



## Technology to Monitor Crop Health

Edmonton, AB | February 26, 2020



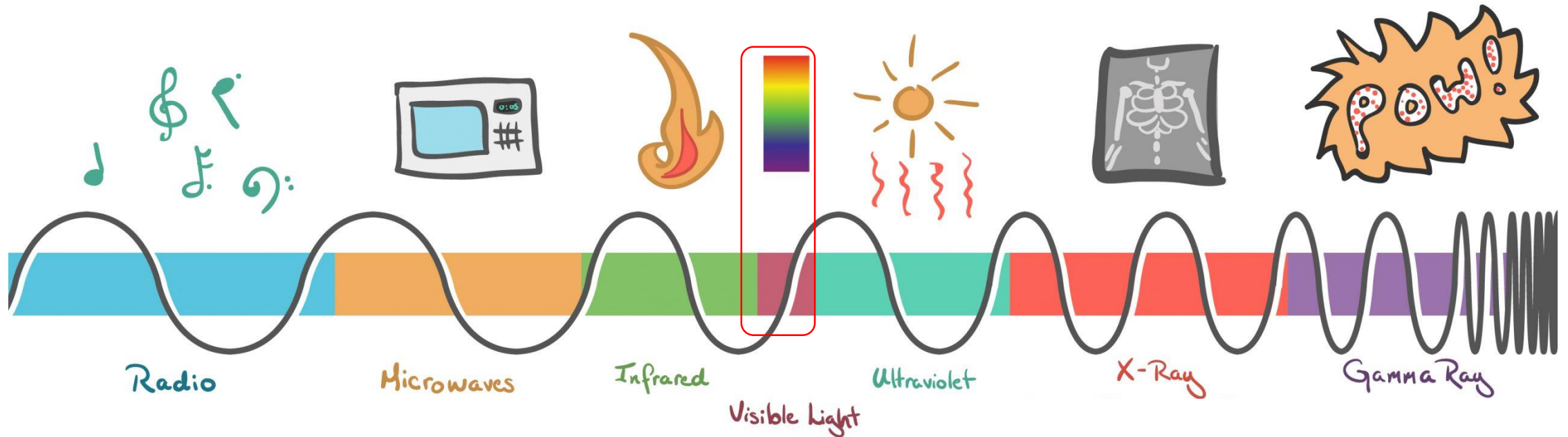
# Key Points

**1**

Principles behind the technology are simple

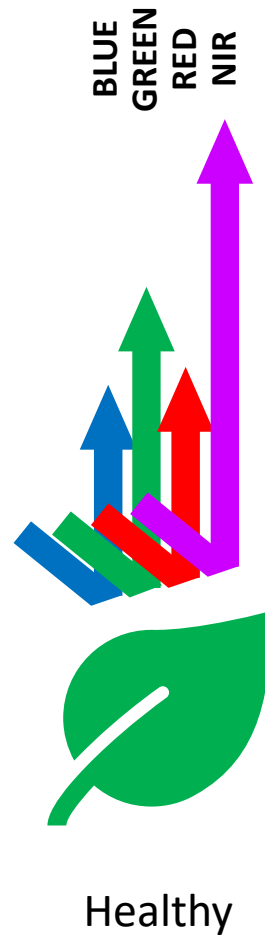
# Physics!

## The Electromagnetic Spectrum



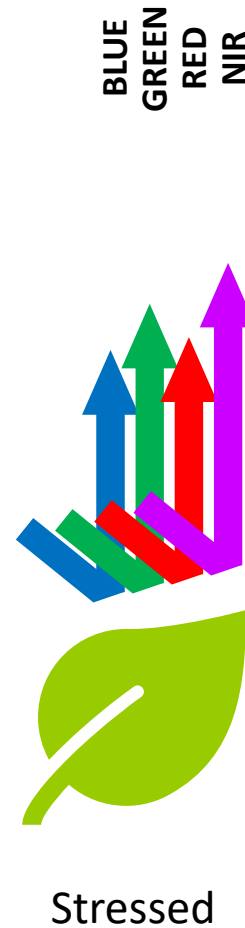
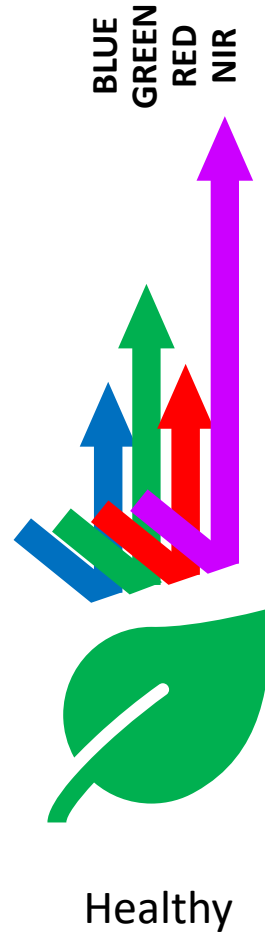


# Healthy Leaves



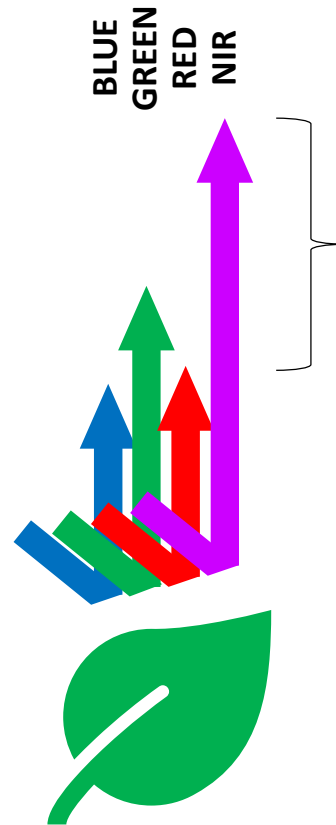


# Stressed Leaves

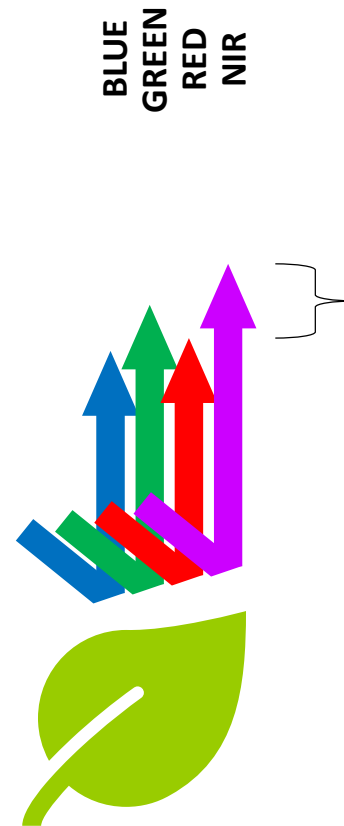




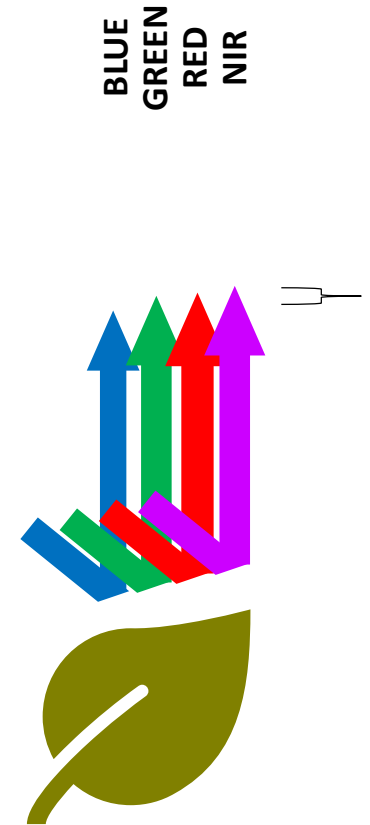
# Dead Leaves



Healthy

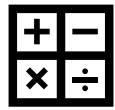


Stressed



Dead

# Math!



$$NDVI = \frac{(NIR - RED)}{(NIR + RED)}$$



Index: Range from -1 to +1  
Mostly 0-1



Over 100 indices have been developed  
Their usefulness depends on the application







# Remotely Piloted Aircraft Systems





# Key Points

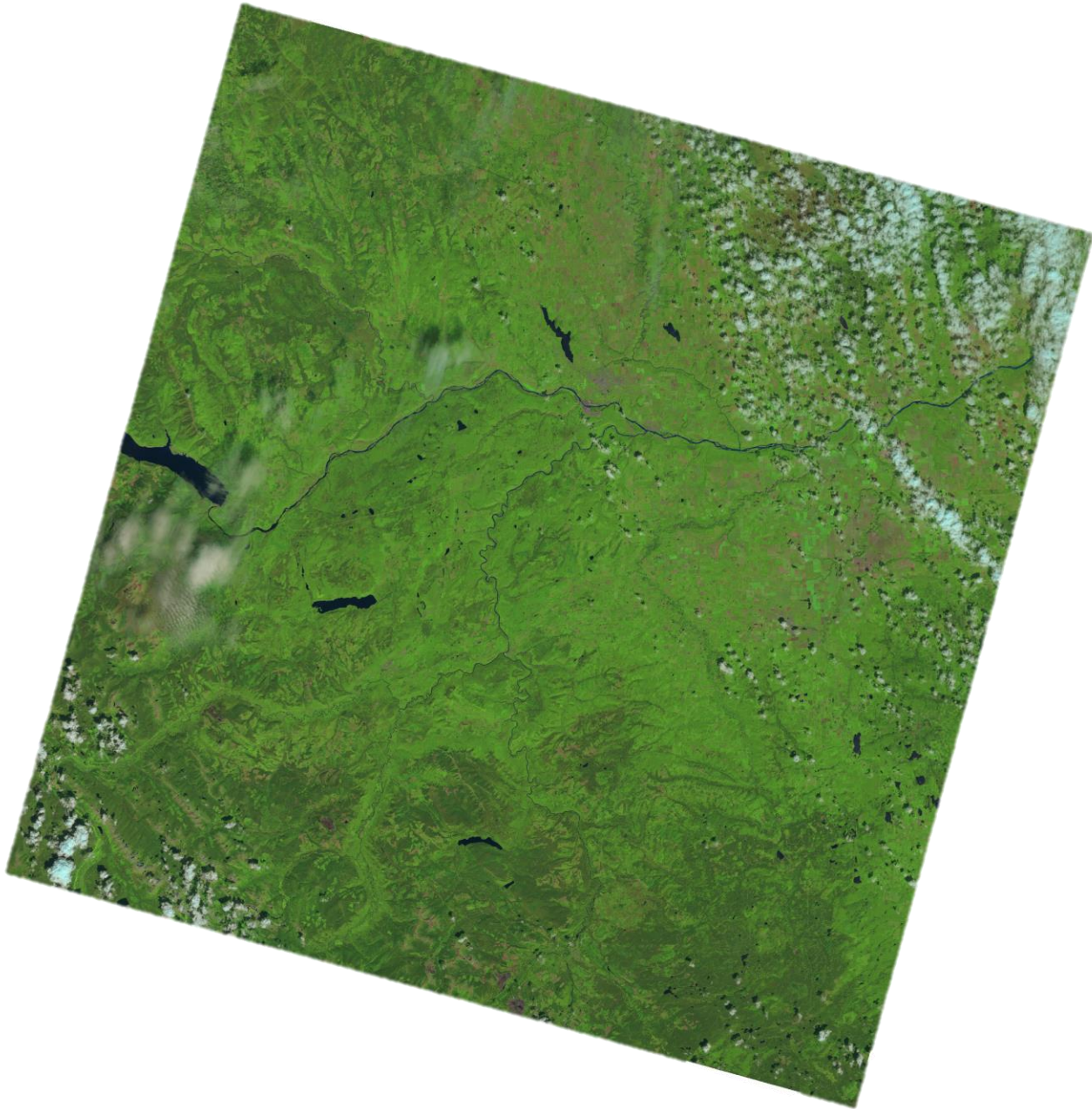
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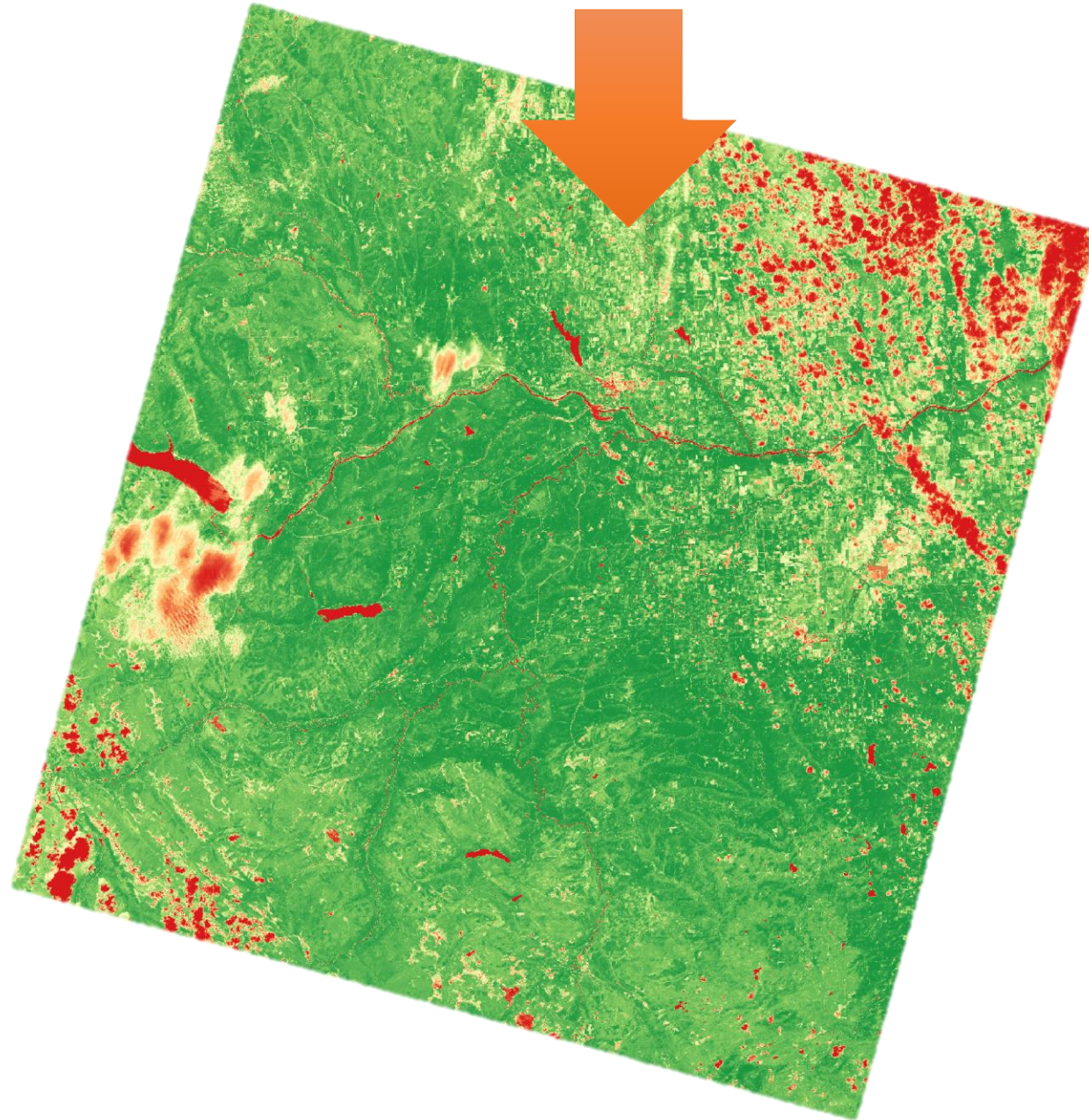
2

Remote sensing is really good at identifying patterns

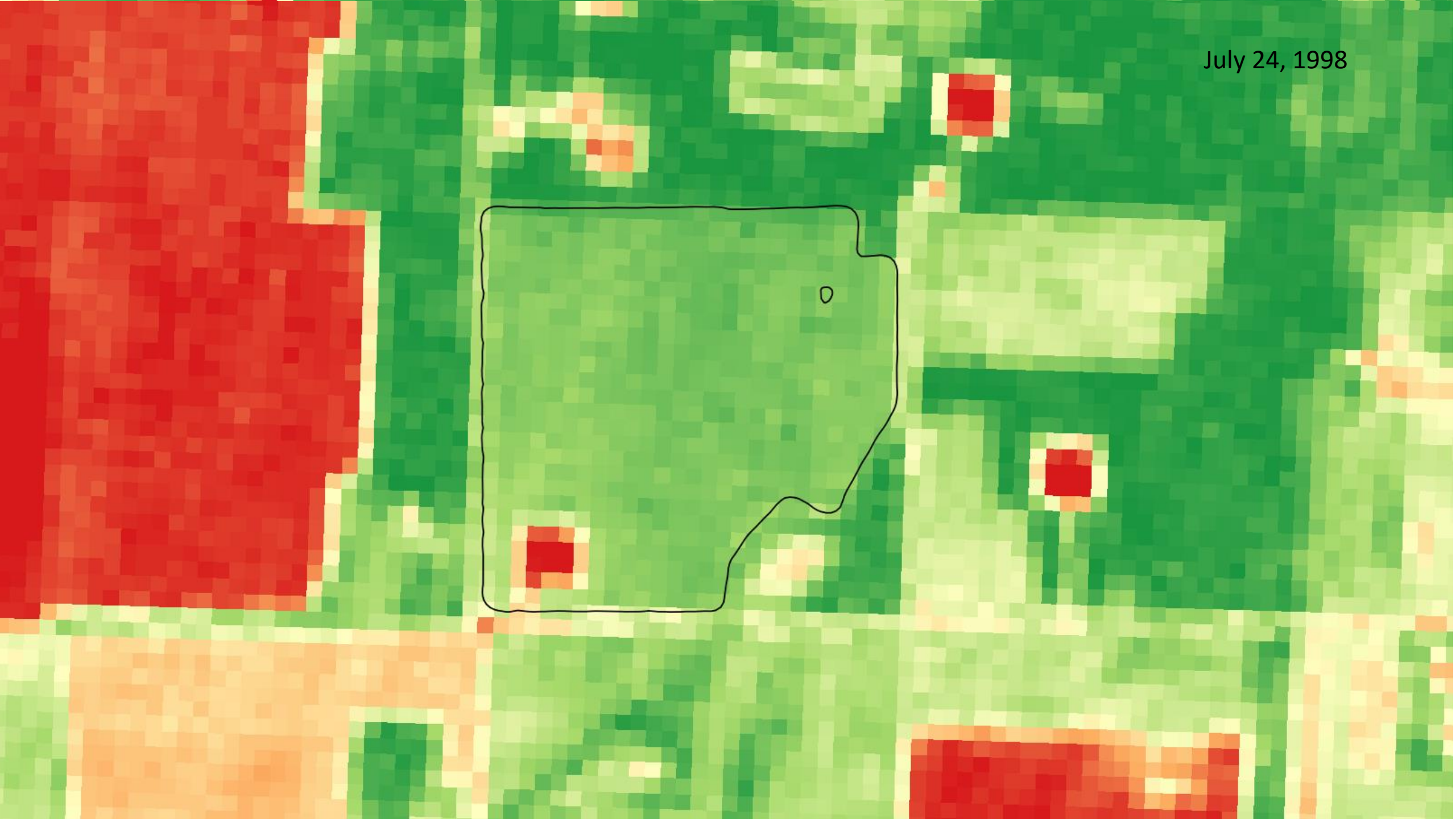
RGB



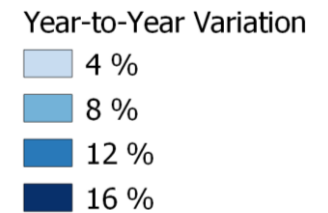
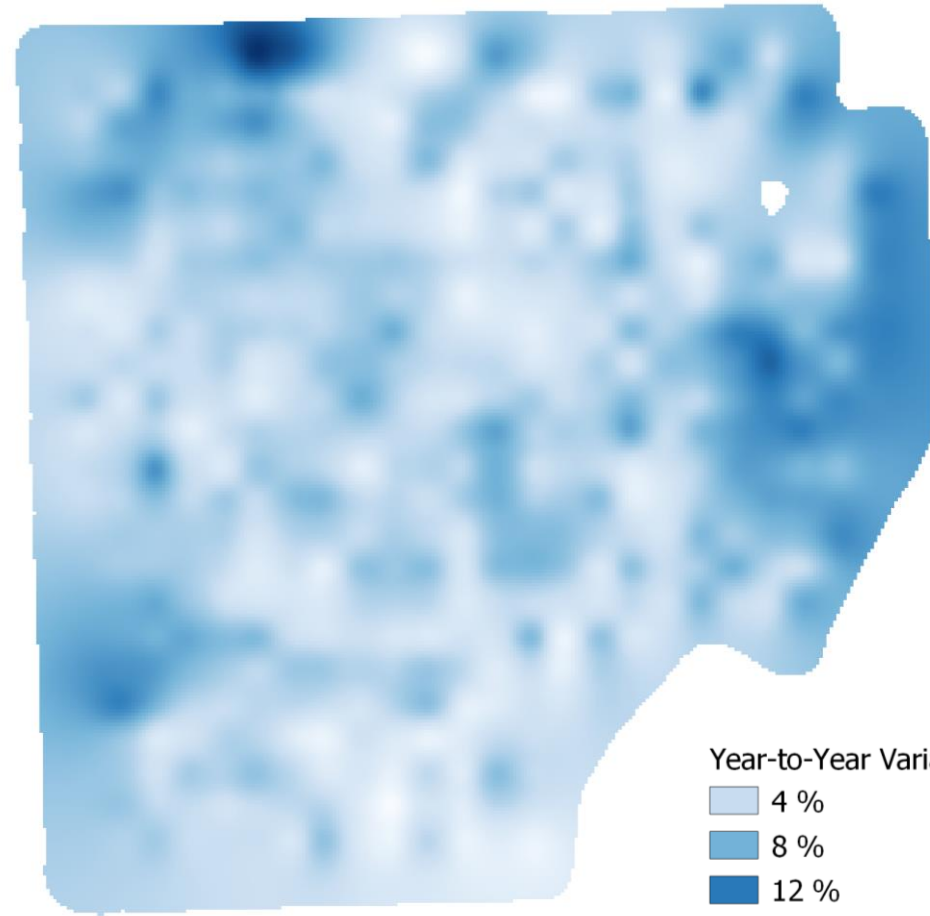
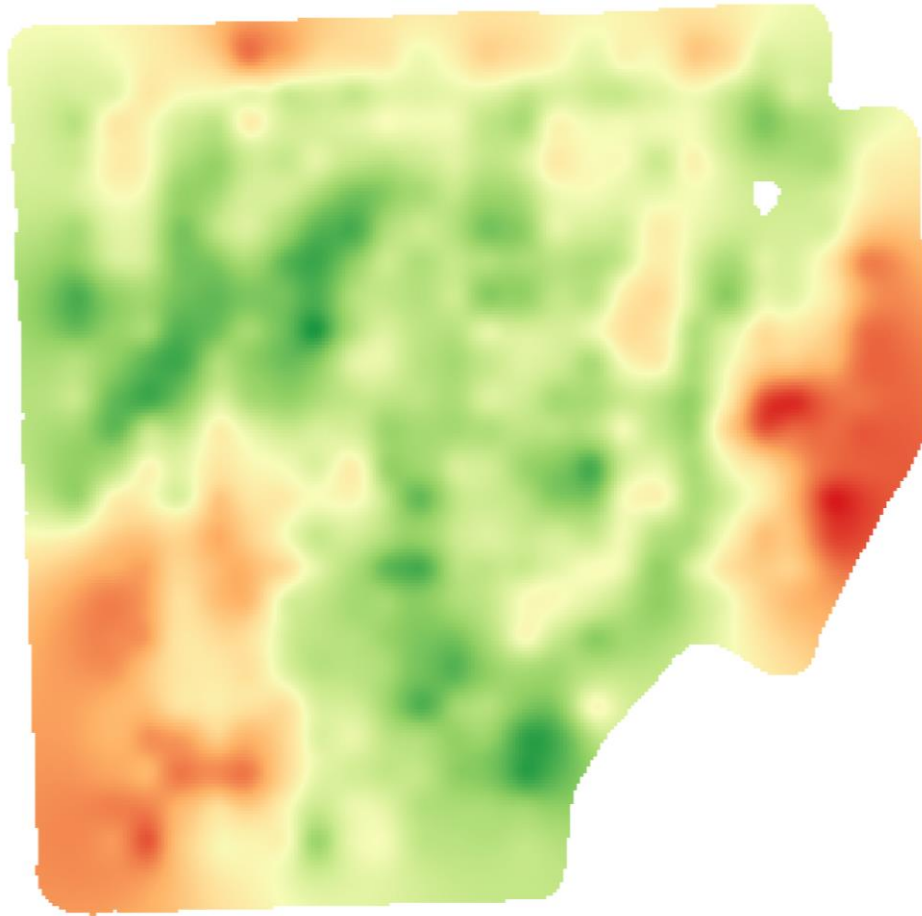
# NDVI



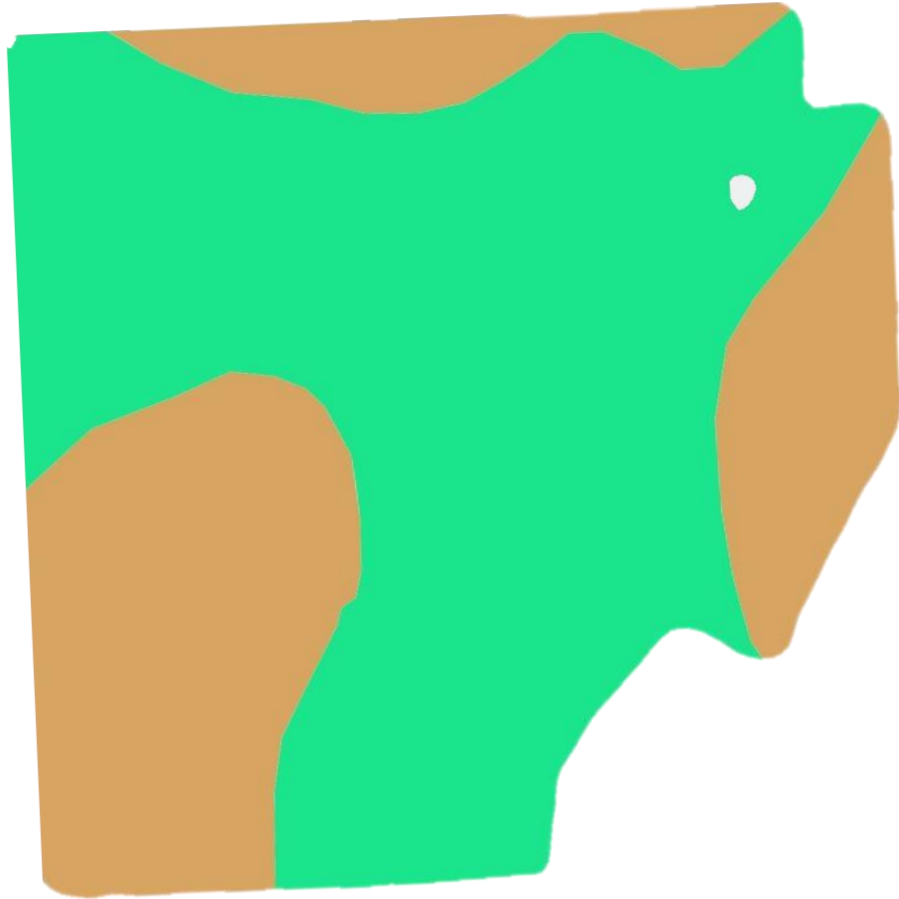
July 24, 1998



# Determining Limiting Factors



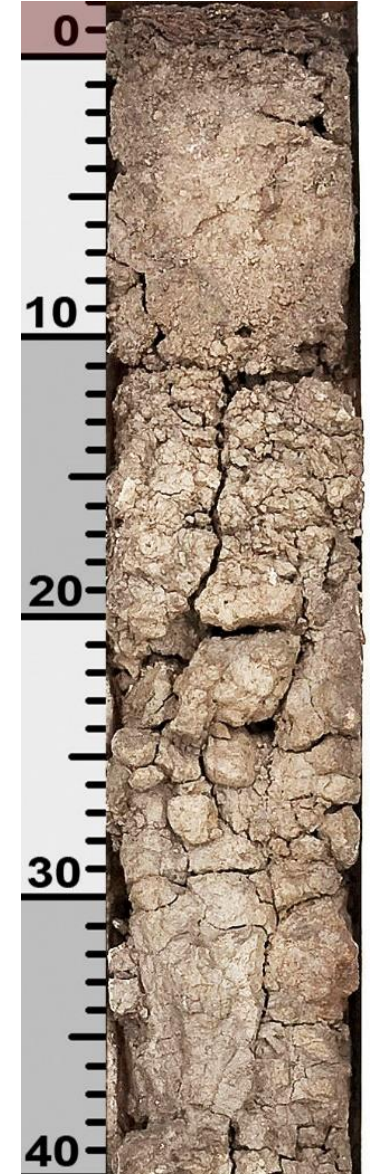
# Soil Factors



Black Solod

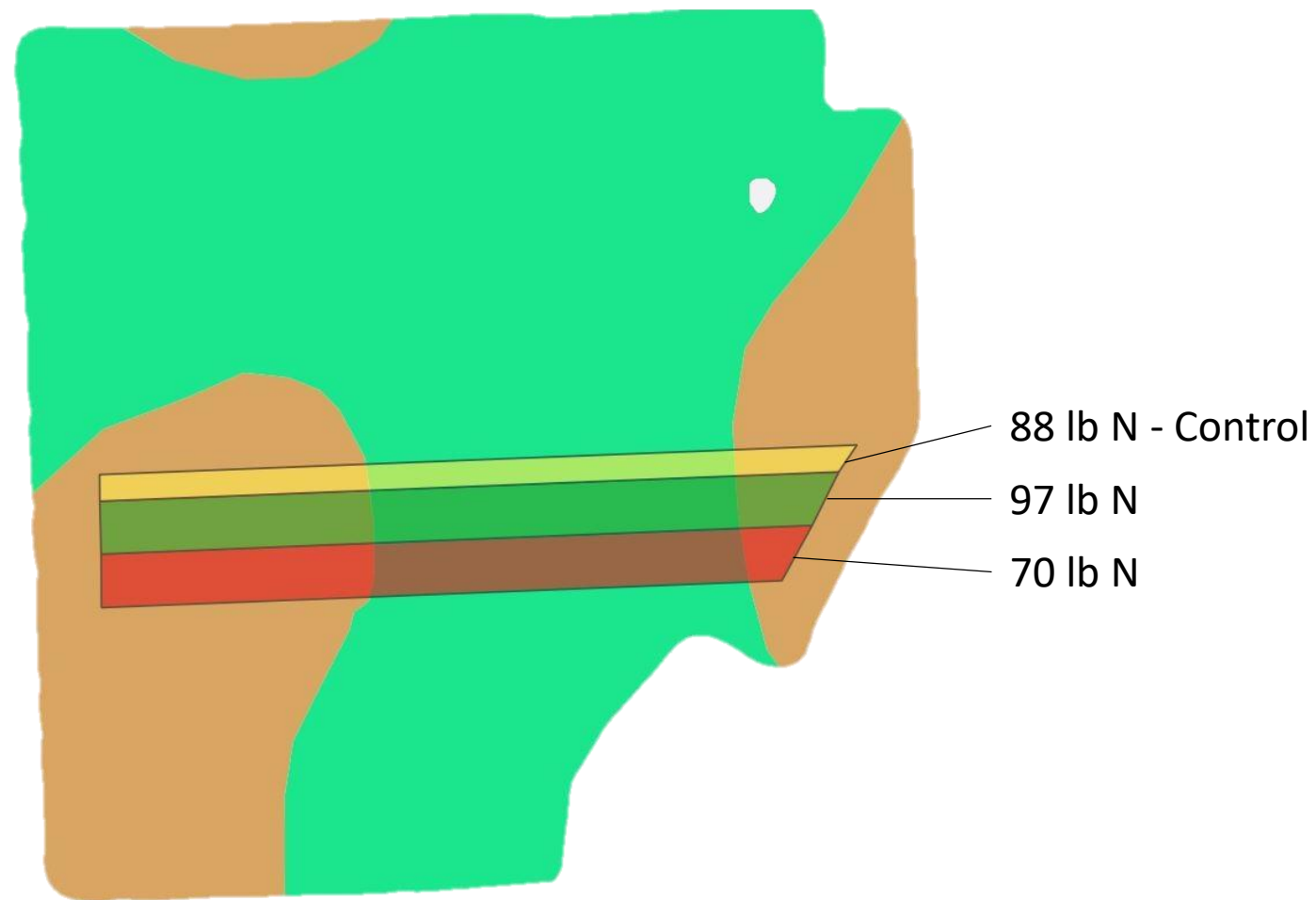


Solonetzic  
Gray Luvisol

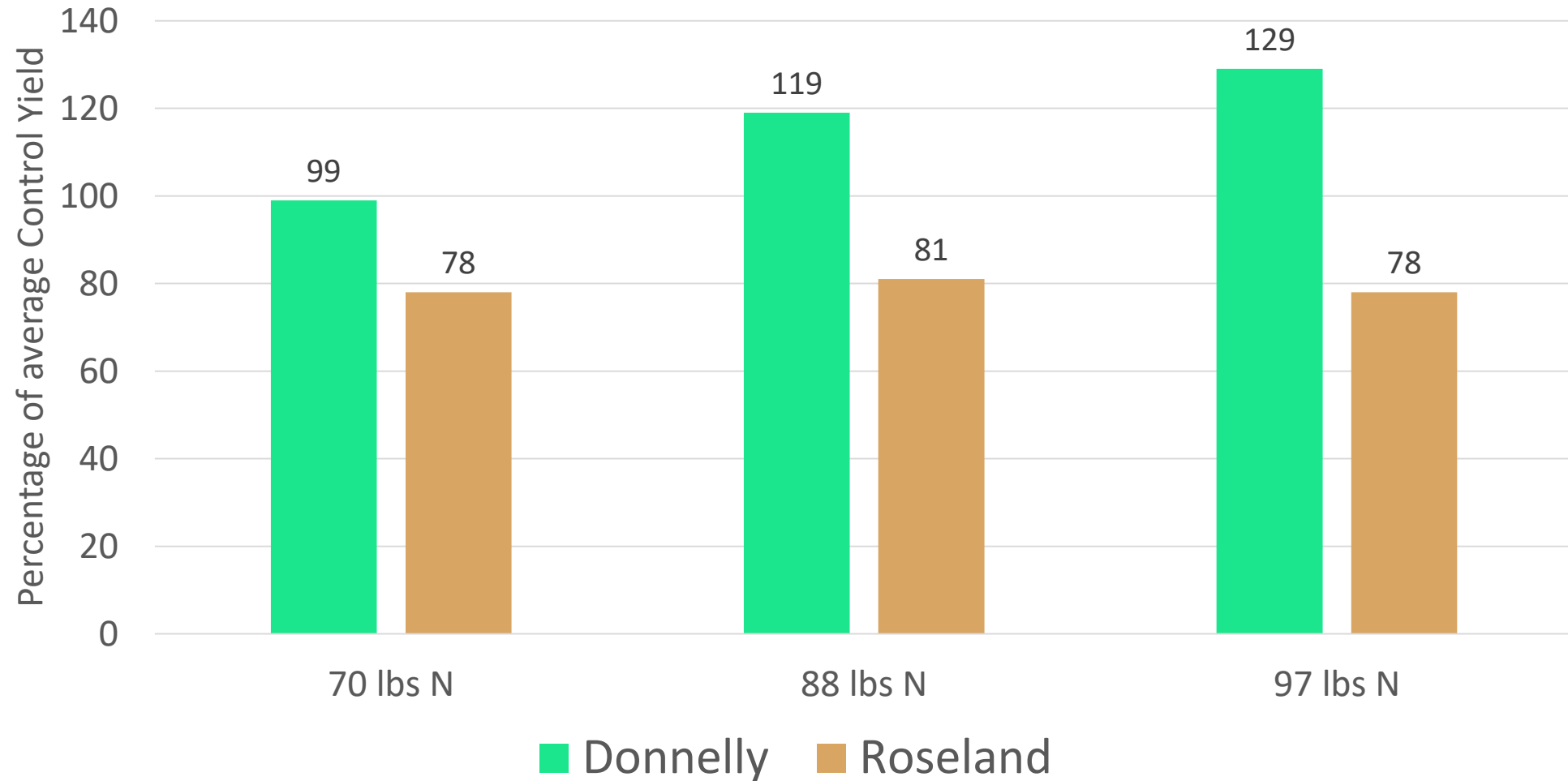




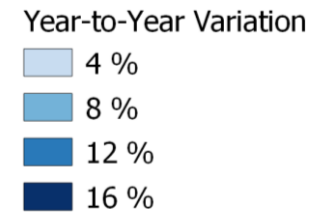
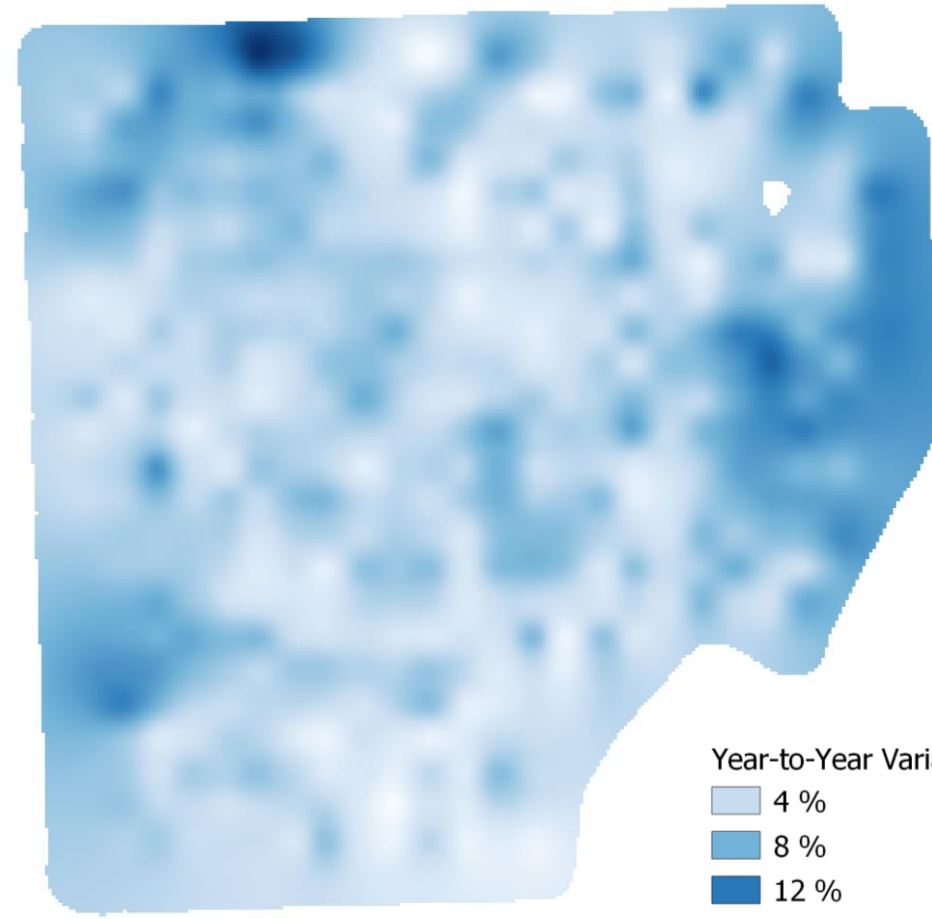
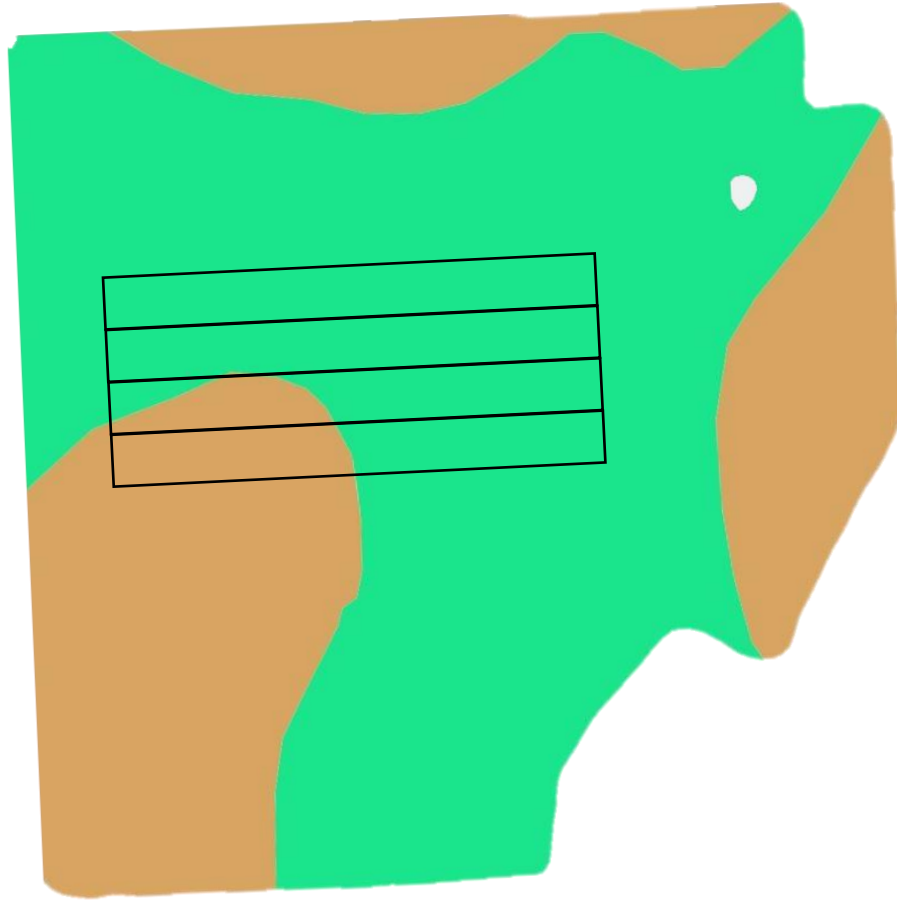
# Yield Response to N



# Yield Response to N



# Why does it matter?





# Key Points

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Remote sensing is really good at identifying patterns

3

The right technology depends on what the question is



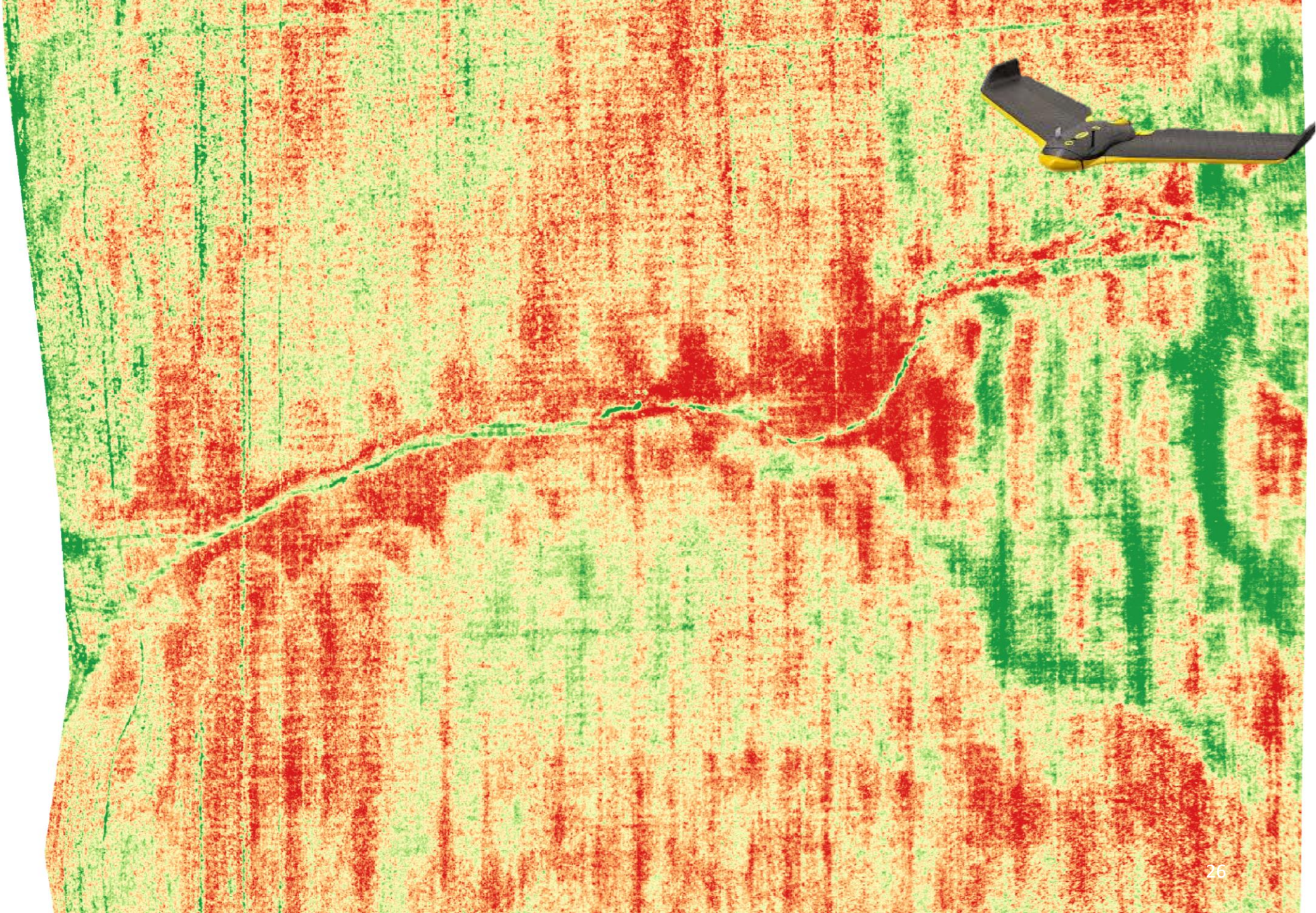








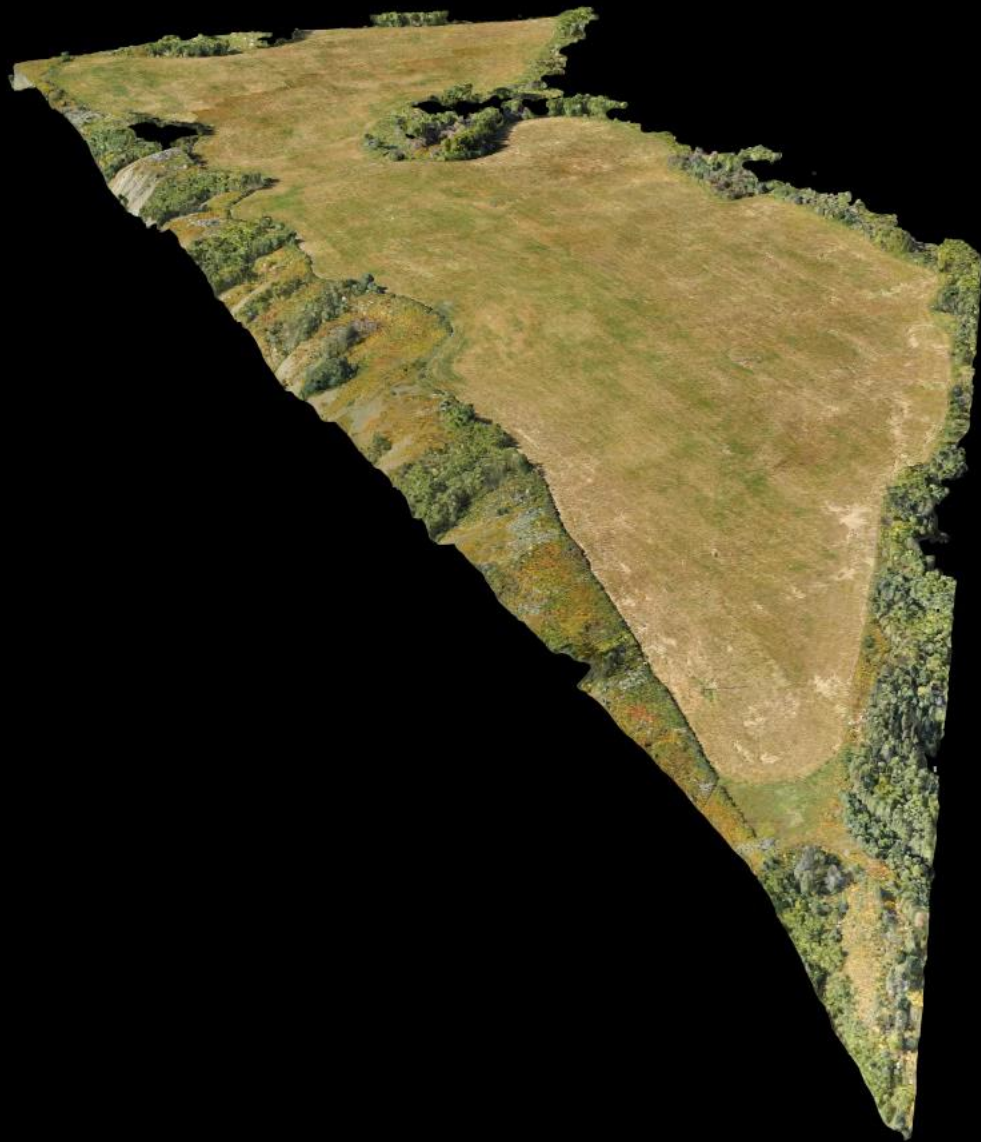




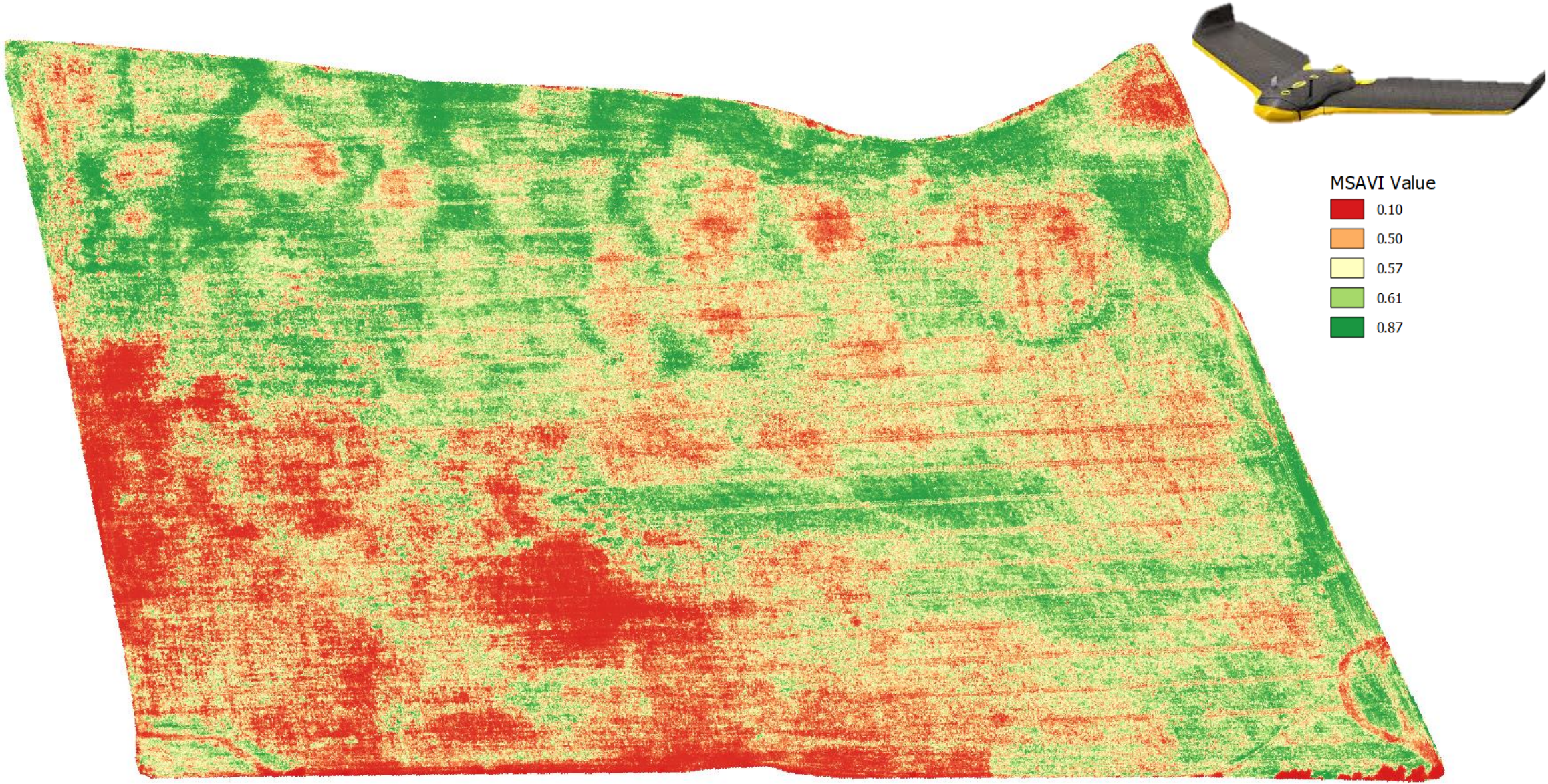






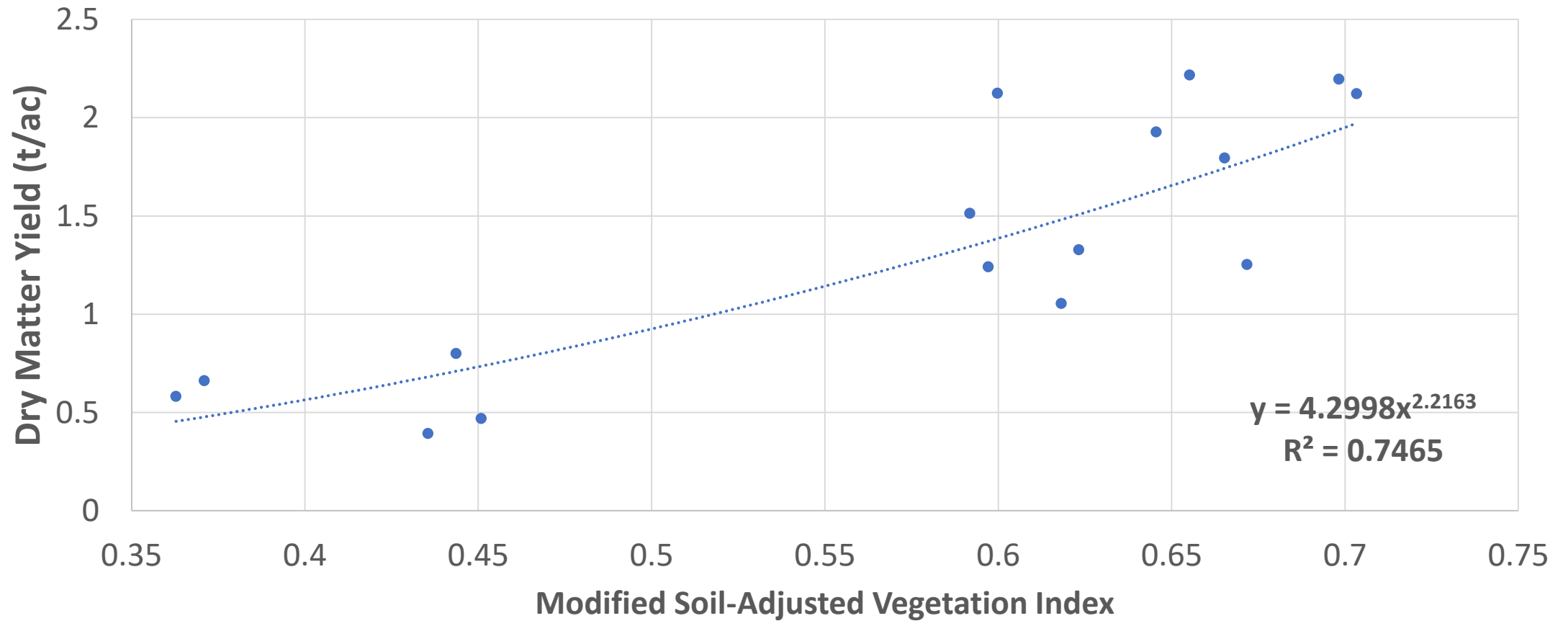


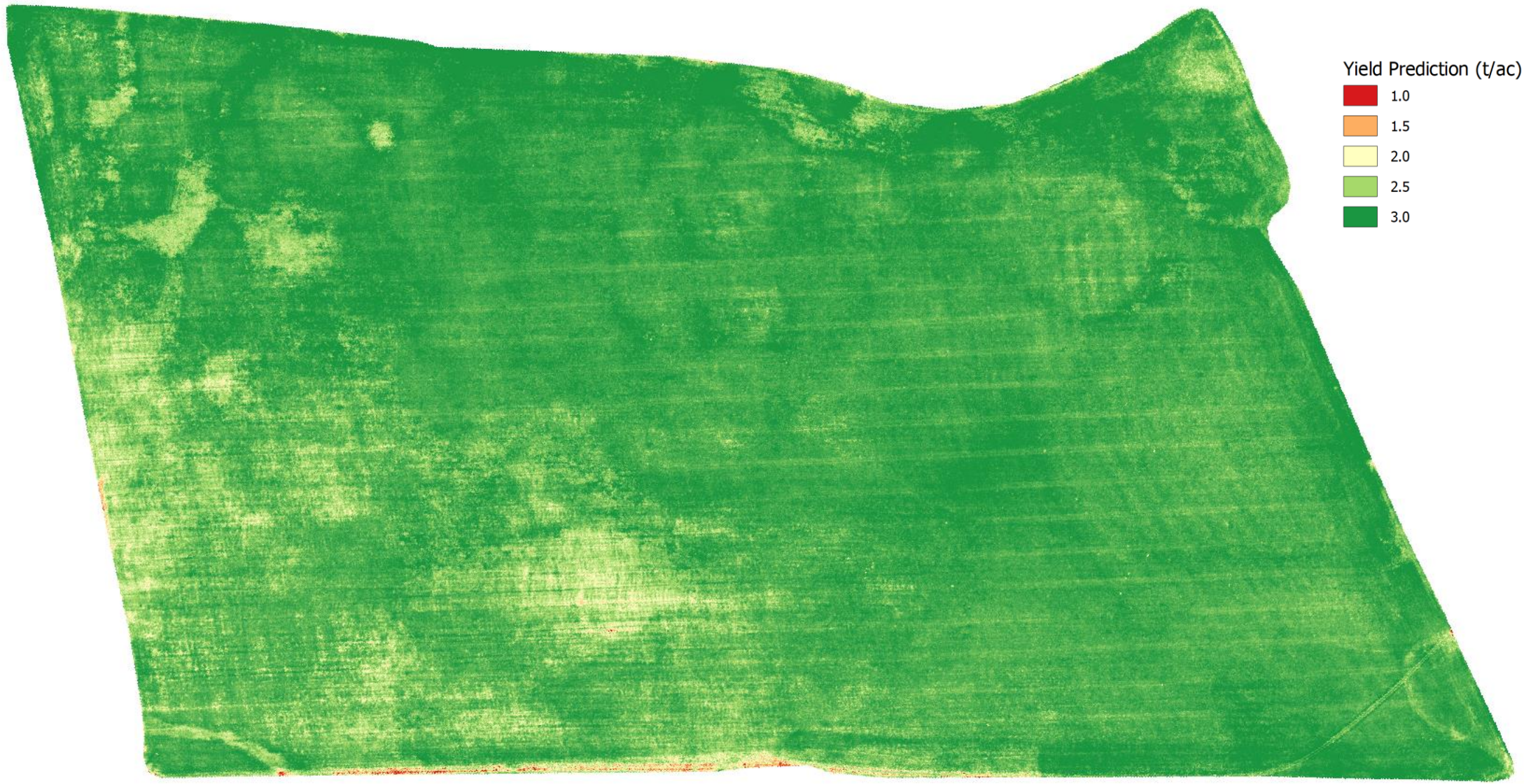






# Regression Analysis





What is it  
good for?



Planning Applied Research



Yield Limiting Factors



In-season monitoring of  
relative crop variability

# What's not working (yet)?



Sensing through clouds, fog, or smoke



Plant detection and ID



Yield estimates  
(correlation, not causation)



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# Thank You!

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# Quick Facts

Reflectance

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Biomass

~

Yield



LandSat/Sentinel free(ish)

Drone \$3-6/ac

LIDAR \$2-3/ac

Planet processes

more than ten

terabytes of data

per day from their dove

constellation



## Satellite Resolutions

LandSat 30 m

Sentinel 10 m

PlanetScope 3.7 m

DigitalGlobe 0.31 m



## Repeat Cycles

LandSat 16 days

Sentinel 5 days

PlantScope 1 day



Over 2,200 satellites in orbit

## Drones

- Fly on-demand
- Fly under clouds
- Cover small areas
- Require licensing