# Progress Report

# Leaf Area Index Estimates to Inform Midrotation Treatments

Modified from "A Neural Network Approach to Generating Leaf Area Index Estimates Using the Sentinel-2 Satellite Record"
CAFS.12.87

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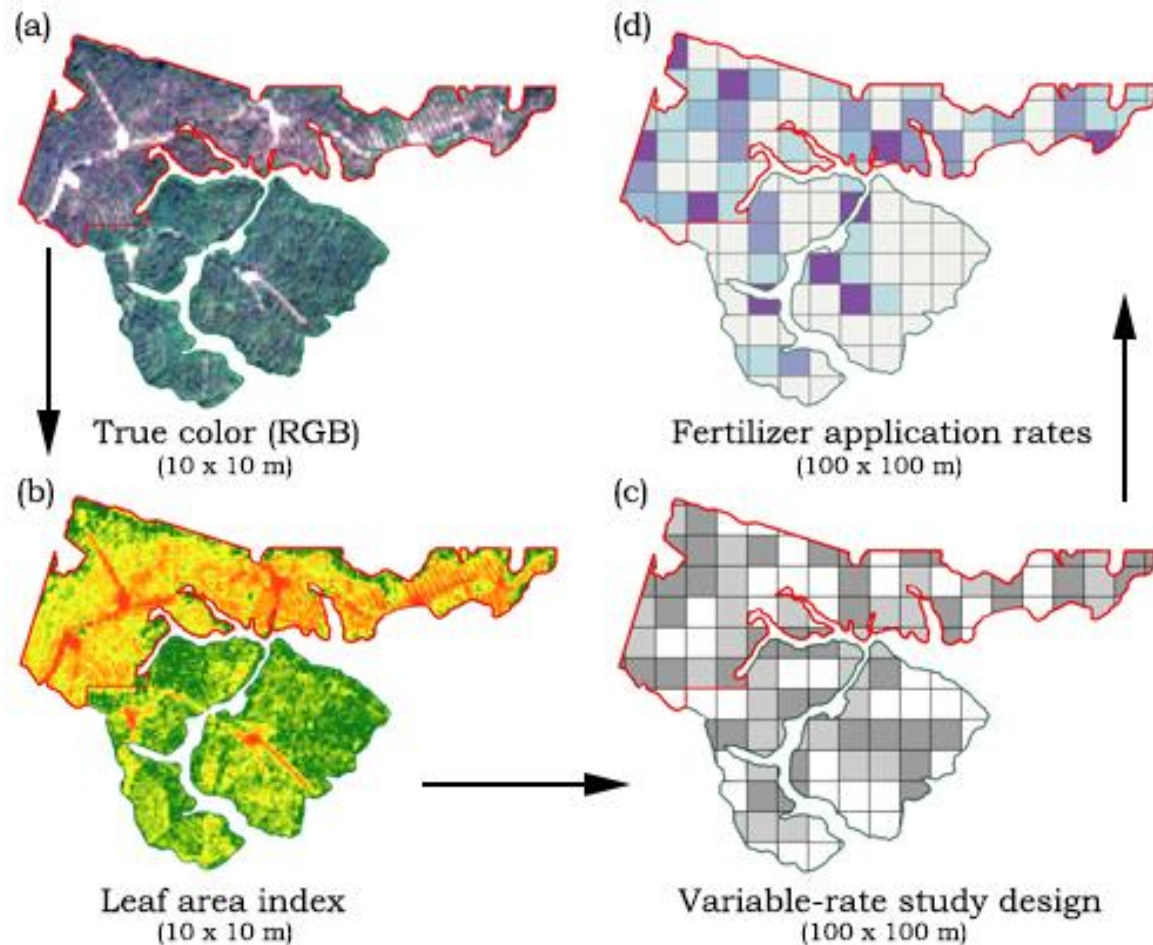
Andrew Trlica (NCSU) presenting

| LAI | N Rate lb/ac |
|---|---|
| >3.5 | 0 |
| 3.0-3.5 | 100 |
| 2.5-3.0 | 150 |
| 2.0-2.5 | 200 |
| 1.5-2.0 | 250 |
| 1.0-1.5 | 300 |

- ## Variable fertilizer rate trials
  - NC and TX installations
  - N+P rates according to sub-stand LAI (Sentinel-2)
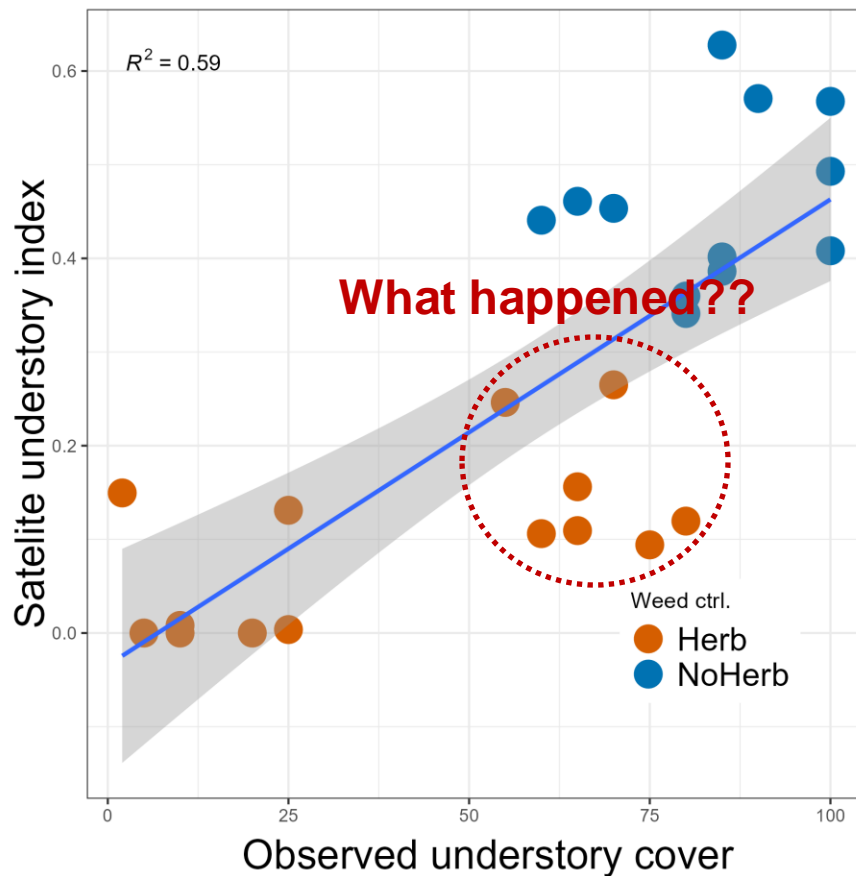
- ## Midrotation Thinning + Herbicide Release



(a) True color (RGB) (10 x 10 m)

(b) Leaf area index (10 x 10 m)

(c) Variable-rate study design (100 x 100 m)

(d) Fertilizer application rates (100 x 100 m)

**OBJECTIVES:**
- Use LAI model to develop potential productivity and response maps in conjunction with soils and climate data
- Apply LAI tools to Midrotation silvicultural decisions
    - Test/refine tools for ongoing remote stand monitoring
- Assess operational level response to herbicide and/or variable rate fertilization
- **Use canopy LAI to make Fertilizer Rate decisions (vs Random rate)**
- **Assess response in canopy LAI due to changes in understory LAI**
- Use repeat LiDAR flights (and ground truth data) to assess individual tree height and volume response to treatments

Satelite understory index (y-axis) vs Observed understory cover (x-axis)

$R^2 = 0.59$

**What happened??**
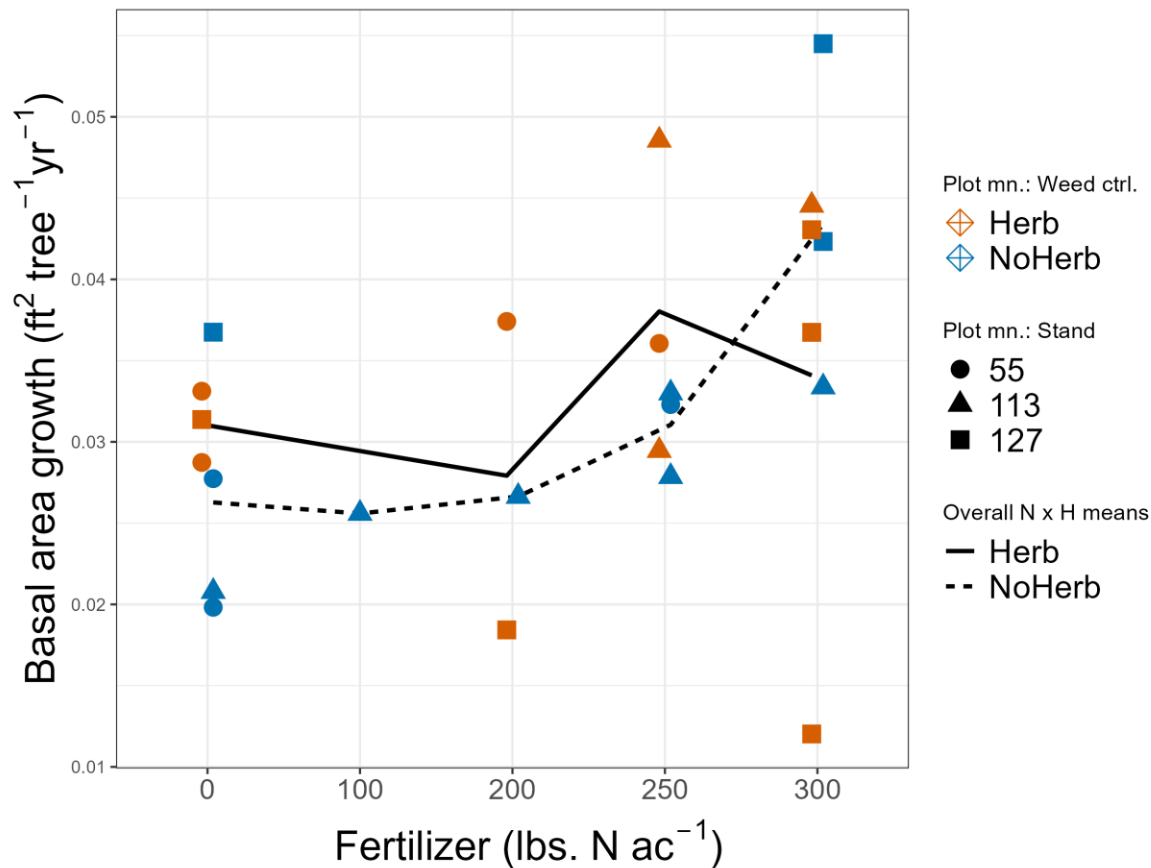
Weed ctrl.
- Herb
- NoHerb

DECIDUOUS UNDERSTORY
- Some success in detecting/calibrating Understory
- Reasonable detection of herbicide release
- … But needs further work

(NC Results)
- Field measurements + time series of Sentinel-2 LAI and Understory metrics Summer 2023
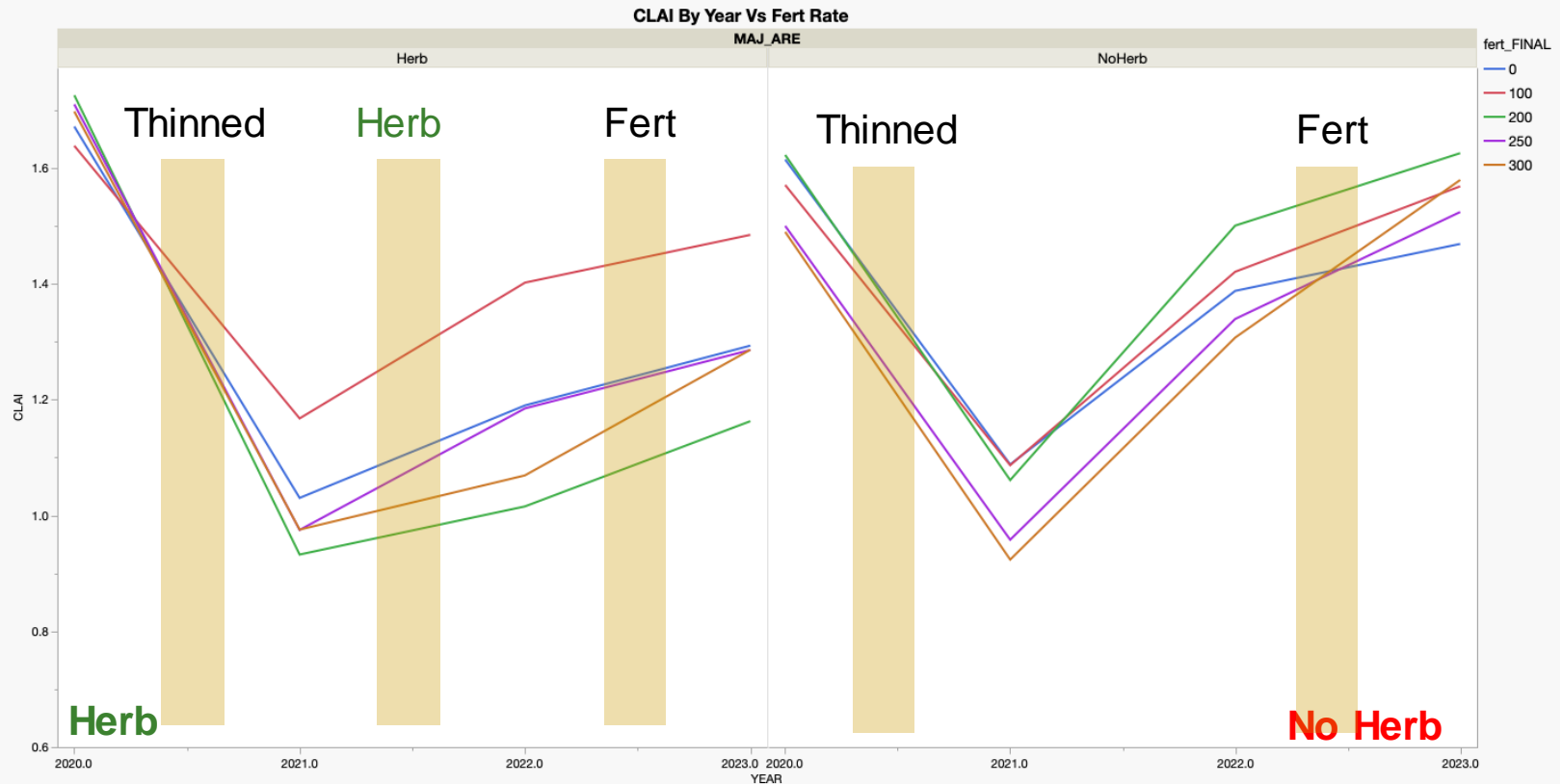
- Some fertilizer response signal is emerging
- …But noisy

(NC Results)
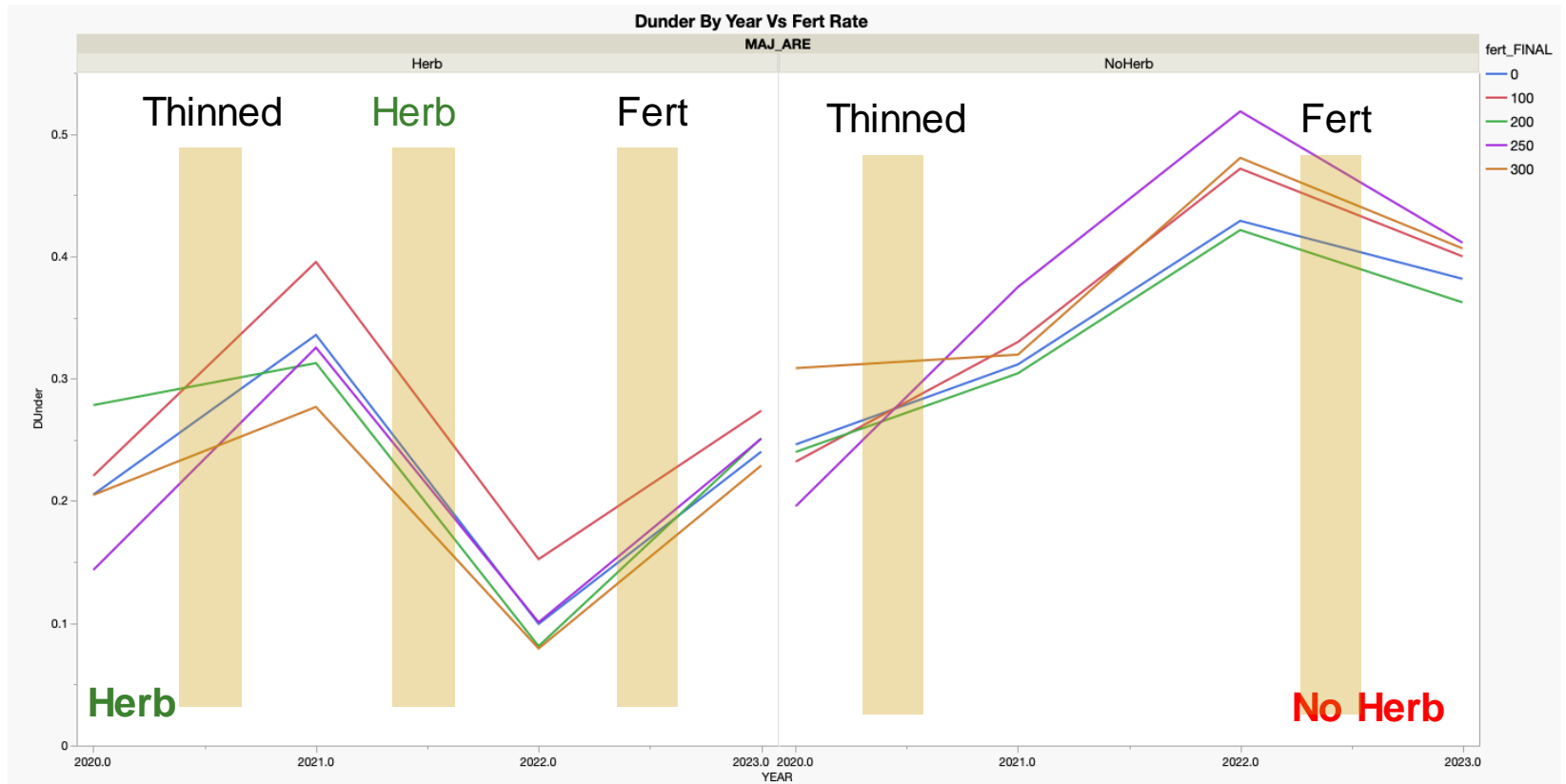- Field measurements + time series of Sentinel-2 LAI and Understory metrics Summer 2023

- Clearly detecting the Thin on reducing LAI
- Possible slower recovery in the Herbicide treatments?

## DECIDUOUS UNDERSTORY



- Clear detection of Herbicide impact on Understory
- … But quick recovery, high year-to-year variability

- Complete analysis of effects of Fertilizer Rate, prescription style (LAI vs. random), Herbicide
  - Reponses in Volume, Basal Area, Height, and LAI
- Include LAI in fertilizer response modeling with soil data
- UAV/Aerial LiDAR
  - + further refinement of the Sentinel-2 understory method