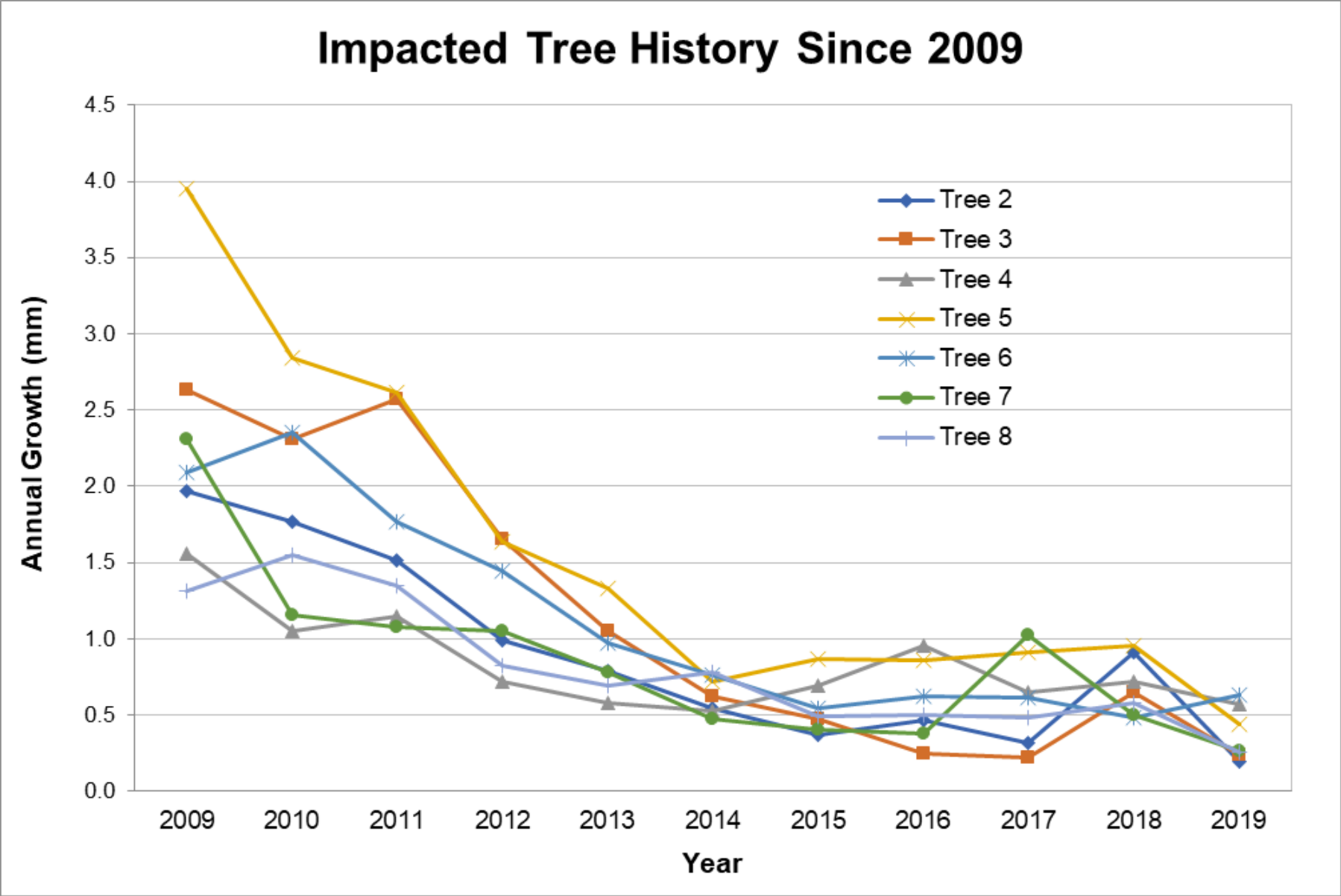


# Dendrochronology



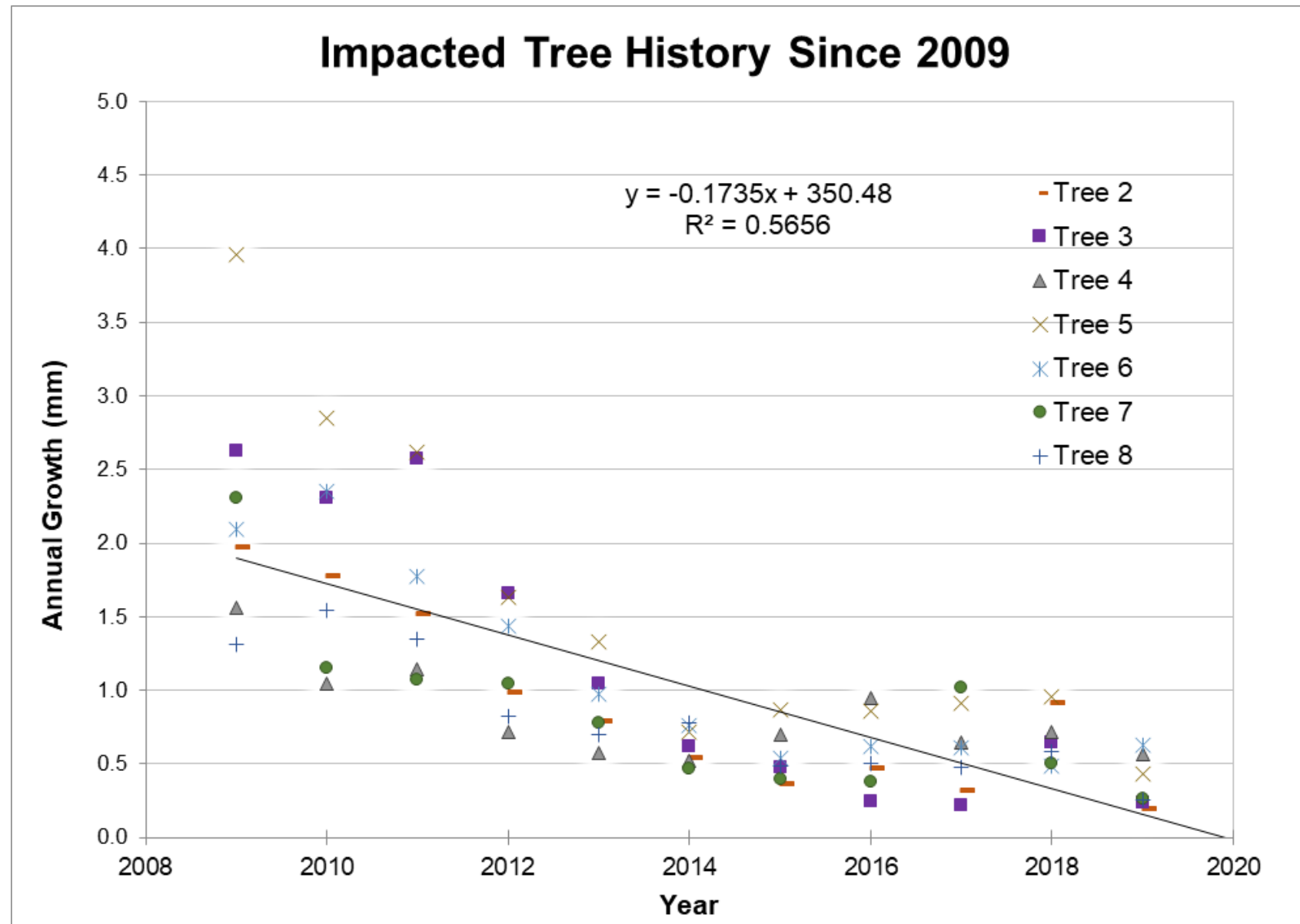


# Dendrochronology



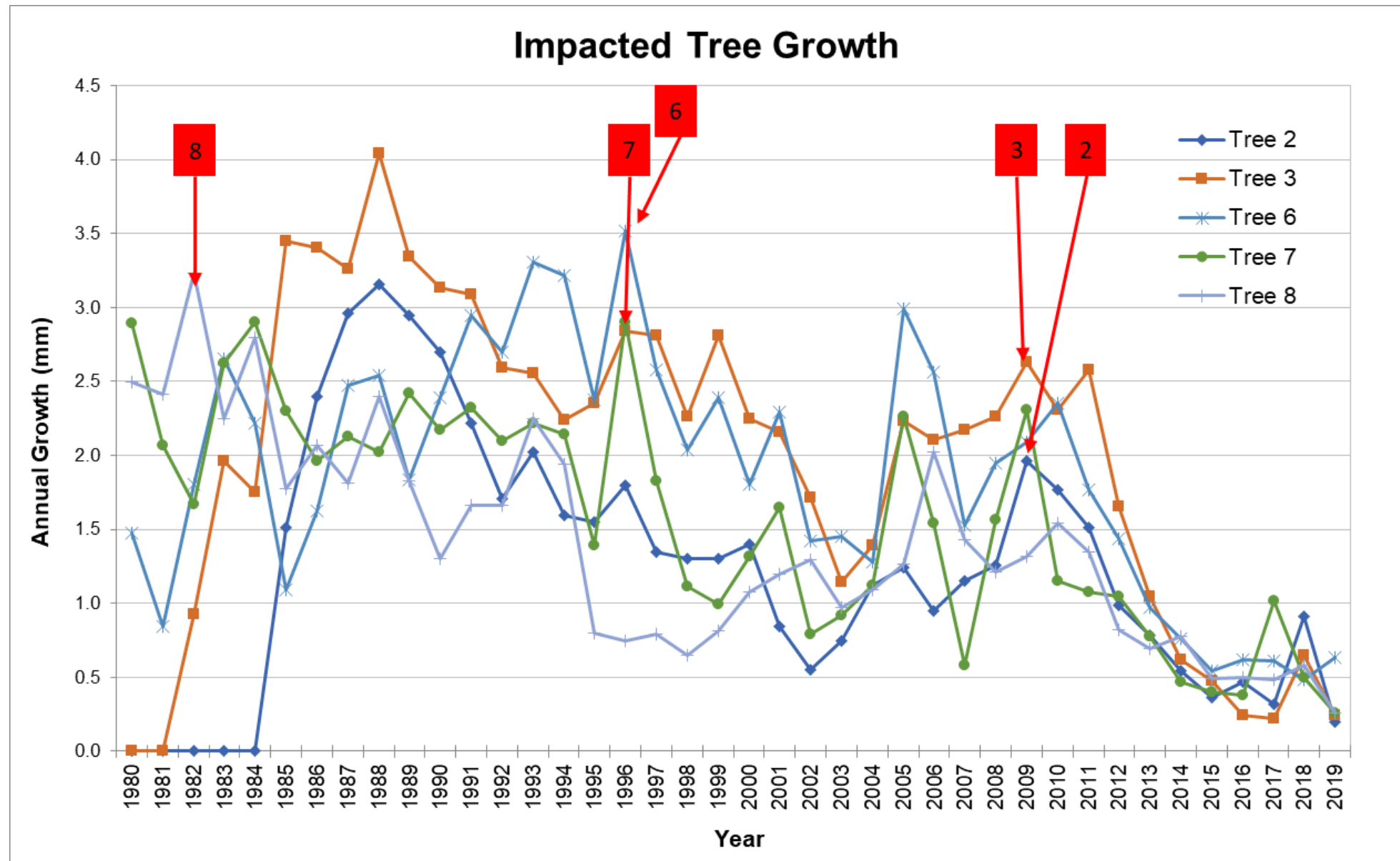


# Dendrochronology





# Dendrochronology





# Dendrochronology



● Tree 8 - 1982

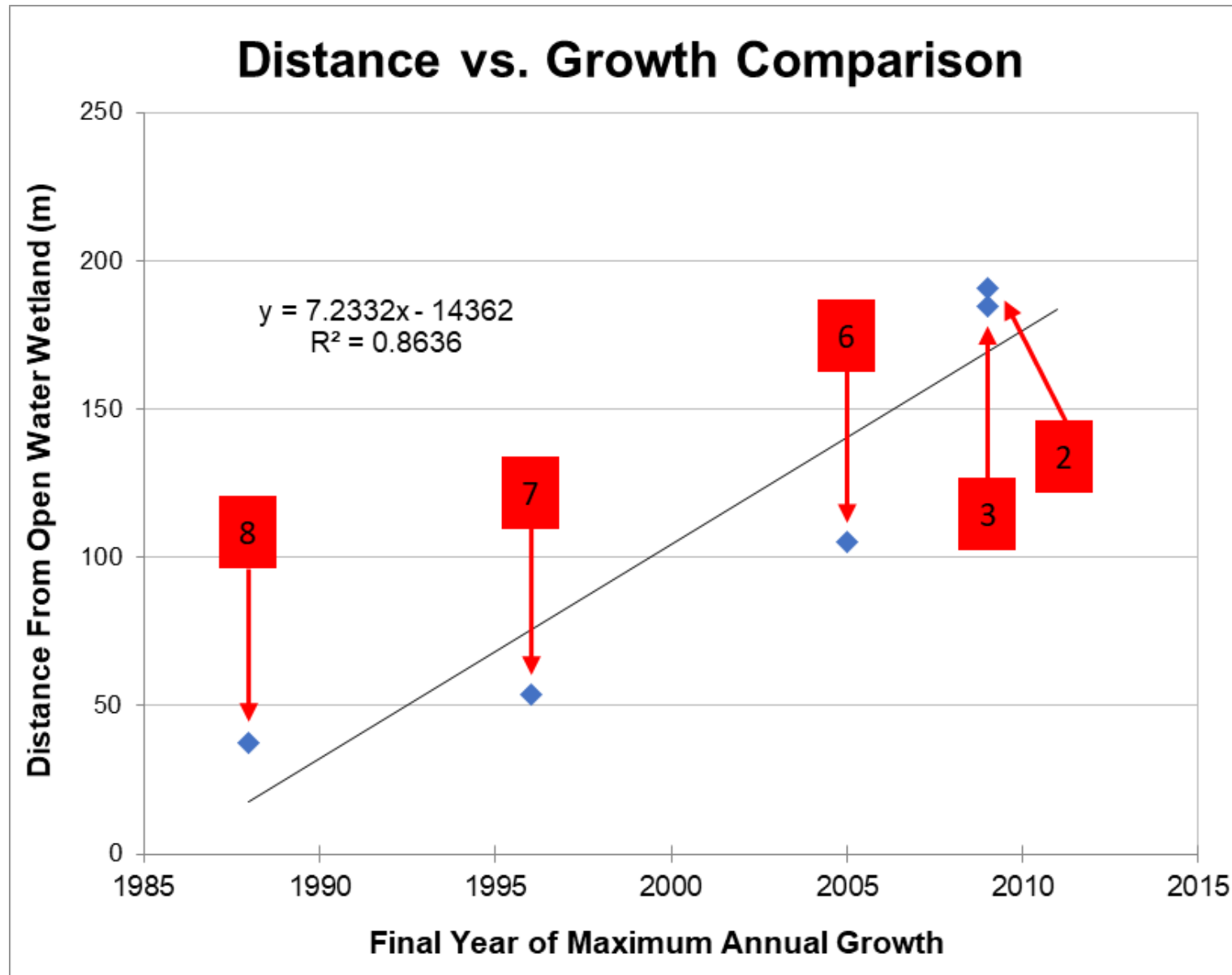
● Tree 7 - 1996

● Tree 6 - 1996

● Tree 3 - 2009

● Tree 2 - 2009

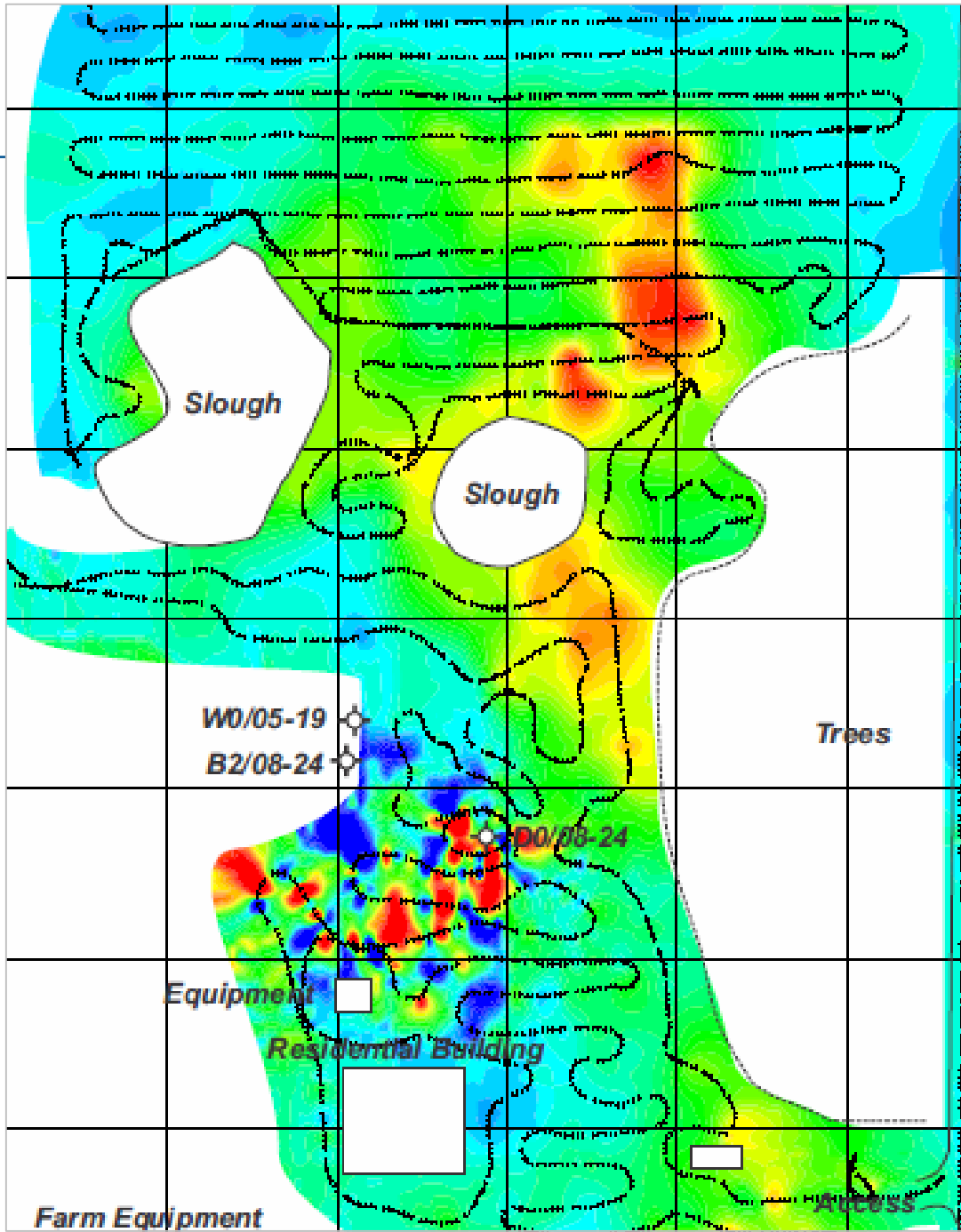
# Dendrochronology







# Validation EM 38





# Questions?

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