



The LAMP shines some light: The Log-Aspect Microsite Project after one growing season

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Inland Empire Reforestation Council (IERC) Meeting,
Coeur d'Alene Resort, Coeur d'Alene, Idaho

Coarse woody debris and seedling microsites

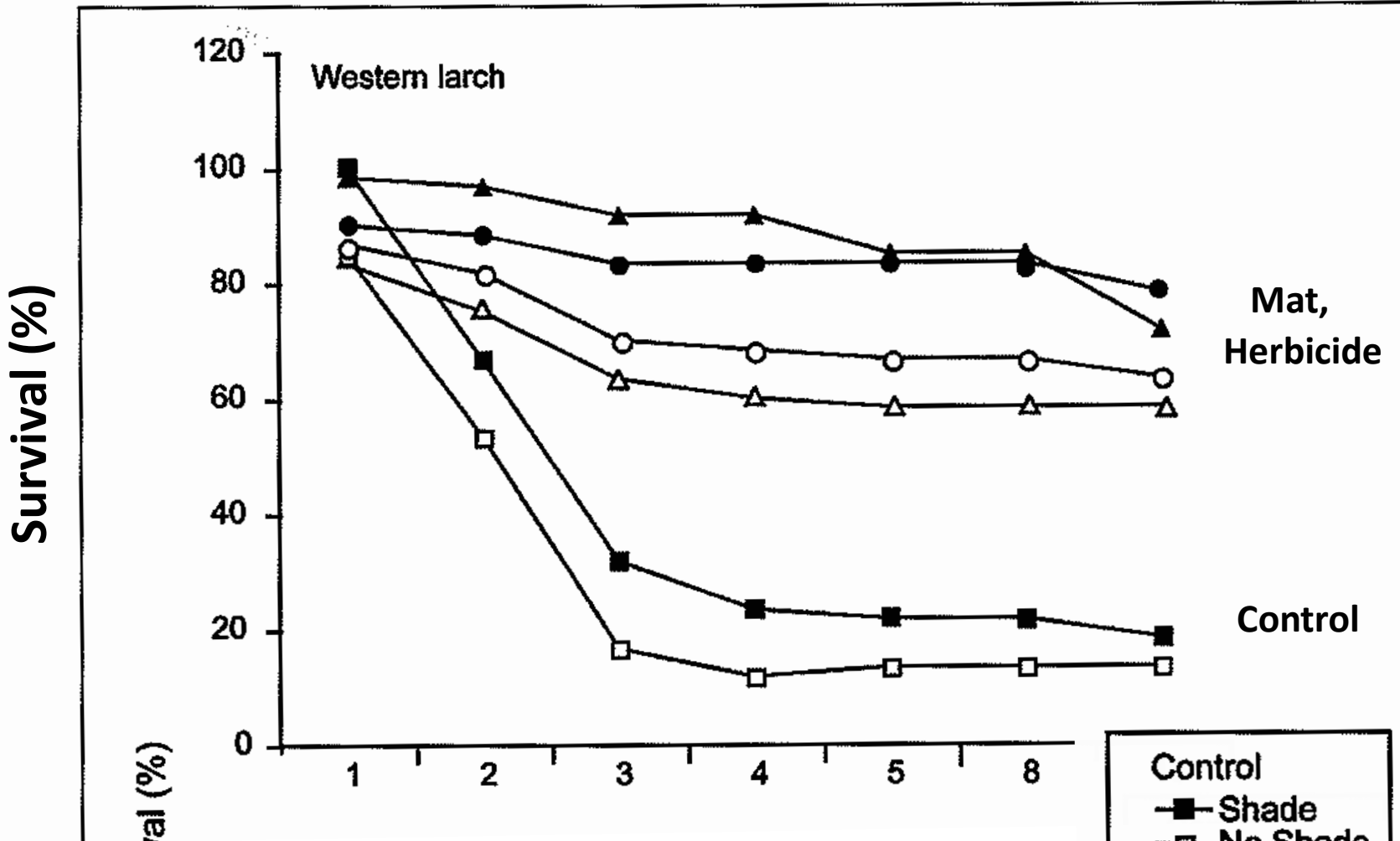
- “Nurse log” phenomenon well-established
- *Planting in the “dead shade”*
- “Shade from shrubs and logs may facilitate seedling establishment during the dry summers by providing moist or cool microsites.” –Dr. Andrew Gray
- Bailey et al. (2012)- eucalypts in Tasmania
 - Surviving seedlings: over 220° shelter with the average distance from a sheltering object **being less than 30 cm**
 - **80% of seedlings** sheltered by coarse woody debris

Spatial clustering of
ponderosa pine
regeneration associated
with woody debris
Superior, MT



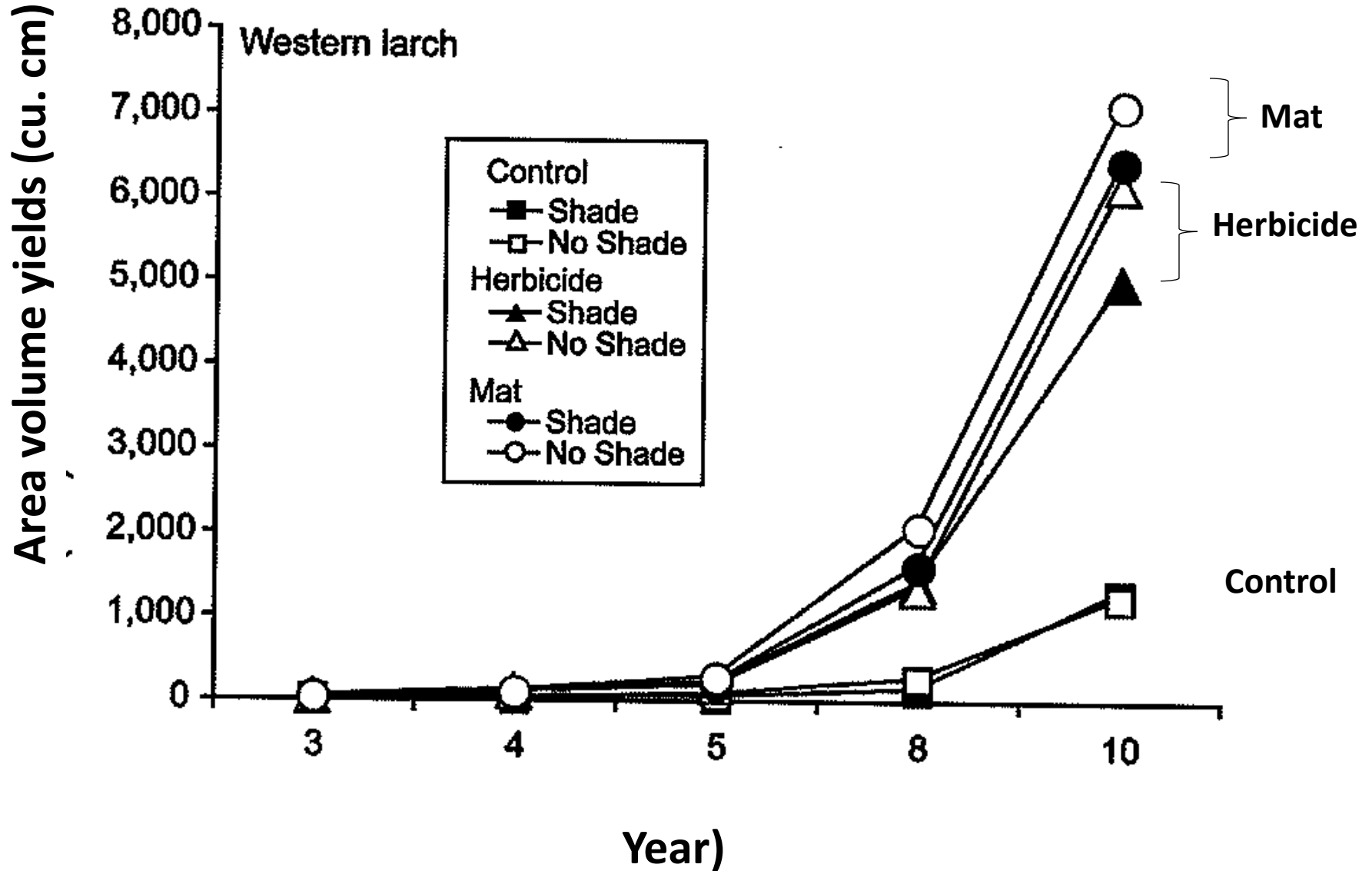


Microsite planting



Survival-
Oester 2008

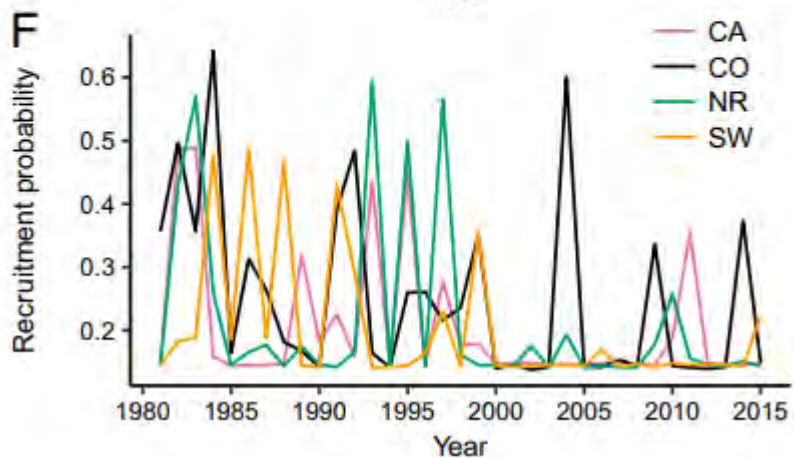
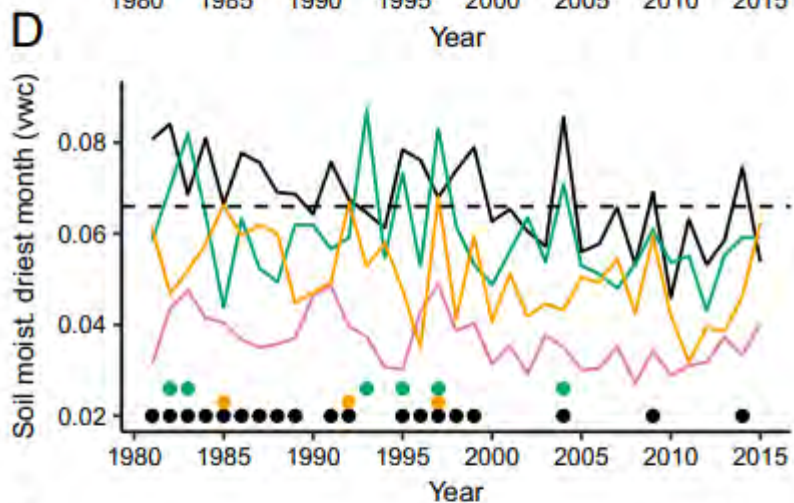
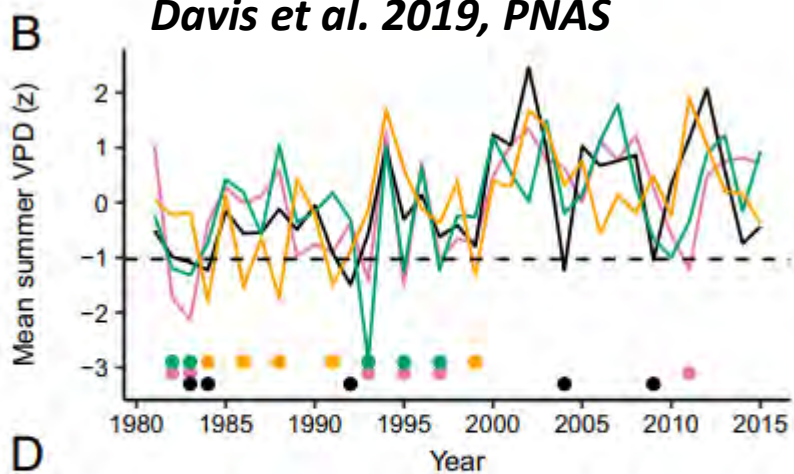
Growth- Oester 2008



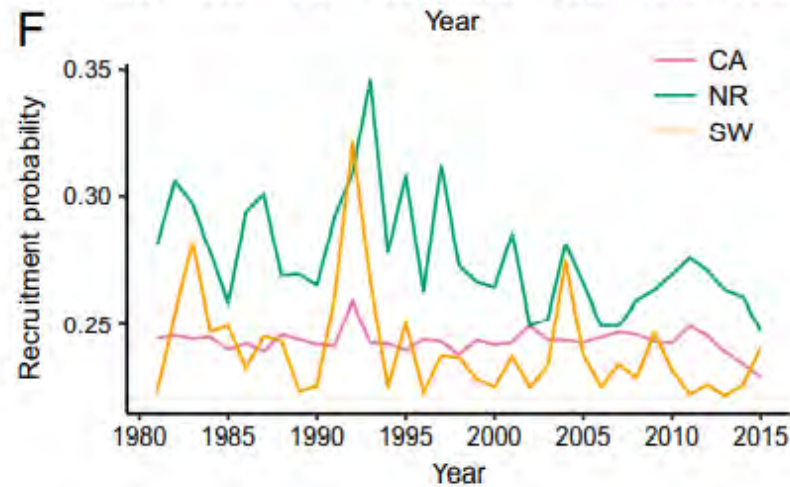
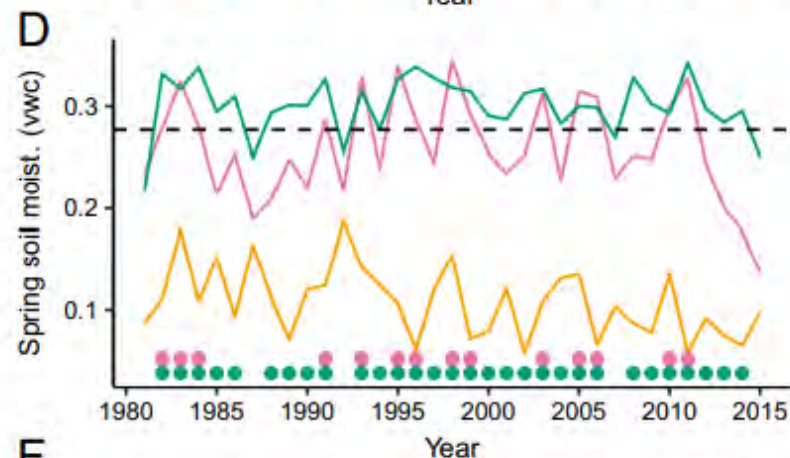
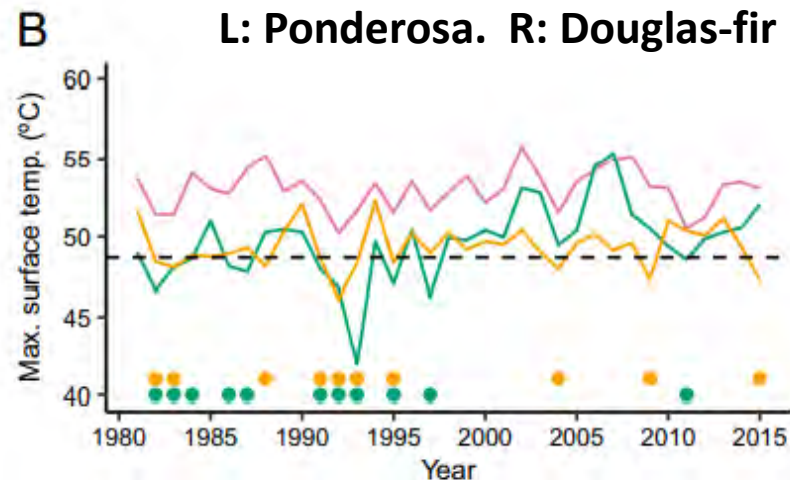
Climate change and seedling success

- Climate trends
 - Increasing temperatures and VPD
 - Decreasing soil moisture through growing season
- Post-disturbance sites may revert to non-forest without successful regeneration (Roccaforte et al. 2012)
- Davis et al. (2019): critical thresholds at low elevations have been reached
- **Microsite features** may provide resilience to tree regeneration

Davis et al. 2019, PNAS



L: Ponderosa. R: Douglas-fir



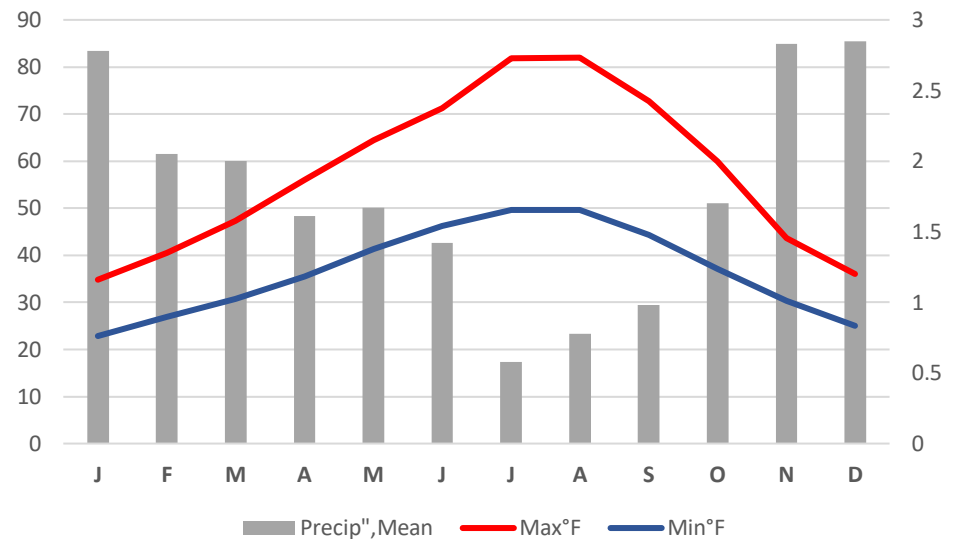
Log-Aspect Microsite Project (LAMP)

- Replicated factorial experiment
 - Three topographic aspects (south, flat ridge, north)
 - Three logs per aspect (replicates)- 16" DOB * 16.5'
 - Two log aspects (north vs. south side of log)
 - Three seedling transects per log aspect
 - Two species per transect
 - *Pinus ponderosa*- ponderosa pine
 - *Pseudotsuga menziesii*- Douglas-fir
 - Four planting distances (0, 0.25, 0.5, and 1.5 m)
 - 0-0.5 m ~ theorized microsite zone
 - 1.5 m ~ isolated from log influence
- $3*3*2*3*2*4 = 432$ seedlings

Site

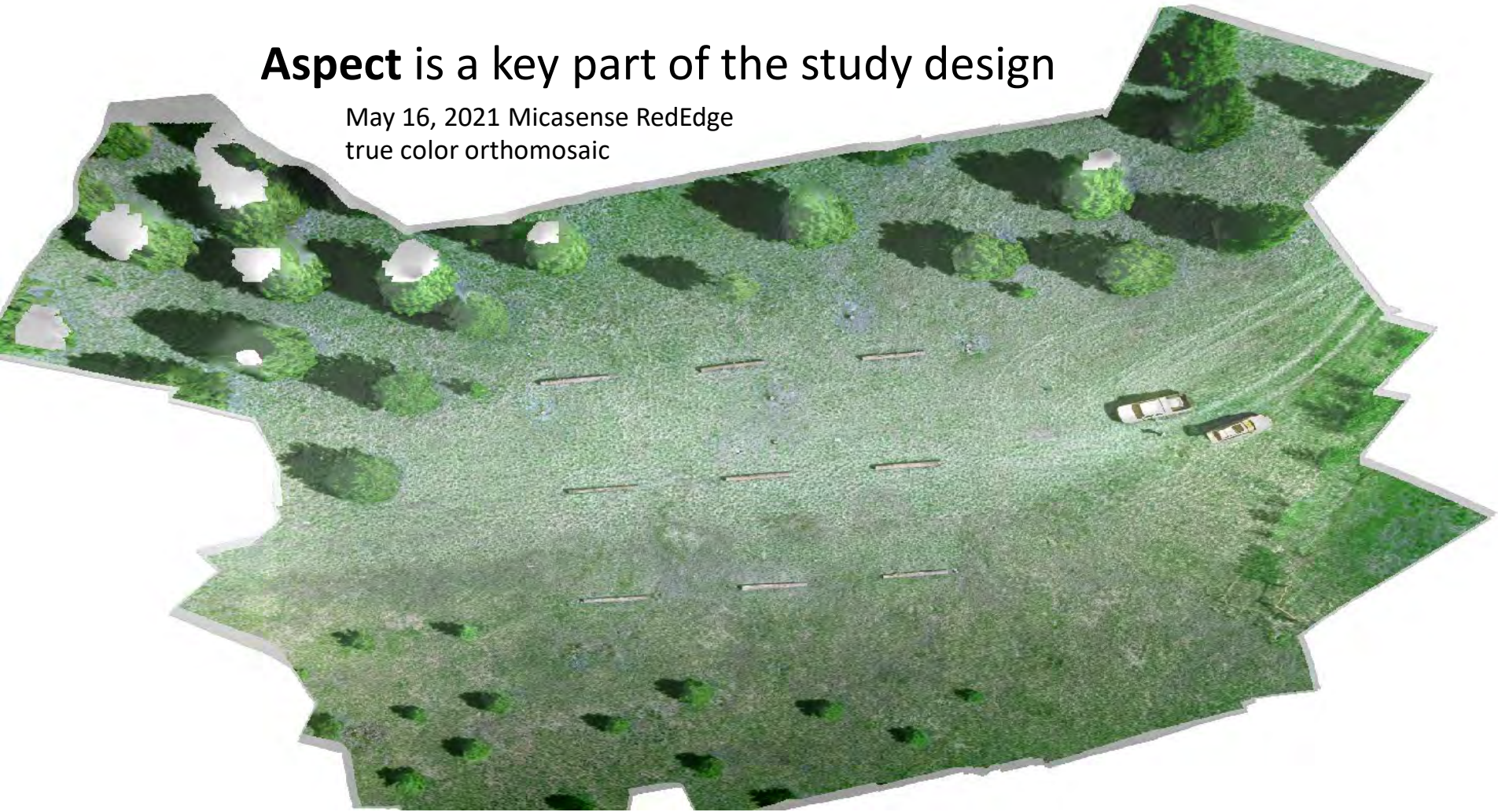


- Elevation 2610 (~ 795 m)
- Palouse-Thatuna silt loams (map unit 29bq)- deep, formed in loess
- Marine-modified continental climate; Mediterranean pattern
- *Festuca ovina* bunchgrass

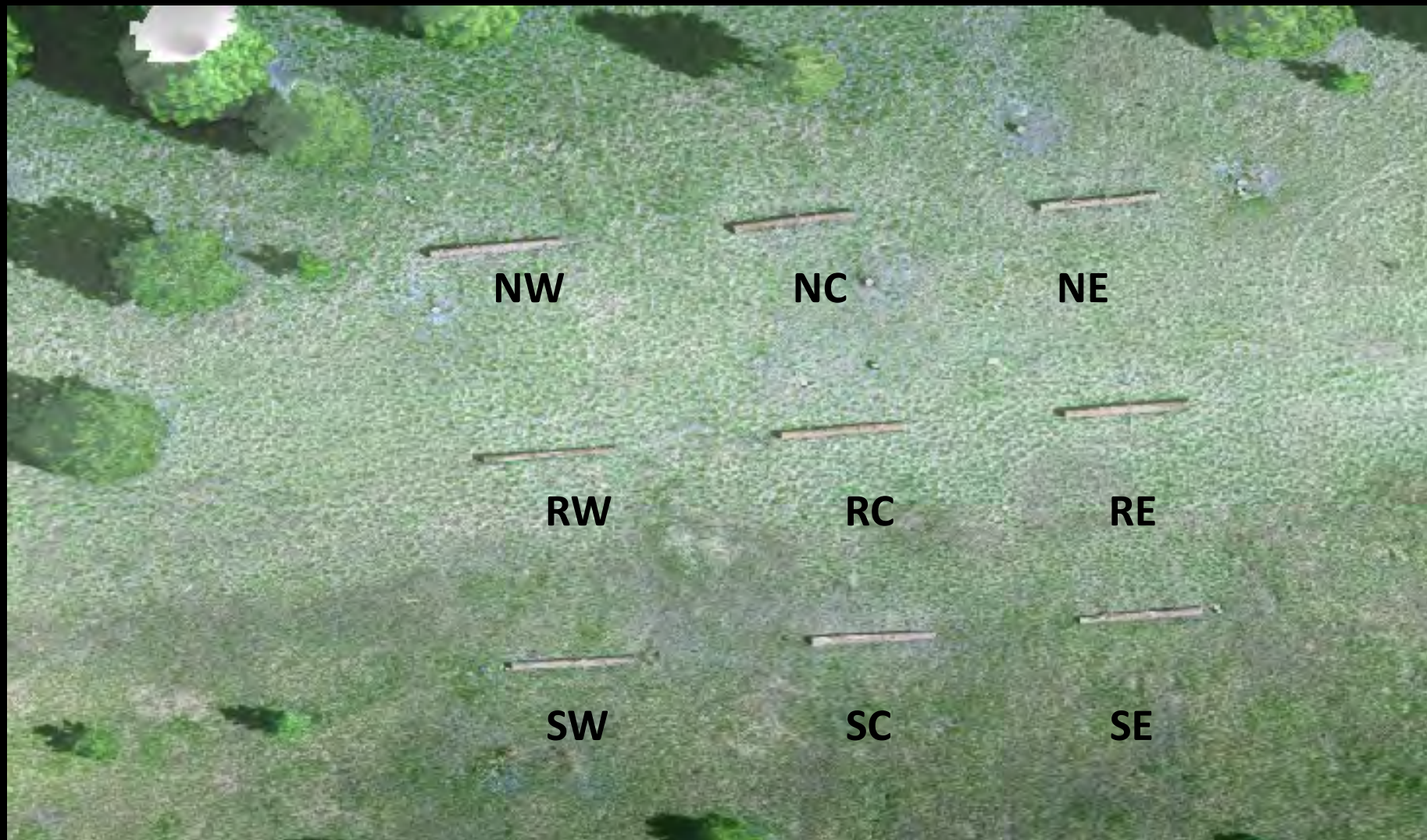


Aspect is a key part of the study design

May 16, 2021 Micasense RedEdge
true color orthomosaic



Overall design



E.H. Steffen Center

*School of the Environment
Washington State University
2 mi east of center of Pullman, WA*



Thanks to the WSU Forestry Club!



Planting Day #1



Planting Day #2



April 10th and 11th, 2021

Log-Aspect
Microsite Project
Steffen Center



Design for planting



(Mirrored on other side of log)

0 m

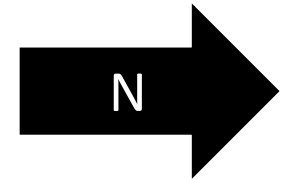
0.25 m

0.5 m

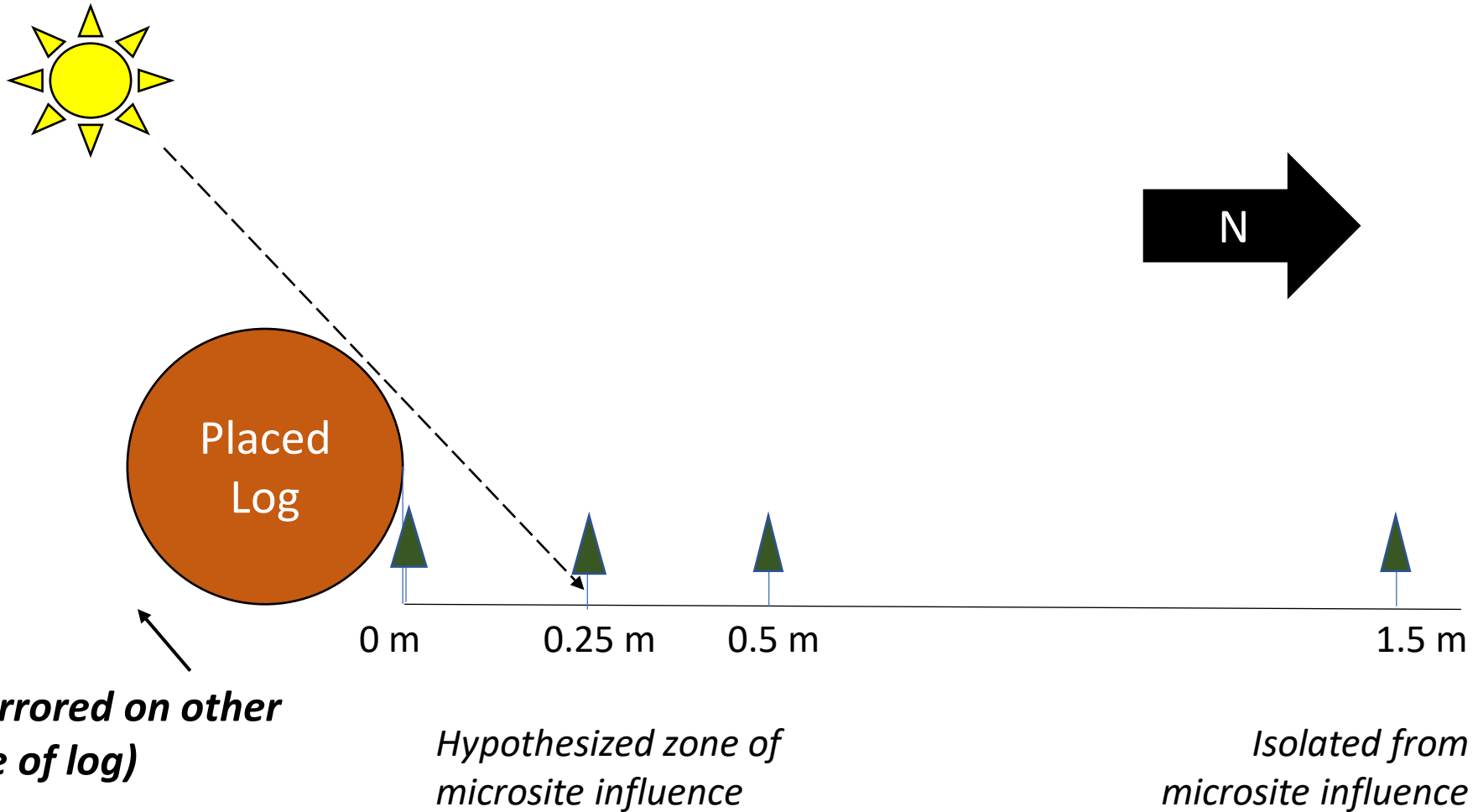
1.5 m

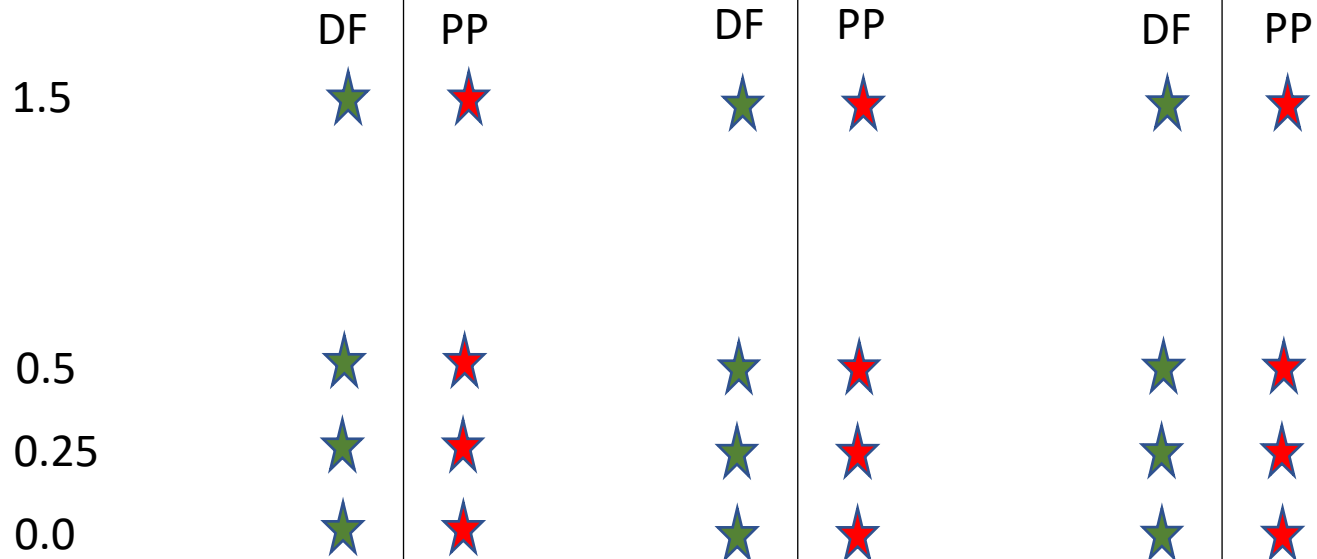
Hypothesized zone of microsite influence

Isolated from microsite influence



Design for planting



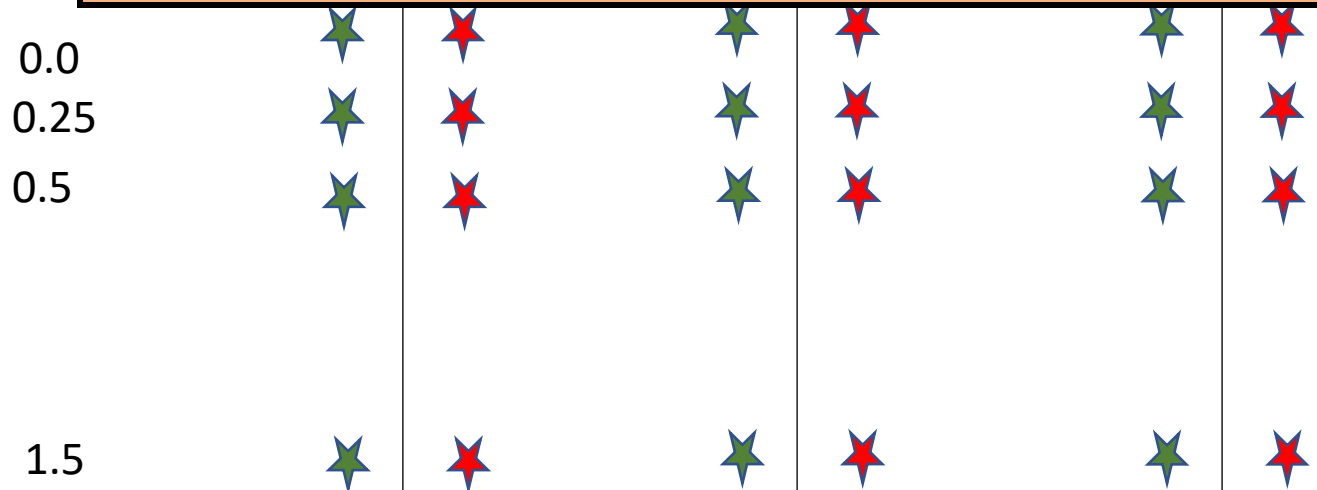


LOG

1.00 m

2.44 m

3.88 m



2021- Monthly measurements of:

- Seedling height (cm)
- Basal caliper (cm)
- Vigor class (1= high, 4= dead)

Occasional measurements of:

- Soil surface temperature (Sept 2021)
- Soil moisture (May 12, 2021)
- FV/FM photosystem II fluorescence
- Snow depth (pre-experiment)



Typical results!

Log South_Center.
North side, west transect.

PP, V3

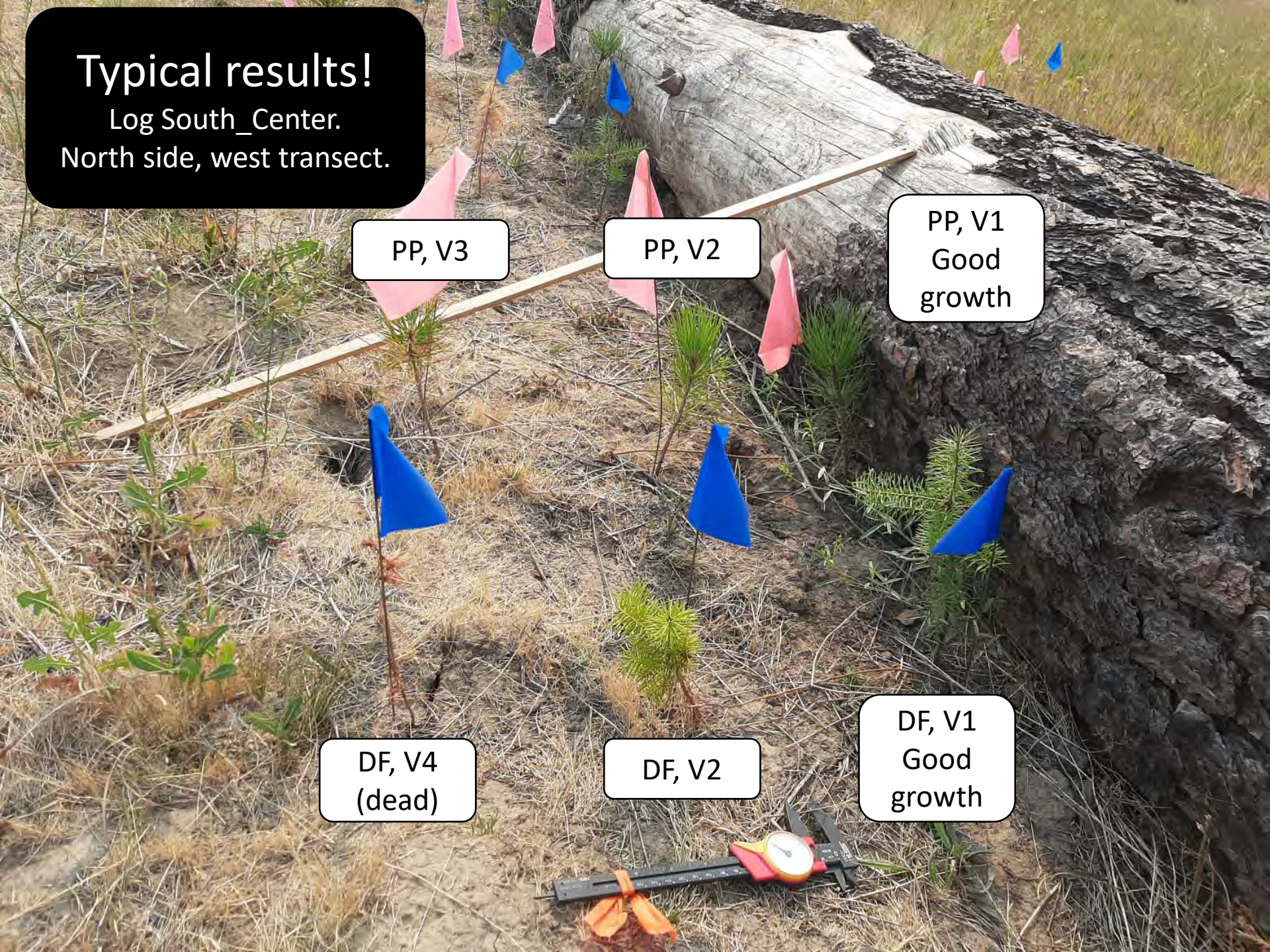
PP, V2

PP, V1
Good
growth

DF, V4
(dead)

DF, V2

DF, V1
Good
growth



Snow depth as a microsite factor



Topographic aspect drove snow duration

March 30th, 2021



SOUTH



RIDGE



NORTH



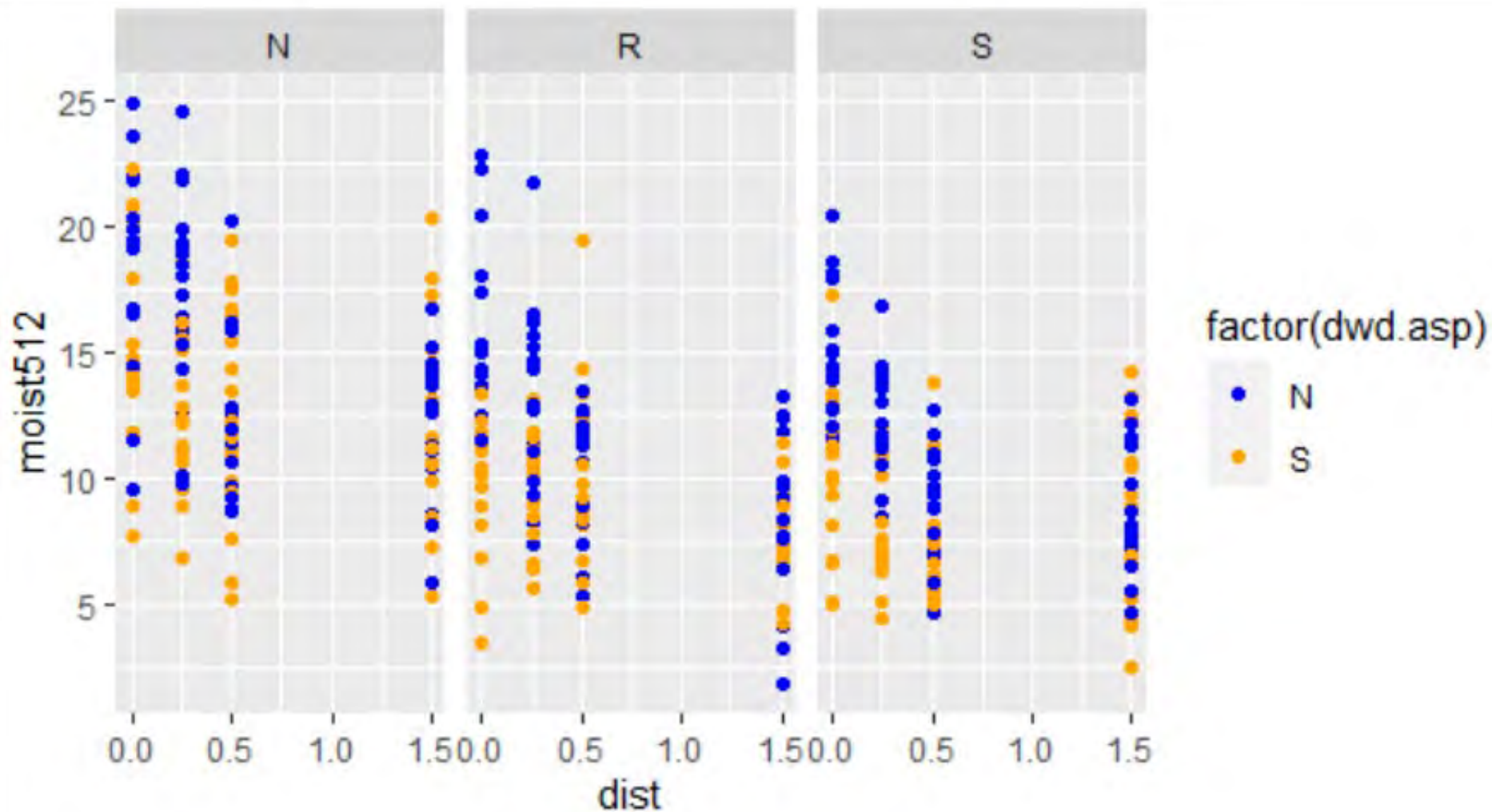
Snow depth

- Snow drifting against logs correlated well with spring soil moisture
- North side of logs did not have much prolonged melting period



Soil moisture (percent)

May 12th, 2021

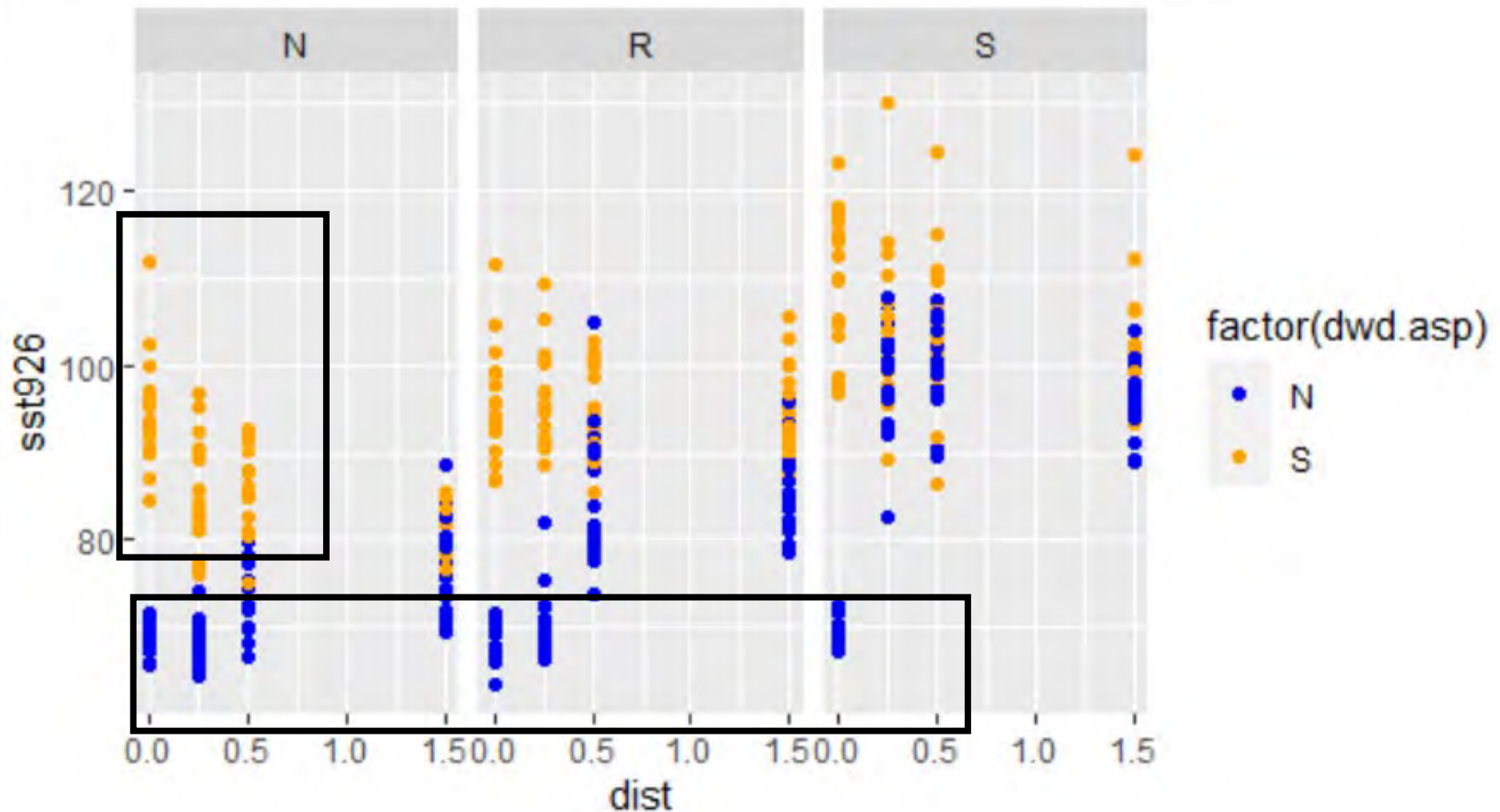


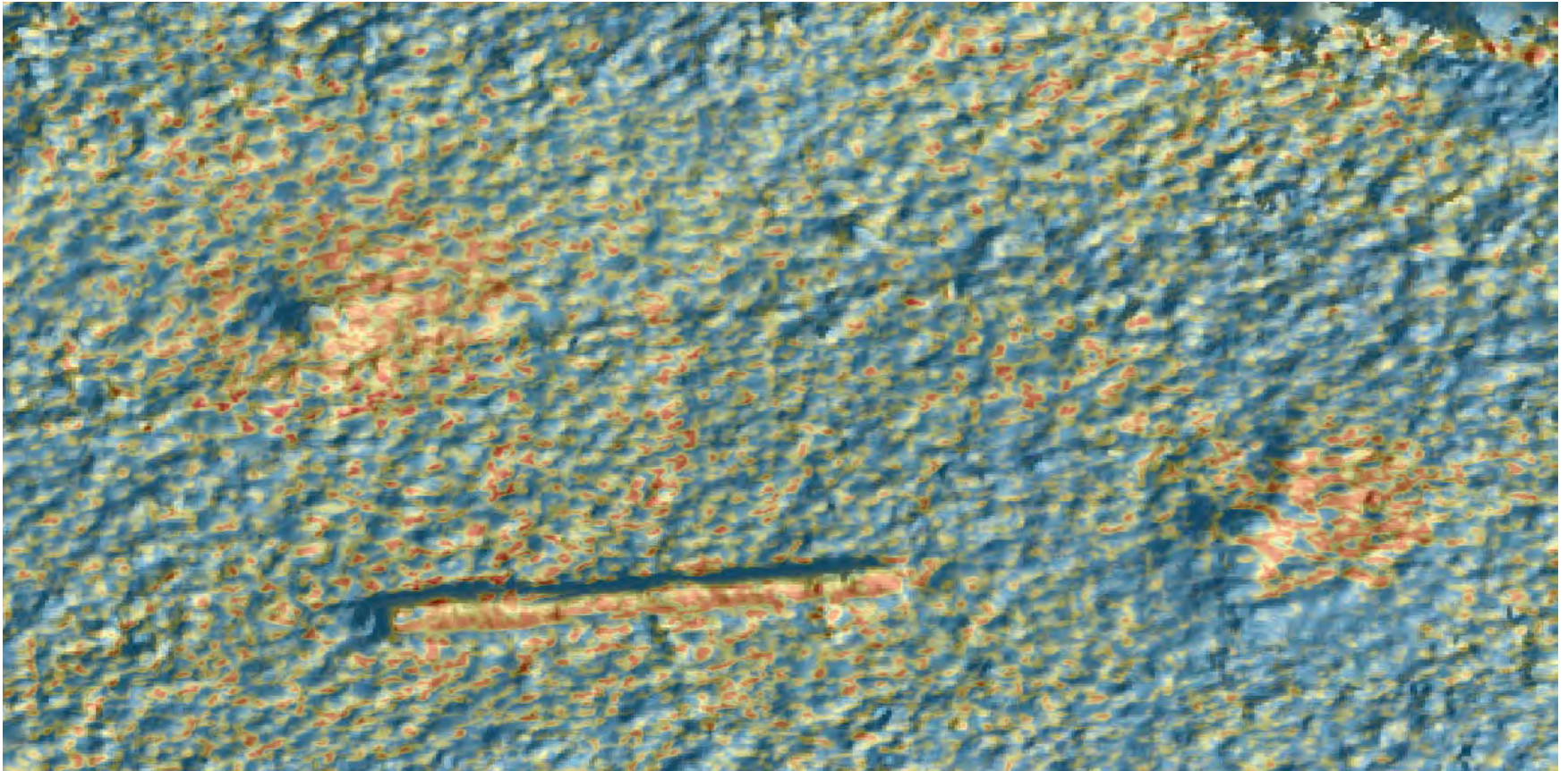


Soil surface temperature

September 26th, 2022 1-3 pm

Ambient: 80°F



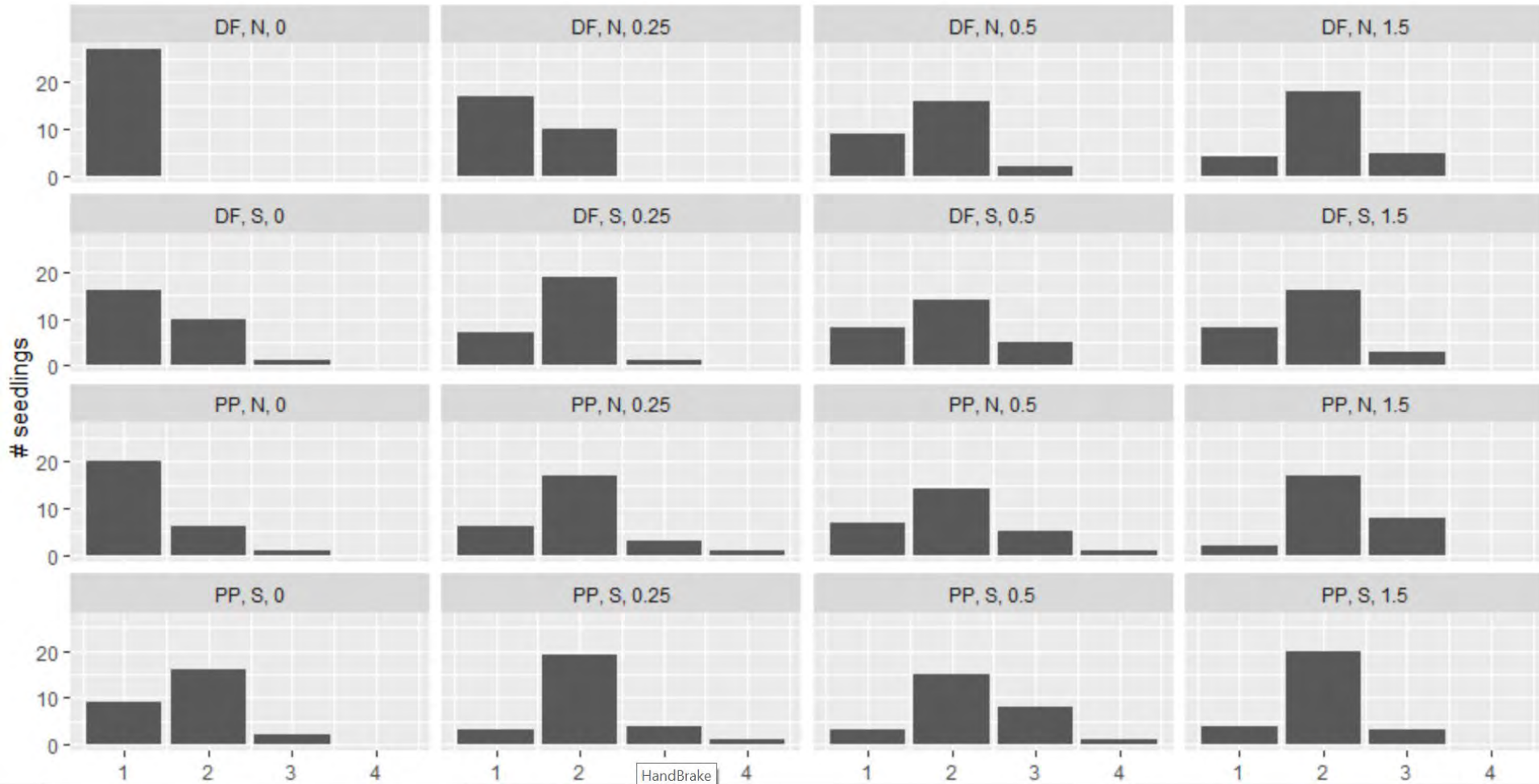


May 16, 2021 FLIR thermal true orthomosaic w/DEM hillshade in background. Blue = low values, red = high (note the northern row of logs show more reds than others on the May 16 morning)

May 1st, 2021 (3 wks post-planting)

Mortality 0.92%

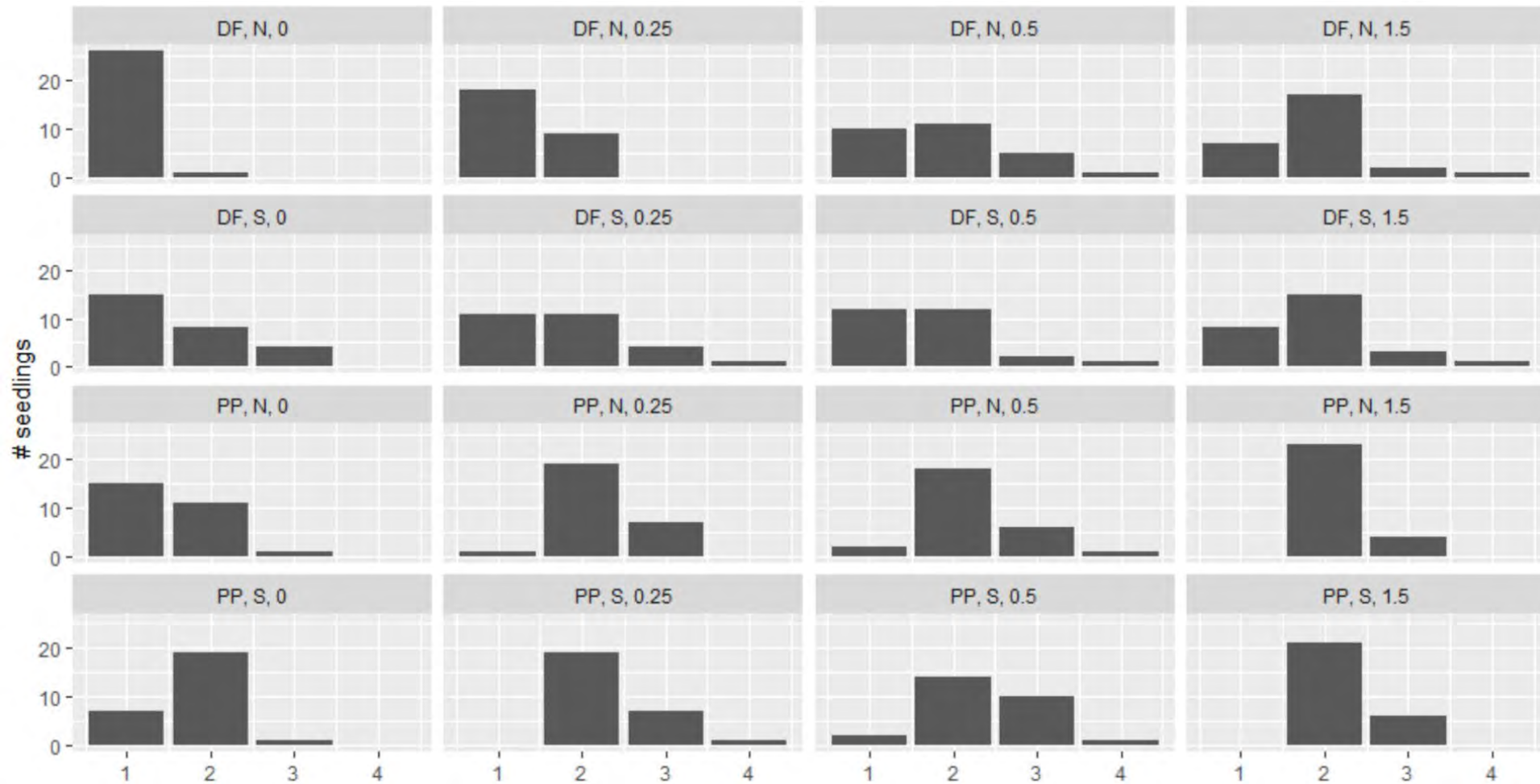
NOTE: these data from across all three topographic aspects



June 5th, 2021

Mortality 1.85%

NOTE: these data from across all three topographic aspects



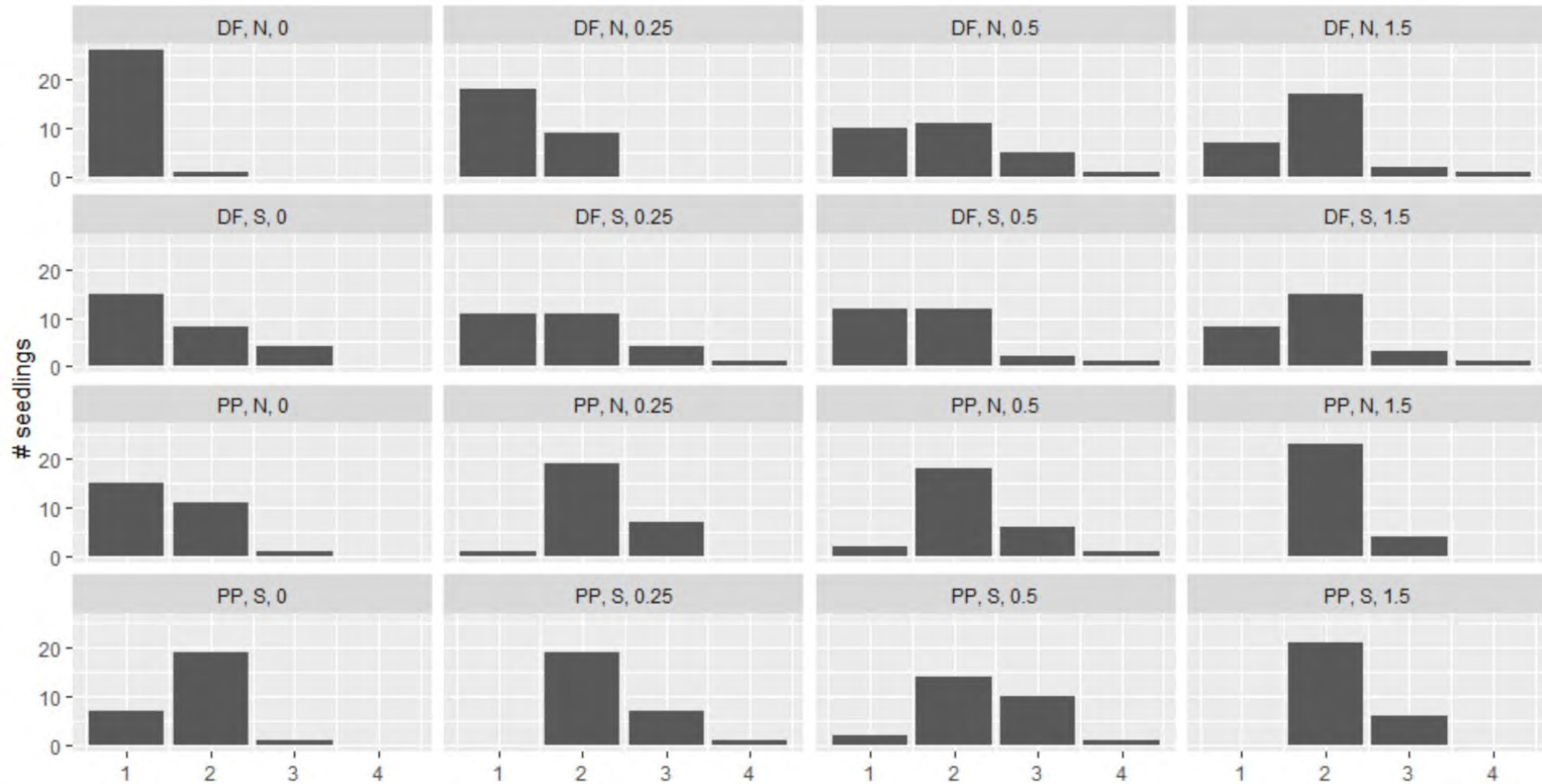


By June 5, 2021:
Survival and height differences
Strong forb response

July 1st, 2021

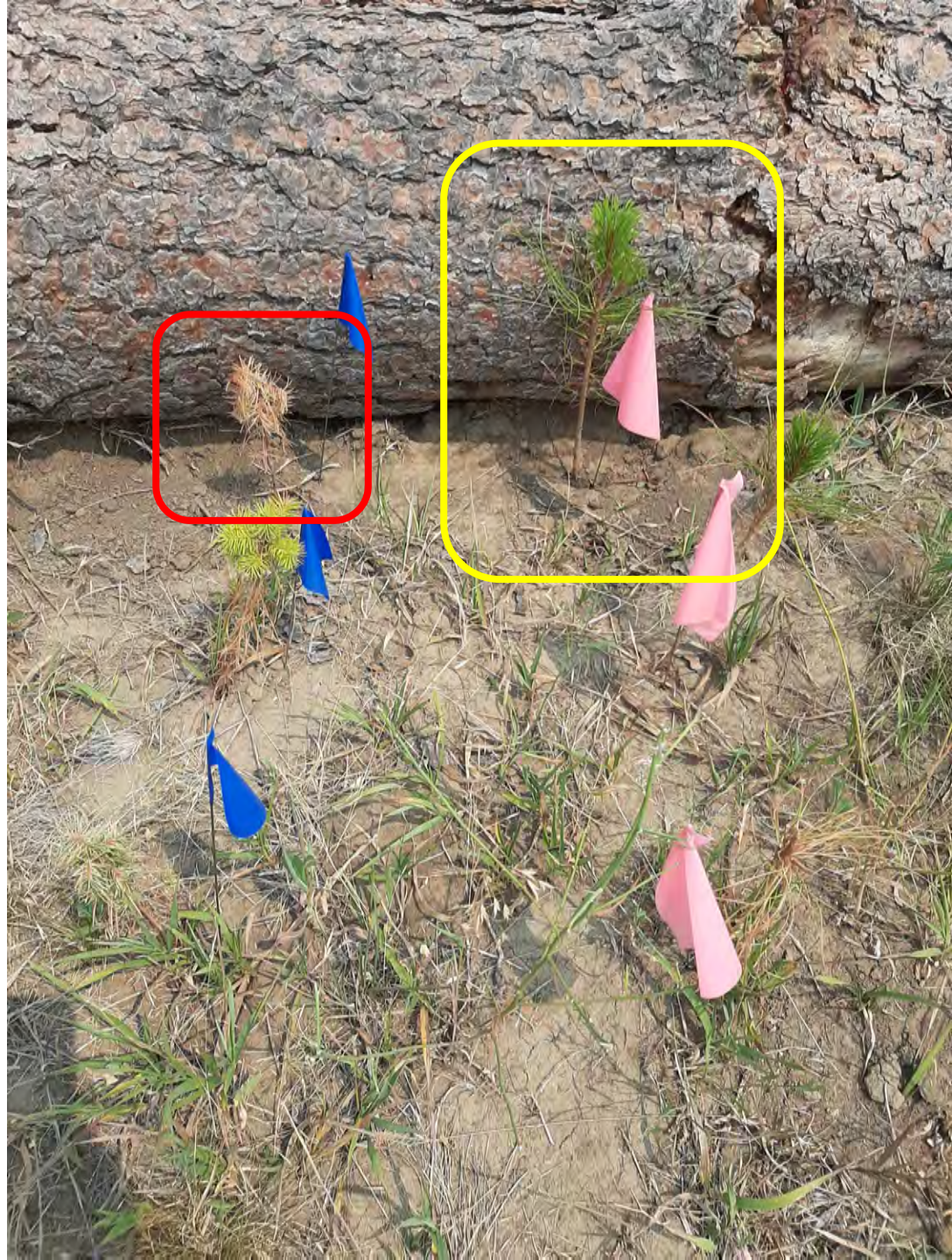
Mortality 12.5%

NOTE: these data from across all three topographic aspects



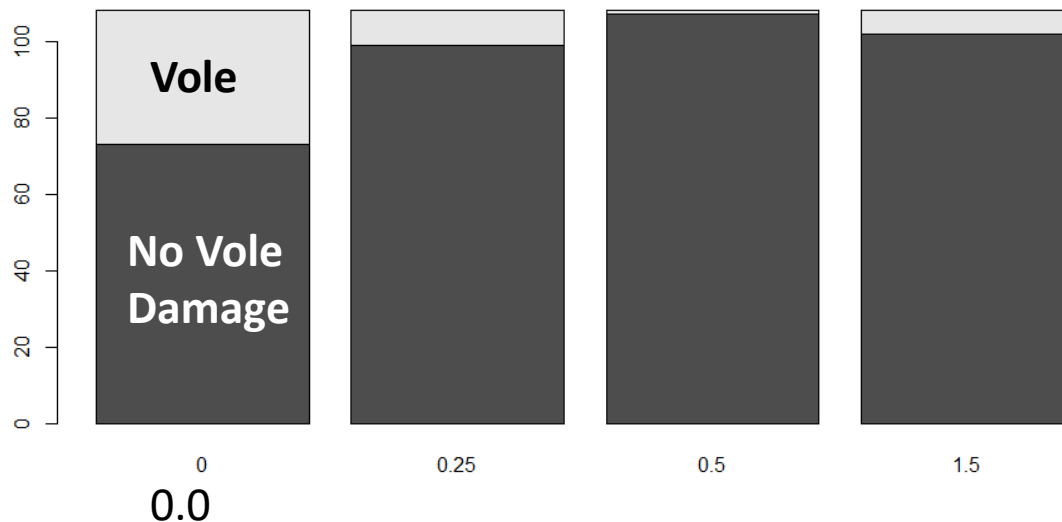
South, 0.0 m

- Soil moisture is higher at the 0.0 meter mark, even on the south side of the log!
- Ponderosa responded well to this
 - DF did not...

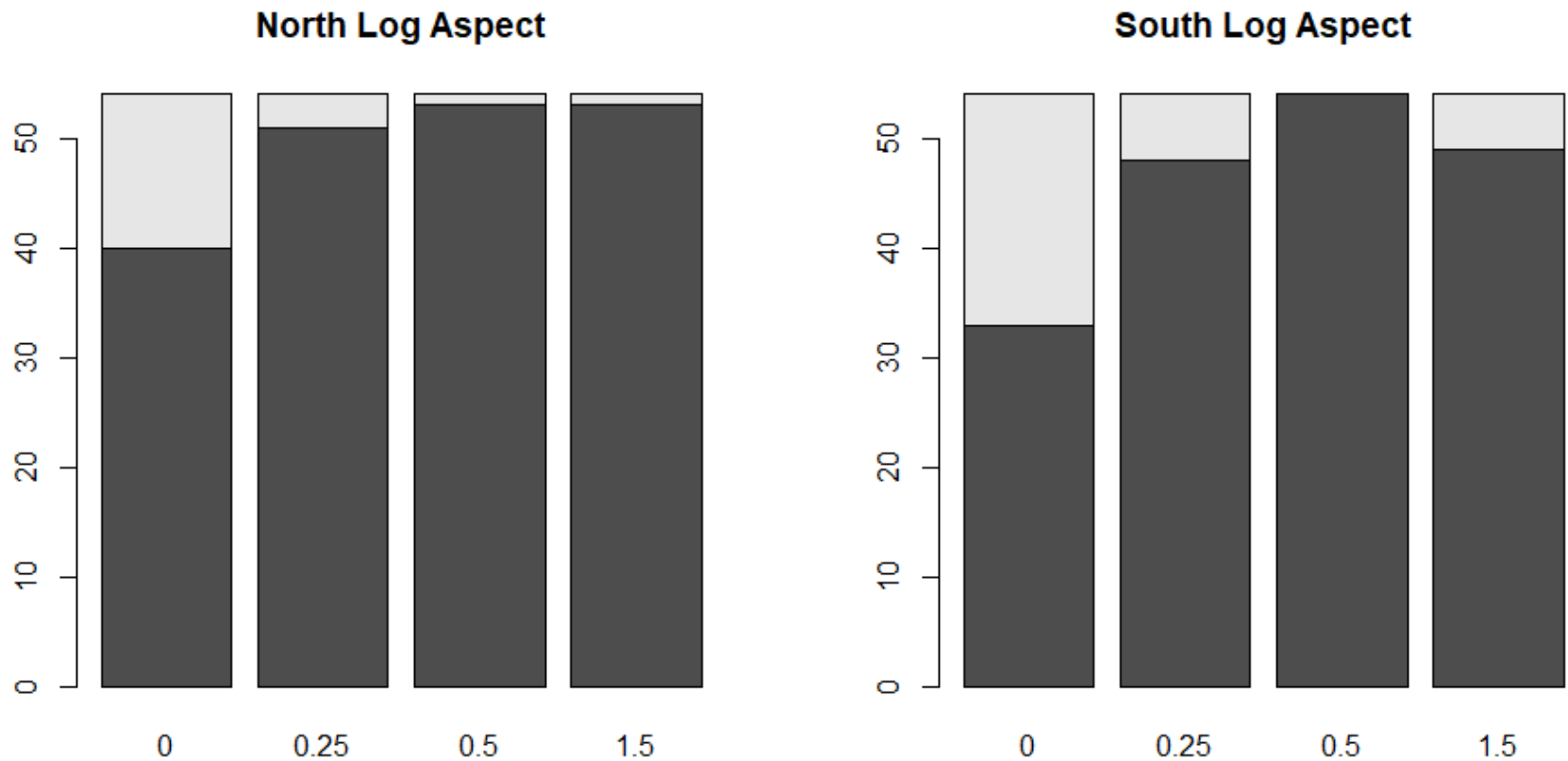


Vole damage strongly associated with woody debris

- Mid-summer increase in this source of mortality
- A feedback that operates in the best microsite- next to log!



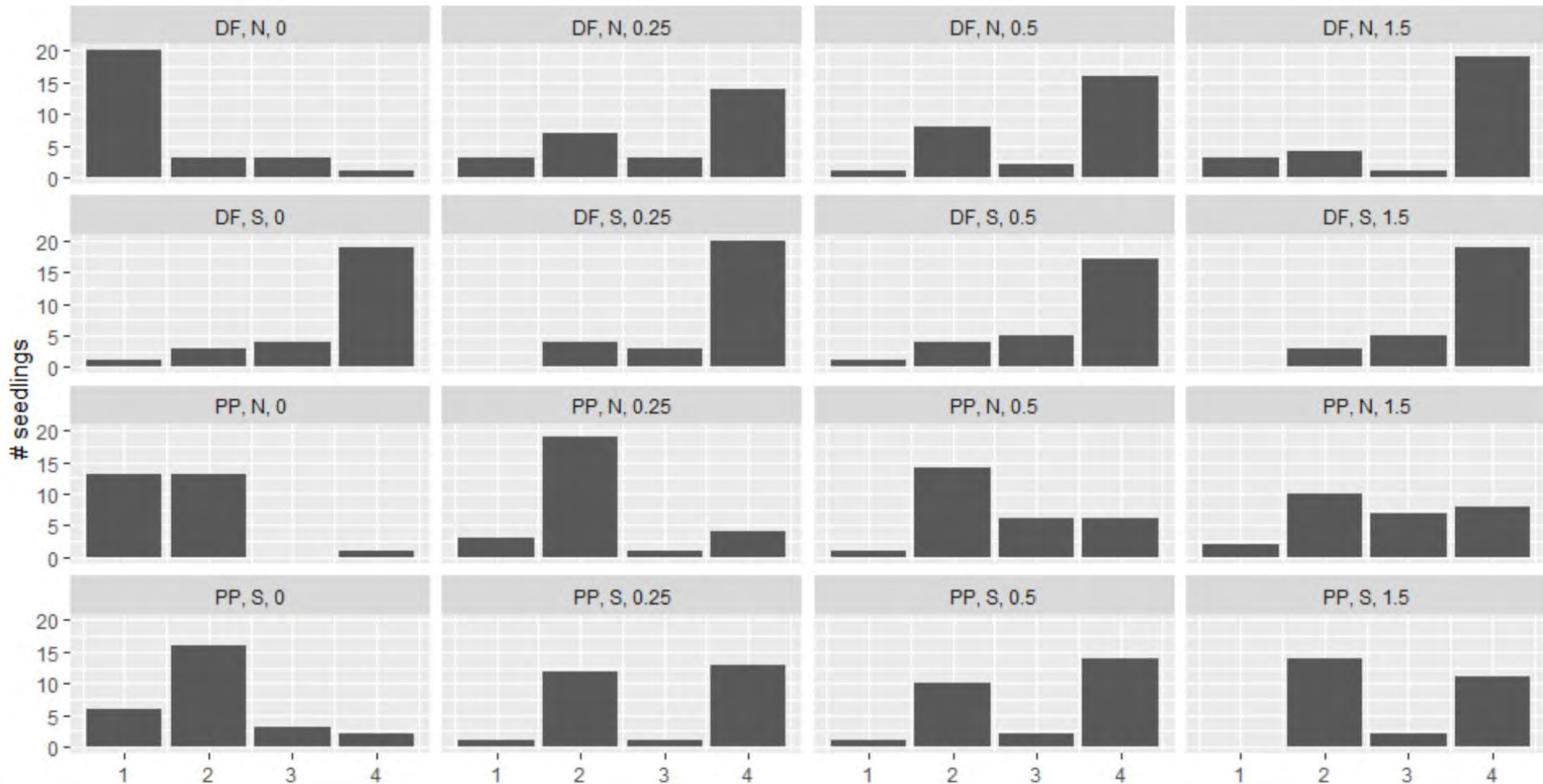
Vole damage did not vary by side of log... concentrated at 0.0 m



NOTE: these data from across all three topographic aspects

August 3rd, 2021

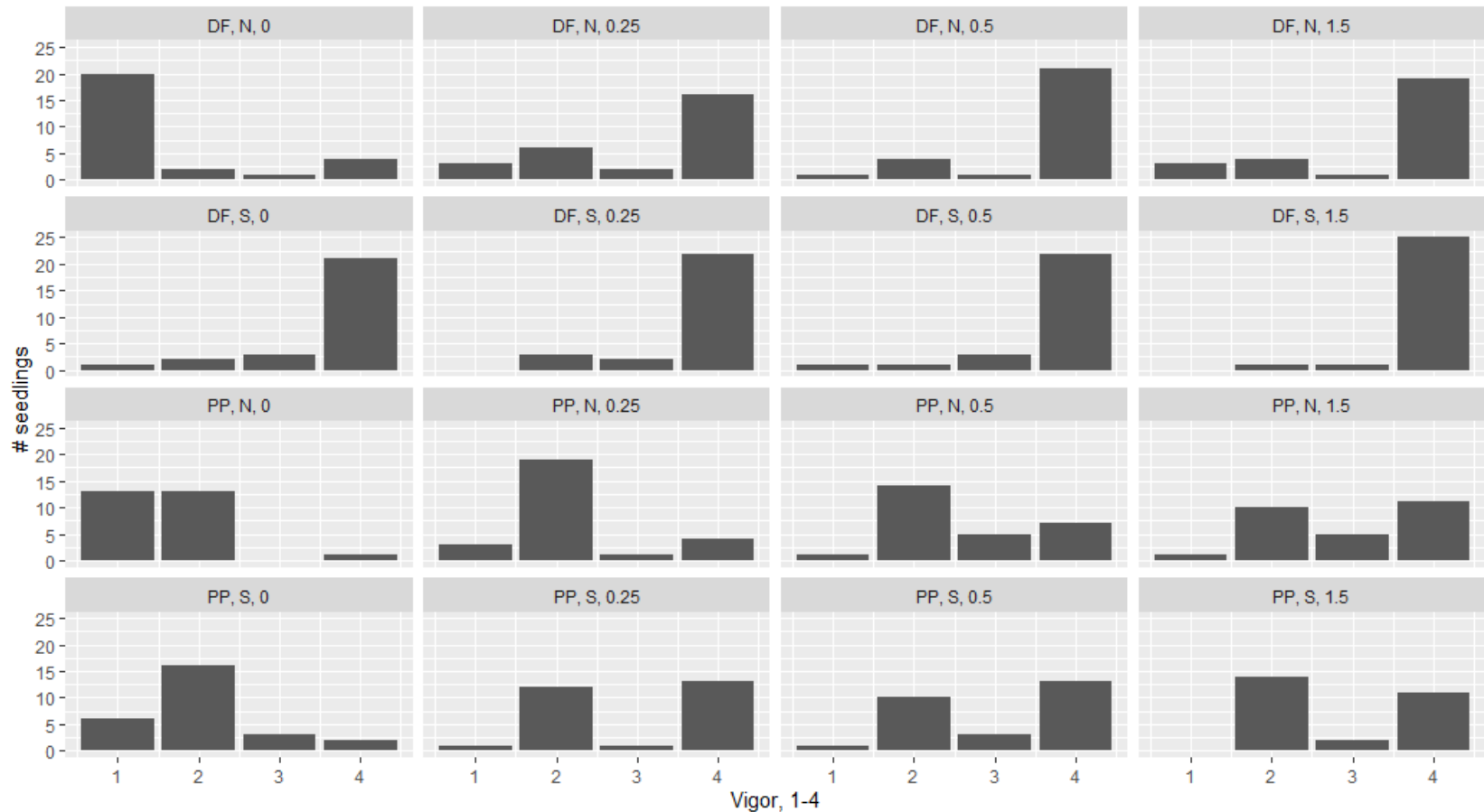
Mortality 42.6% * Includes some vole damage



NOTE: these data from across all three topographic aspects

September 9th, 2021

Mortality 51.2% * Includes some vole damage

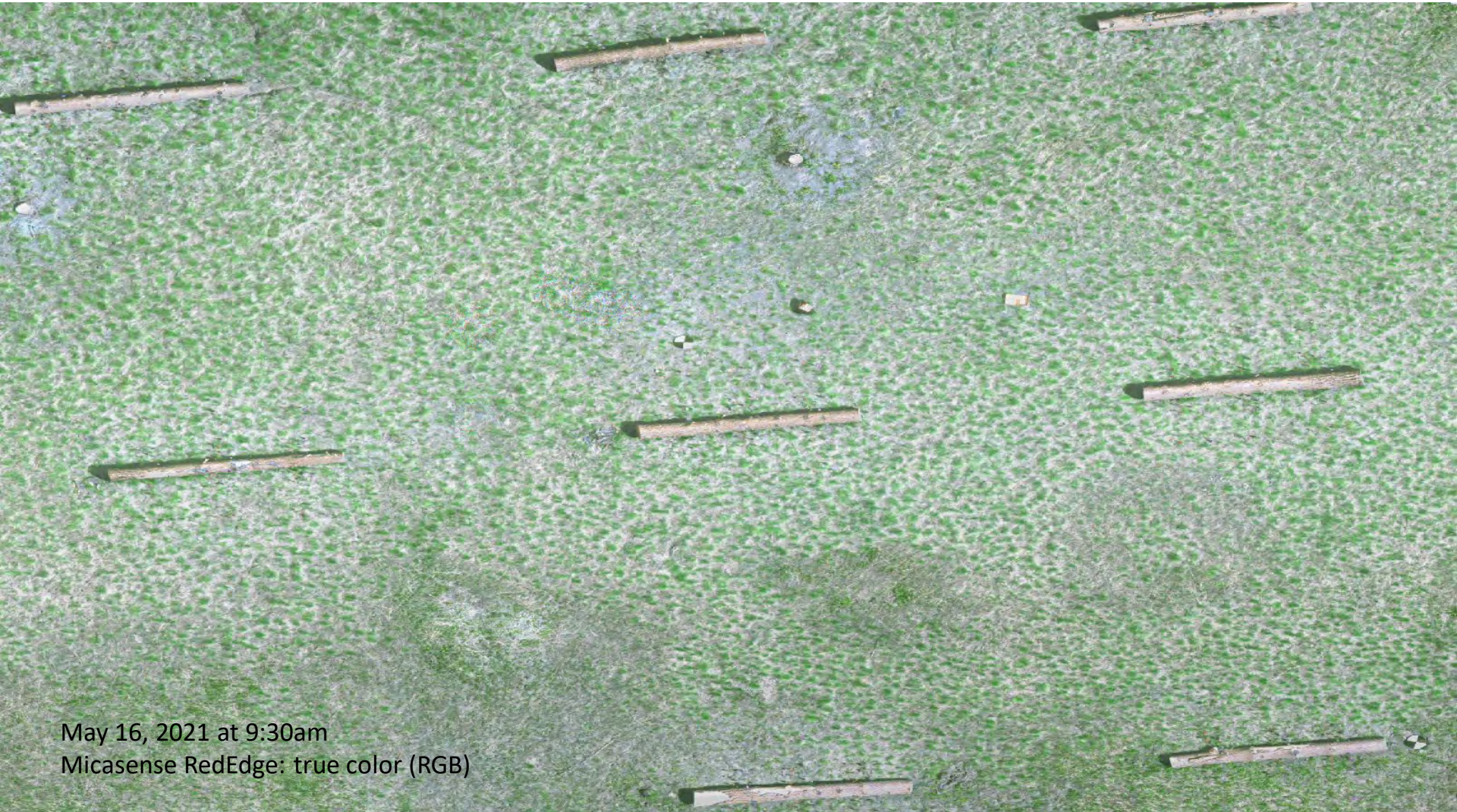


September, 2021

- End of growing season
- One no longer needed a chlorophyll fluorescence meter to detect differences in vigor!
- Some stems “recovered” from V3 to V2
- Strong differences between N-0.0 and all other locations for both species
 - Especially DF

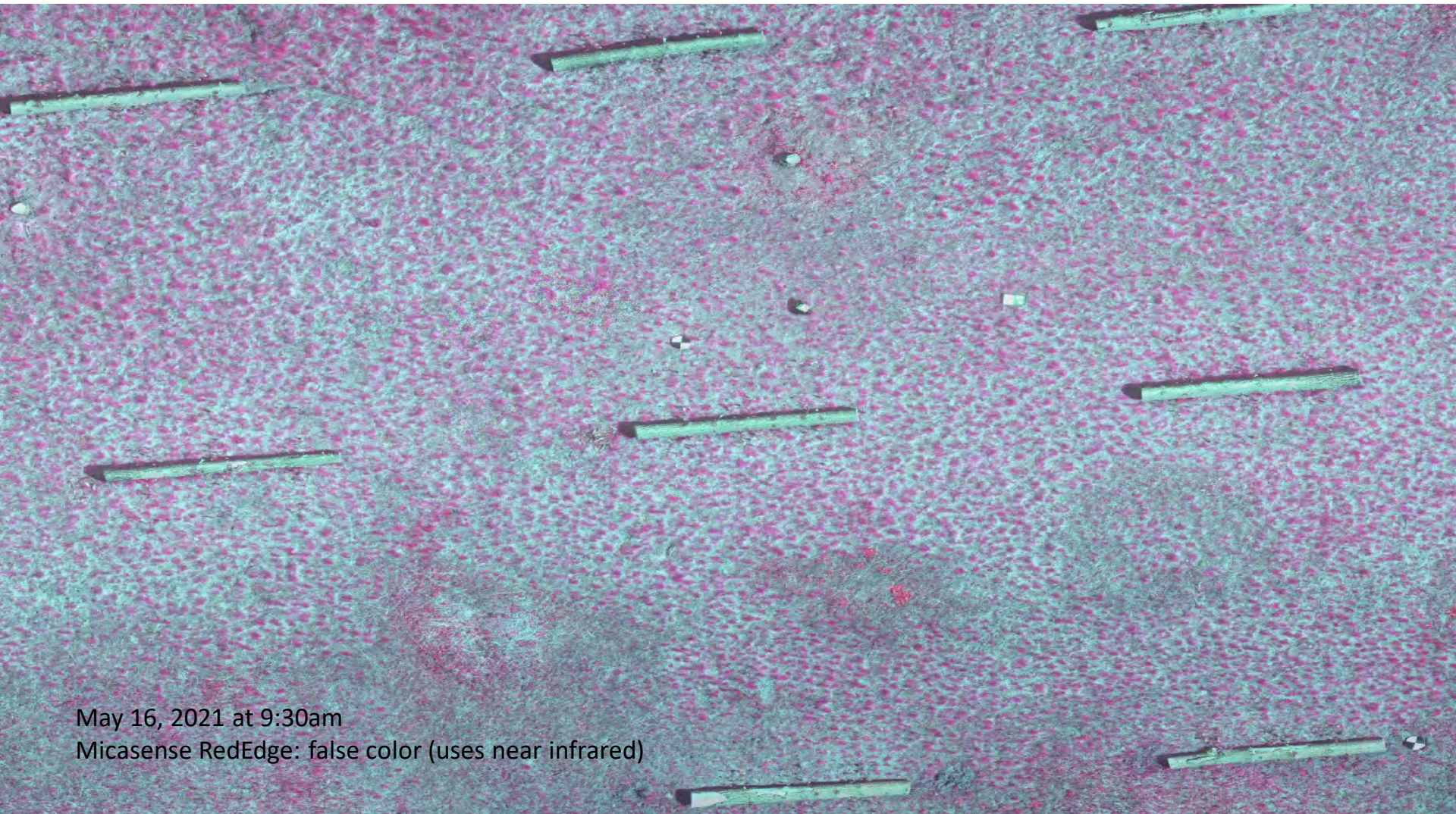


Ongoing work: remote sensing with drones



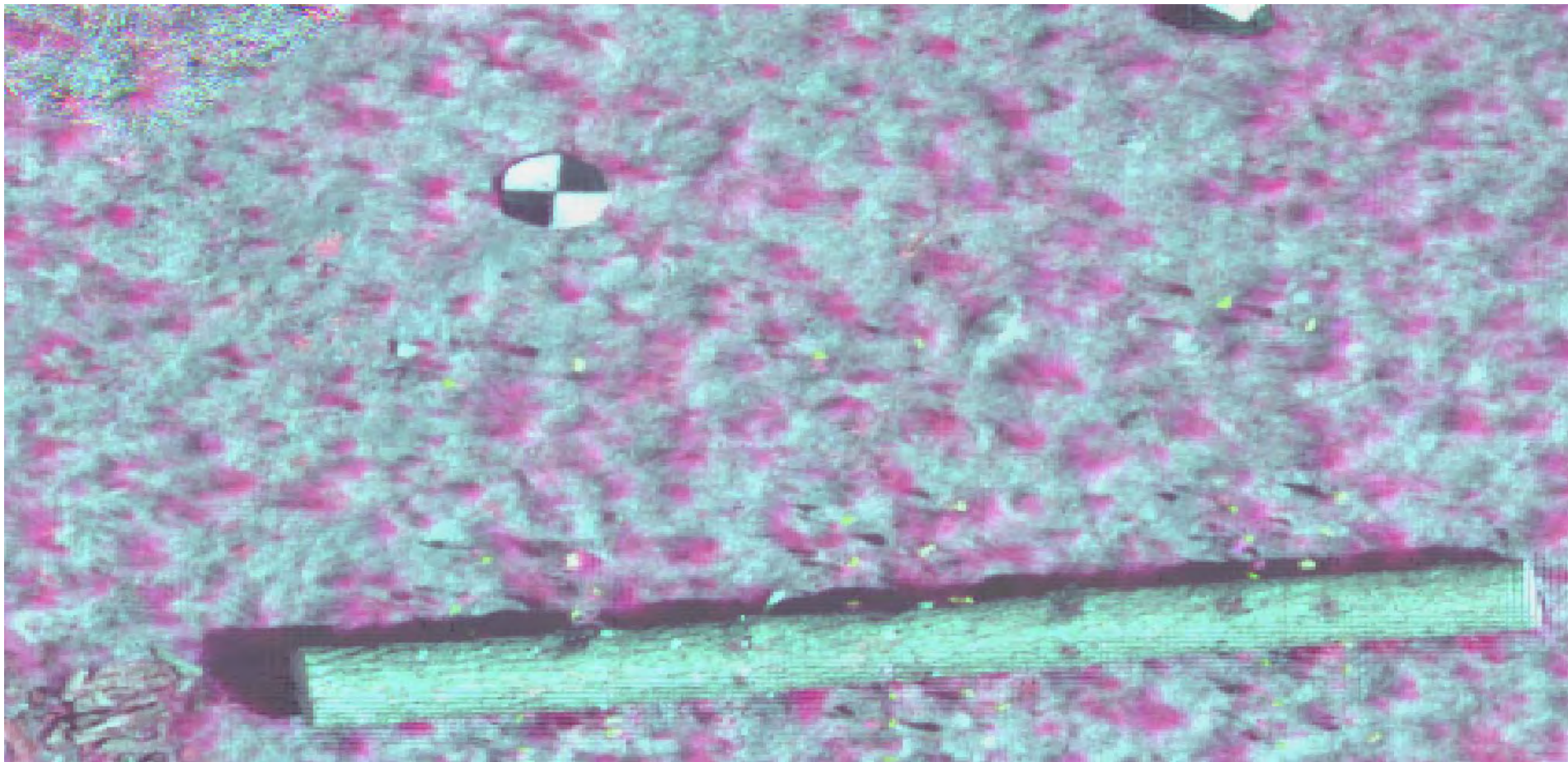
May 16, 2021 at 9:30am

Micasense RedEdge: true color (RGB)

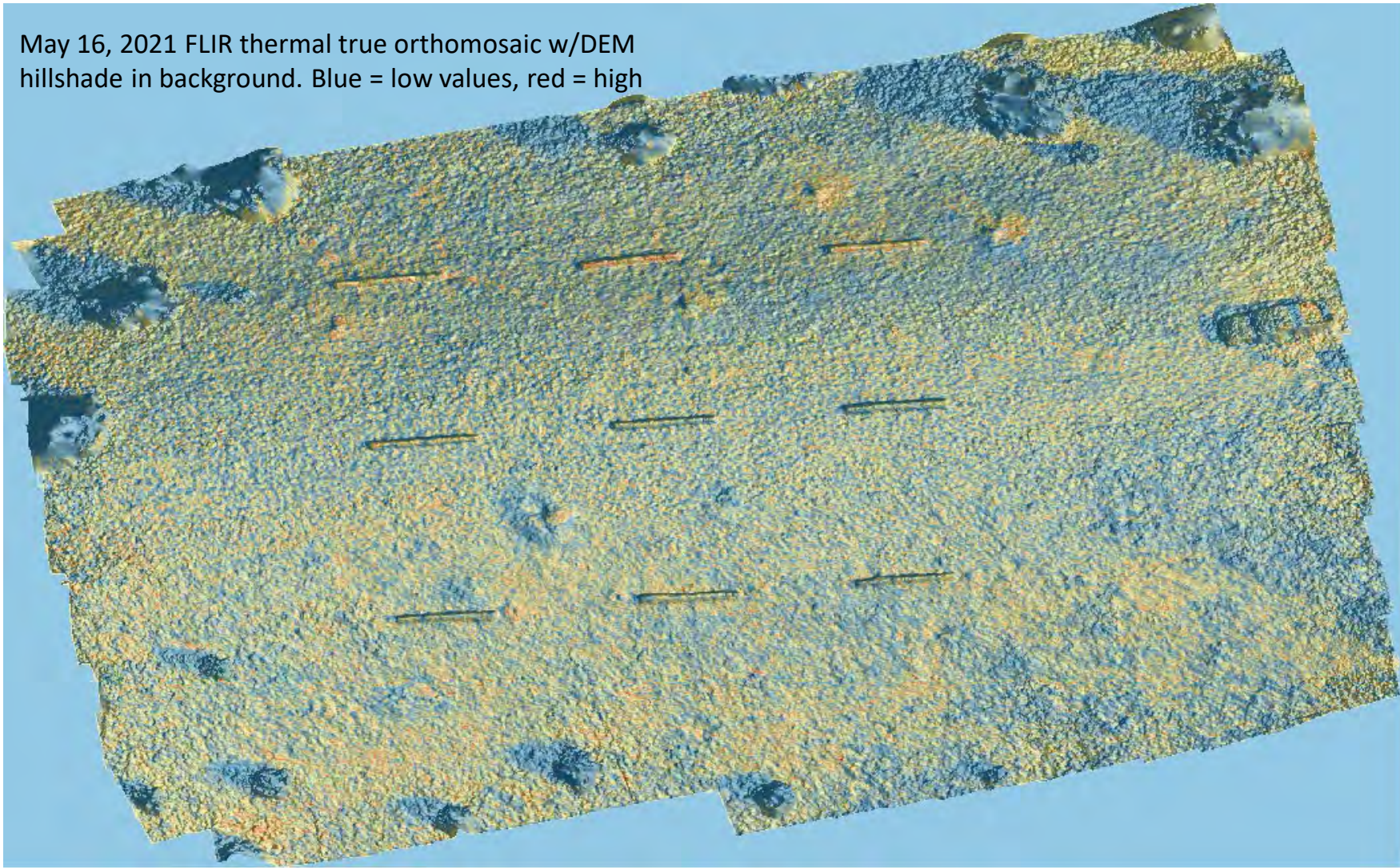


May 16, 2021 at 9:30am
Micasense RedEdge: false color (uses near infrared)

May 16, 2021 at 9:30am-Micasense RedEdge—here is where it starts to get grainy



May 16, 2021 FLIR thermal true orthomosaic w/DEM
hillshade in background. Blue = low values, red = high




Practical application

The microsite effect is:

- Species-specific
 - PP benefits from both the immediate north side of a log AND the higher soil moisture zone at S-0.0
 - Good survival of DF limited to “shade zone”, N-0 and N-0.25
- Somewhat conditioned by topographic aspect
- Moderated by vole girdling damage!
- Seemingly unaffected by greater competition from forbs close to log

Questions

- How persistent is the beneficial effect?
 - ... for Douglas-fir, in particular
- Is the “seedling filter” the true limit?
 - Daubenmire 1968
 - If so, then log microsite may be part of climate solution
- Silviculture
 - Retention of woody debris (cull)
 - Questions of log diameter
 - Deliberate placement?
 - How different from shade cards?

A black dog with white paws is lying on a large, weathered log in a grassy field. The dog is wearing a blue collar. The log is surrounded by several small, young trees, each marked with a pink flag. The background shows a rolling landscape with a fence and hills under a clear sky.

Even dogs recognize
microsite advantages...

THANK YOU!
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Height growth patterns of 1st growing season survivors

