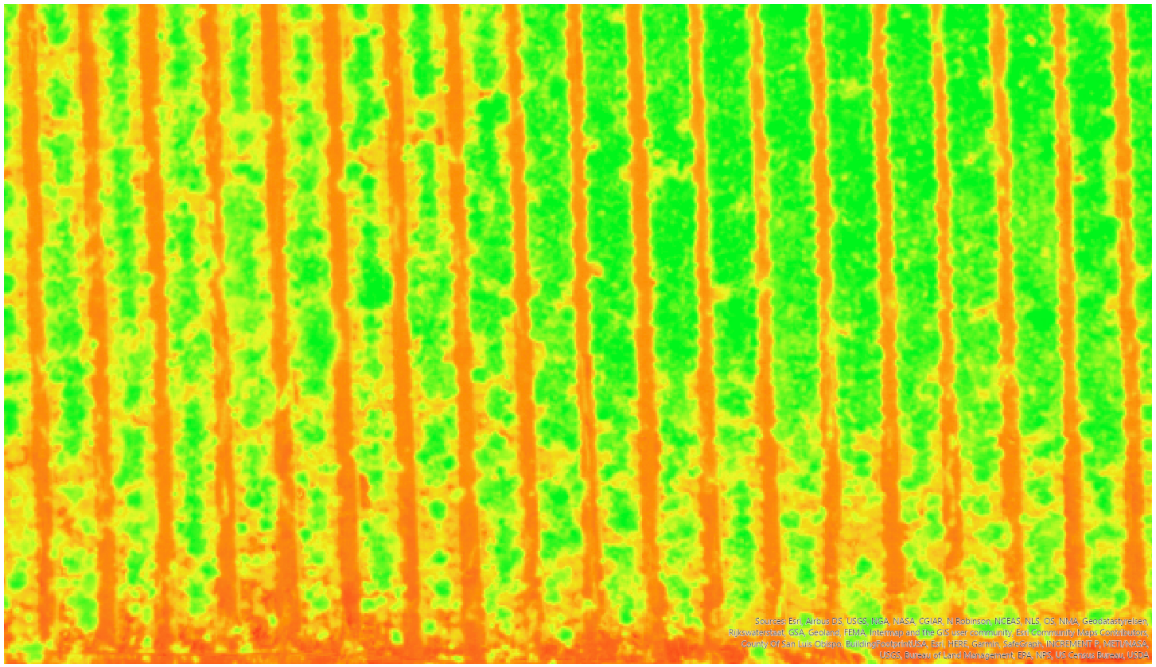
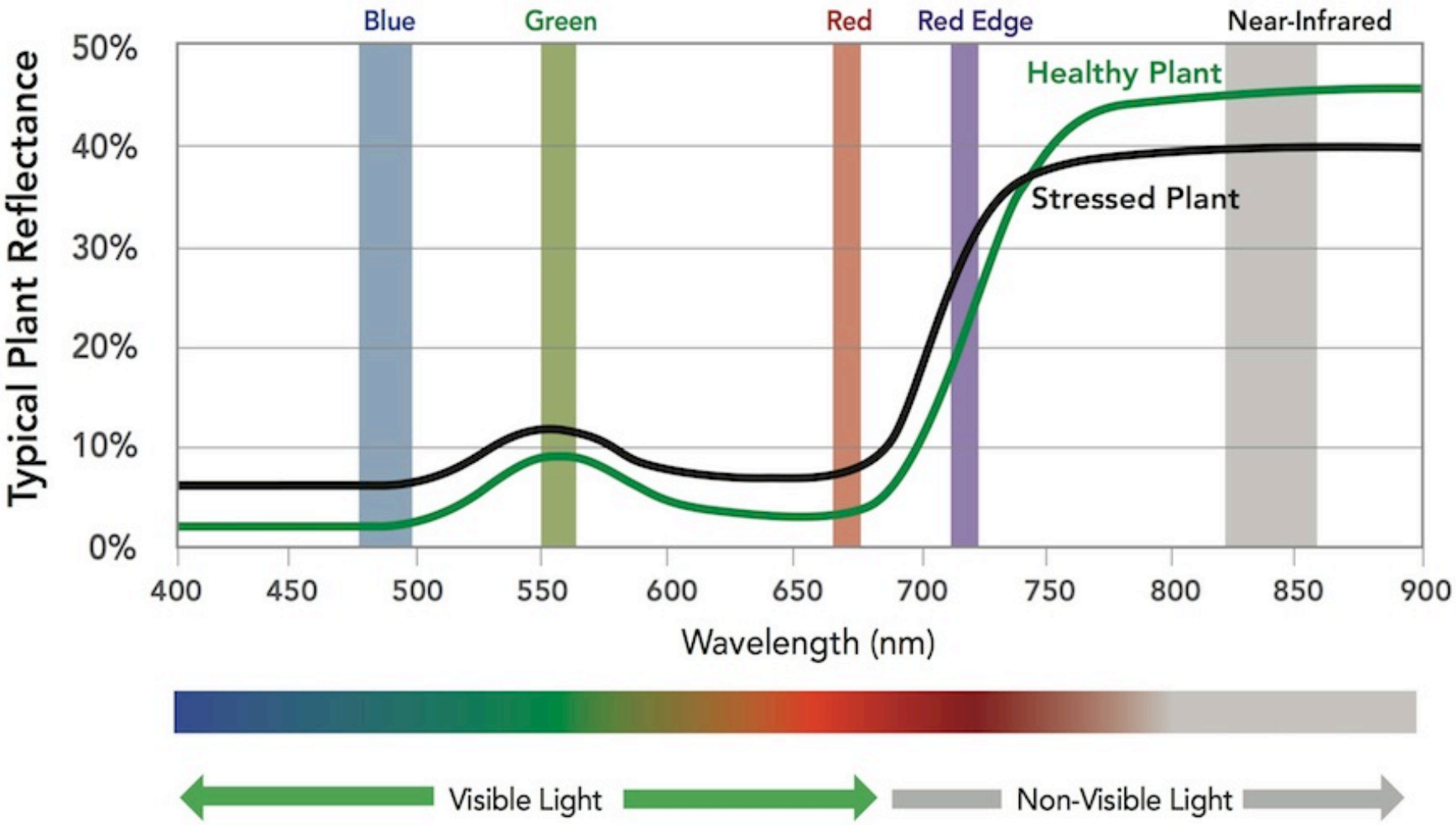
Multispectral Imaging in Strawberry - Monitoring Crop Health with Regards to Pests and Diseases

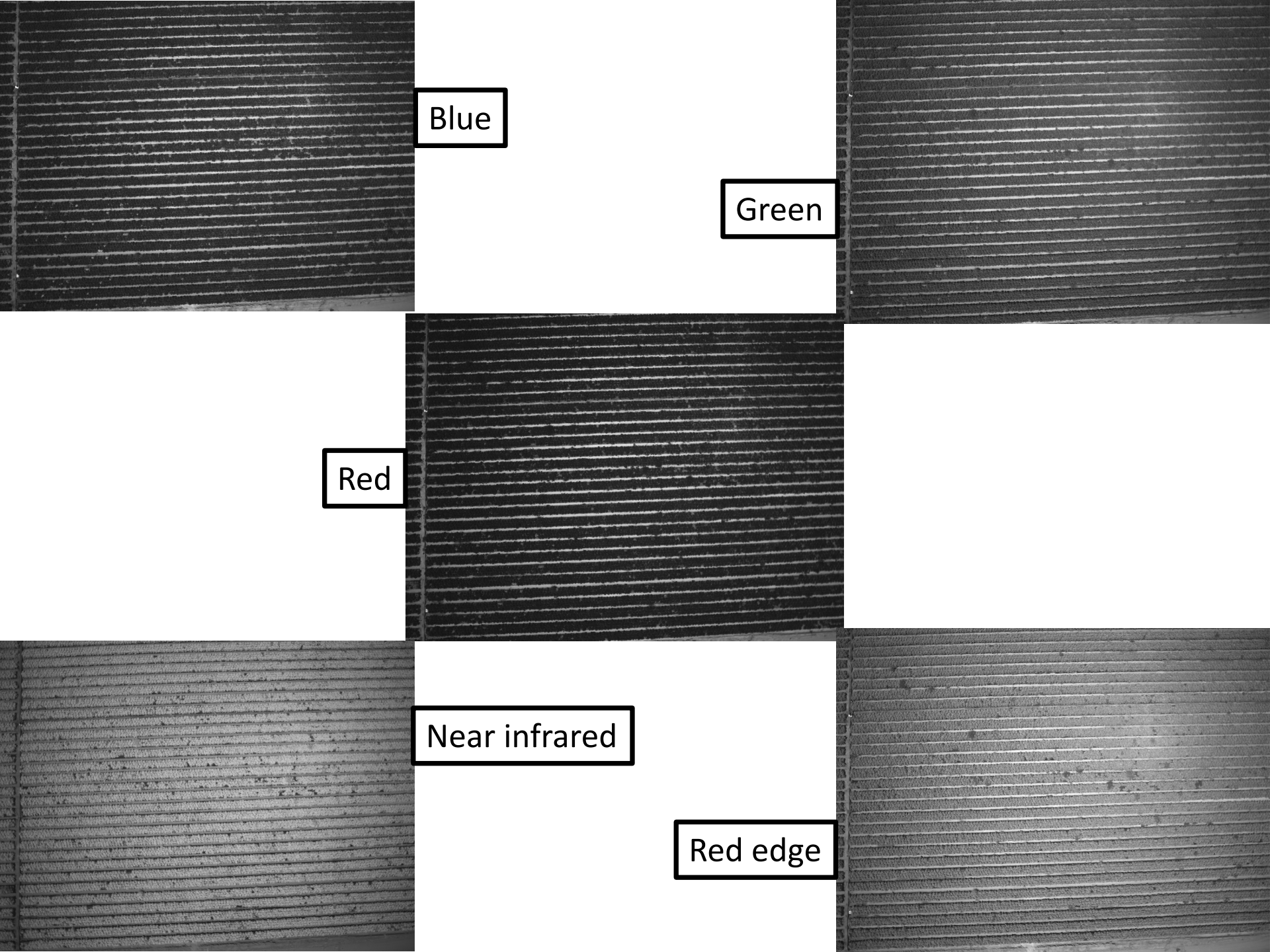


Christopher A. Greer, PhD
University of California Cooperative Extension
Integrated Pest Management Advisor
San Luis Obispo, Santa Barbara and Ventura Counties
cagreer@ucanr.edu or 805-888-1355

DJI Matrice 200v2 sUAS/drone

- MicaSense Altum multispectral/thermal camera
  - Captures 6 spectral bands
    - Visible light - Blue, Green and Red bands
    - Non-visible light in the red edge, near infrared and thermal bands

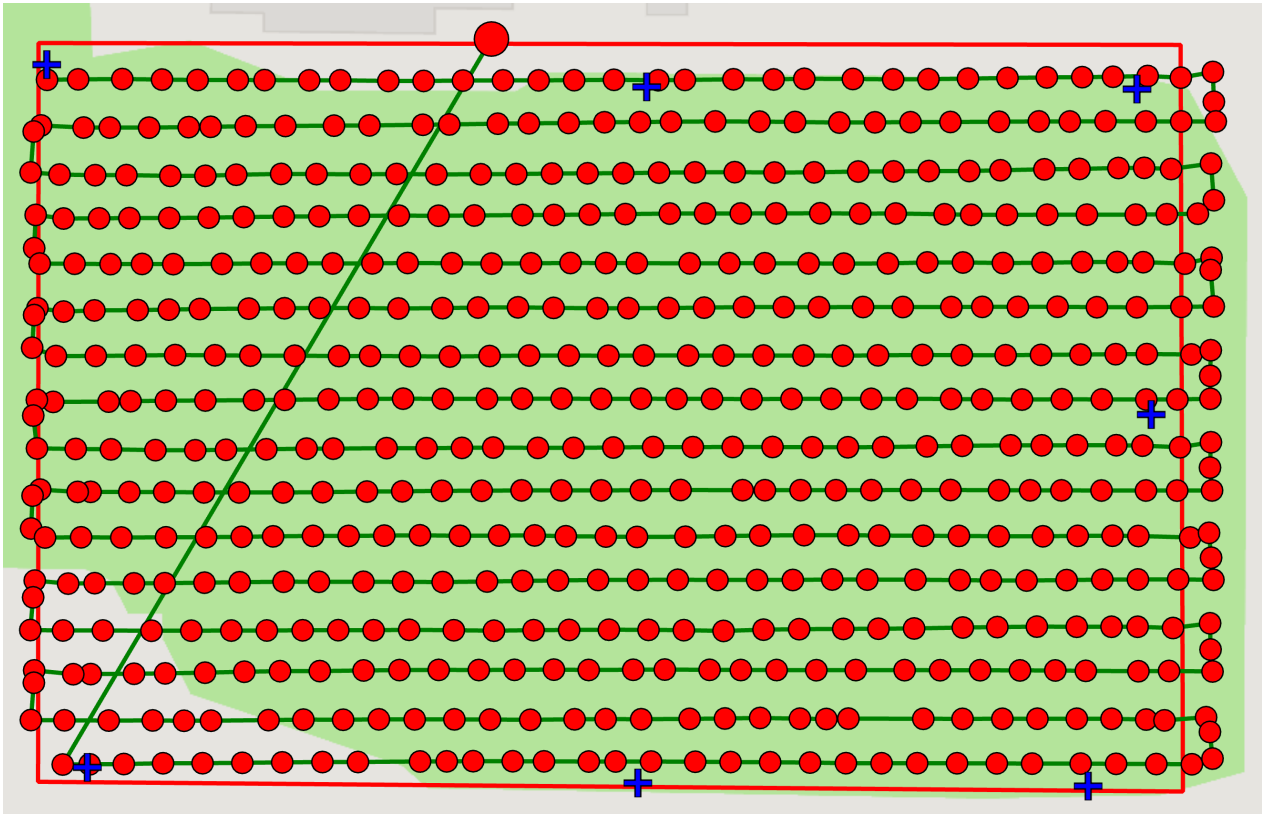

Blue
Green
Red
Red Edge
Near-Infrared
Healthy Plant
Stressed Plant
Typical Plant Reflectance
50%
40%
30%
20%
10%
0%
400
450
500
550
600
650
700
750
800
850
900
Wavelength (nm)
Visible Light
Non-Visible Light


Blue
Green
Red
Near infrared
Red edge

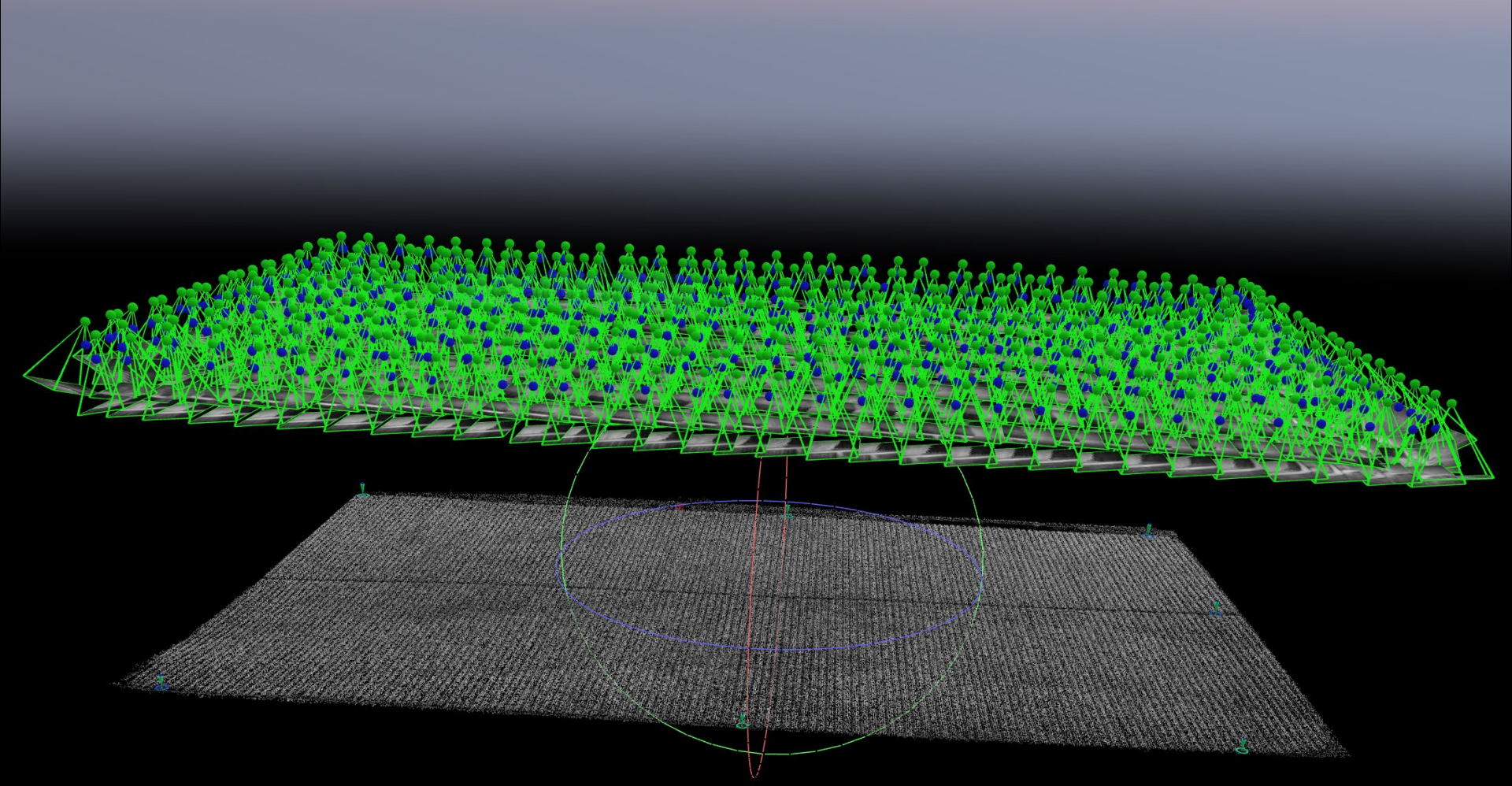
Flight Path for Mapping 6.1 Acres

- Flying at 200 ft altitude – Ground sampling distance of 1.07”
- Images overlap 85%
- 2,635 total images - one image for each band at 529 locations
- 2.3 mile long flight, 18 minutes
- Processing performed using Pix4DMapper software (Pix4D SA, Switzerland)

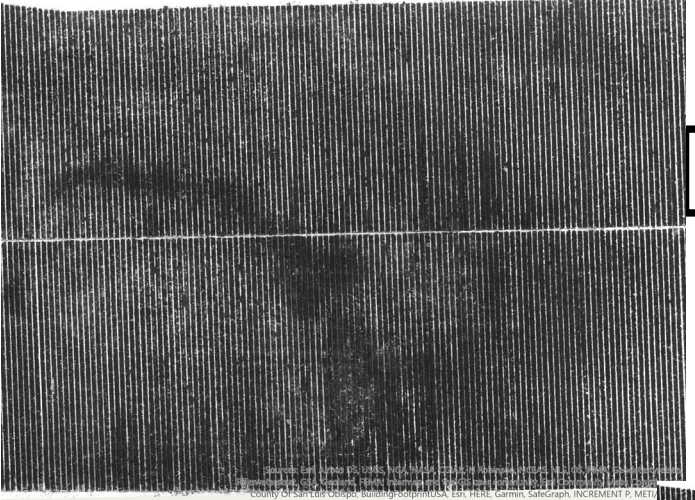
400 ft



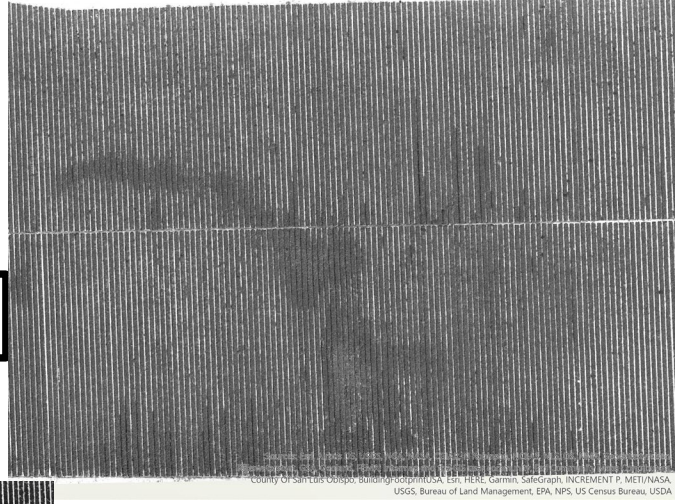
670 ft



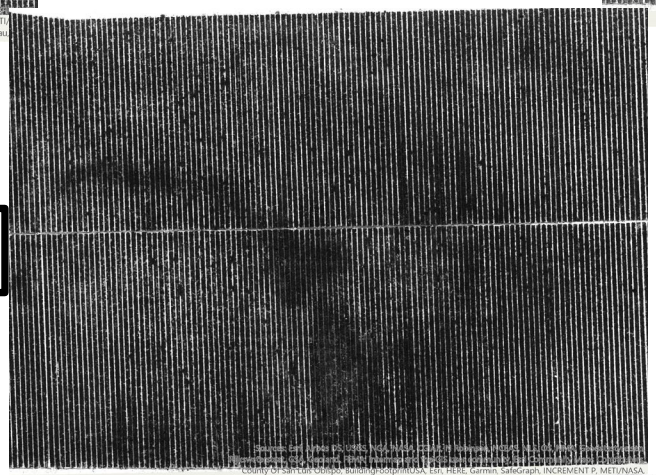
Processing performed using Pix4DMapper software (Pix4D SA, Switzerland)



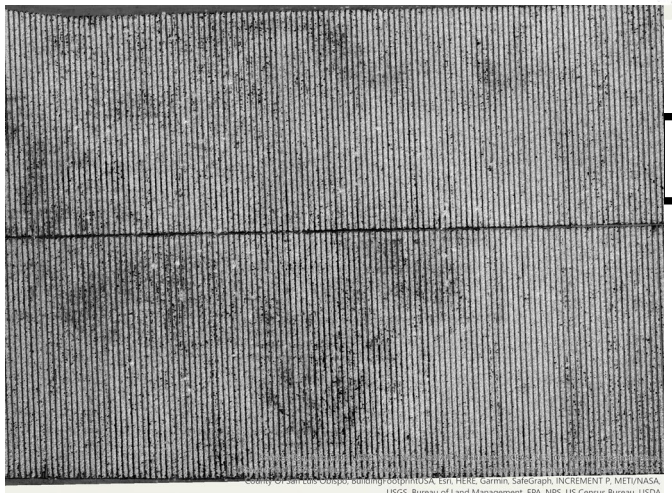
Blue



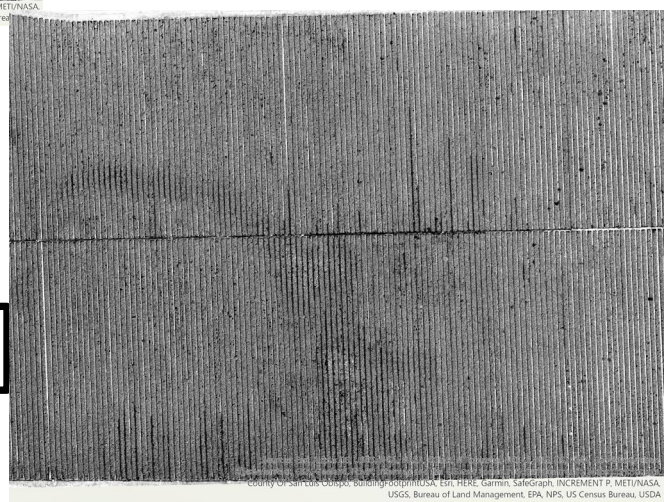
Green



Red



Near infrared



Red edge

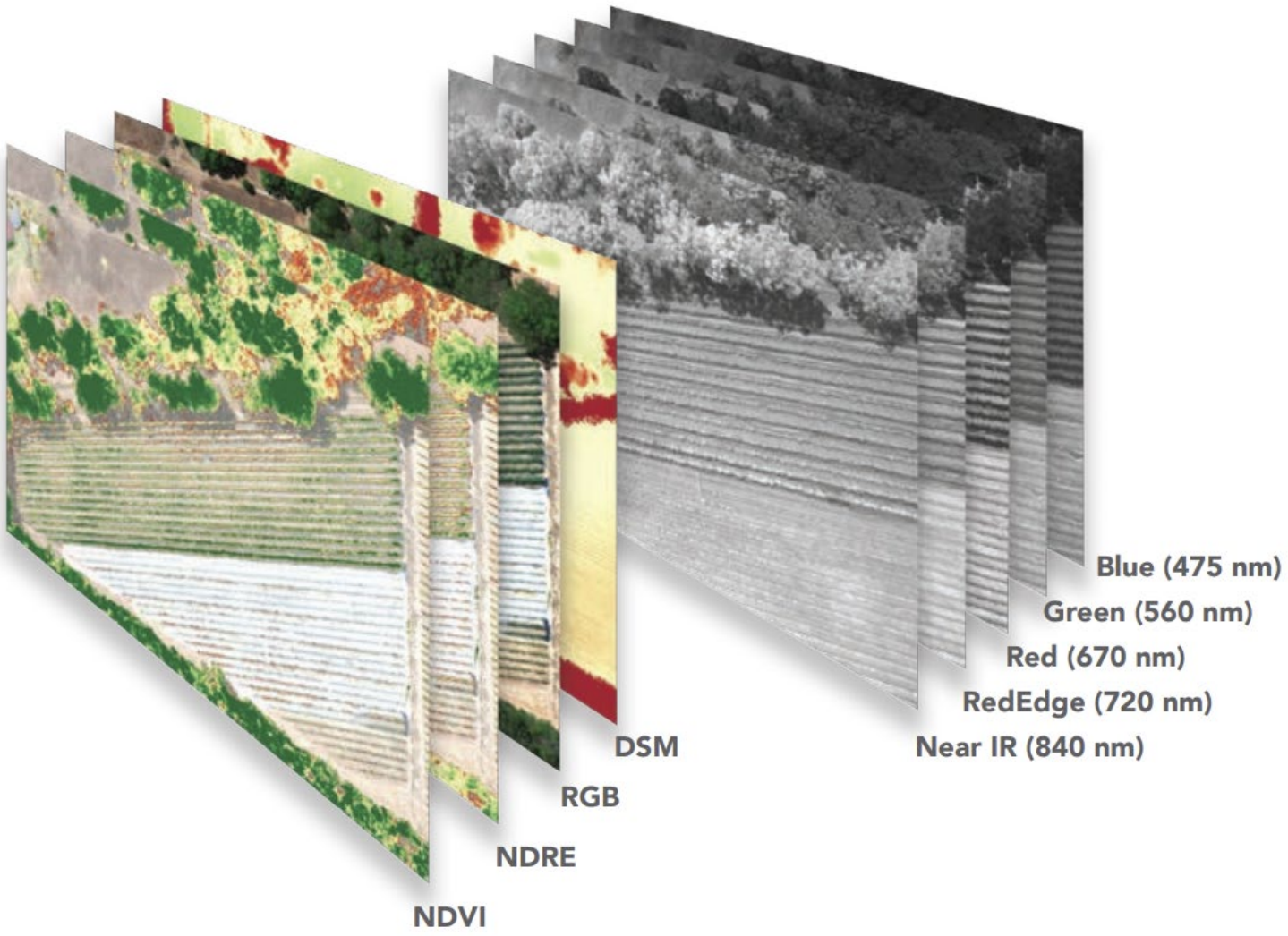
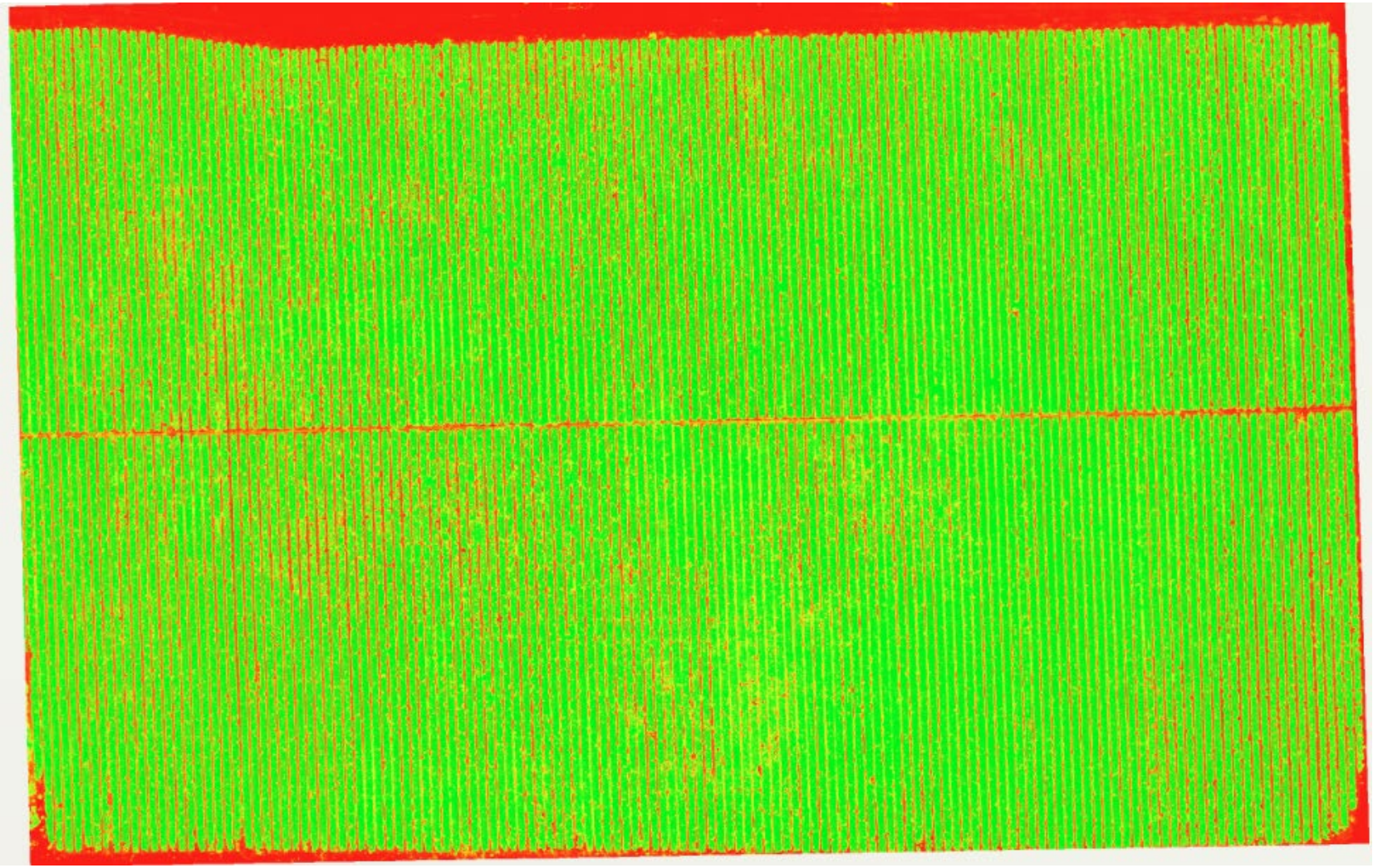


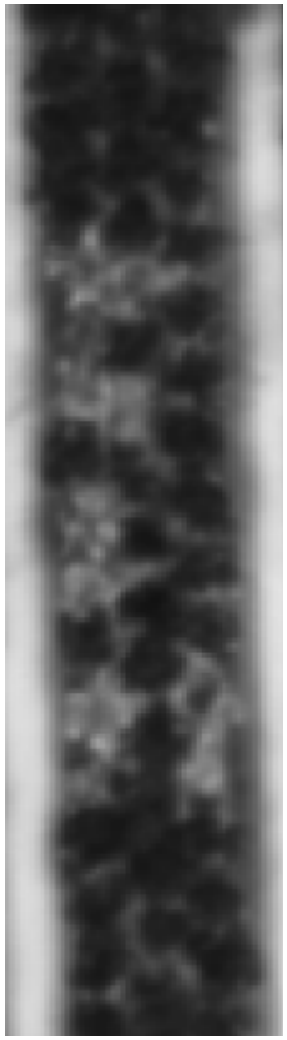
Figure Credit: MicaSense (https://micasense.com/)

NDVI = (NIR − RED) / (NIR + RED)
(Normalized Difference Vegetation Index) - quantifies vegetation by measuring the difference between near-infrared (which vegetation strongly reflects) and red light (which vegetation absorbs). High NDVI values = healthier vegetation. Low NDVI = less healthy or no vegetation.



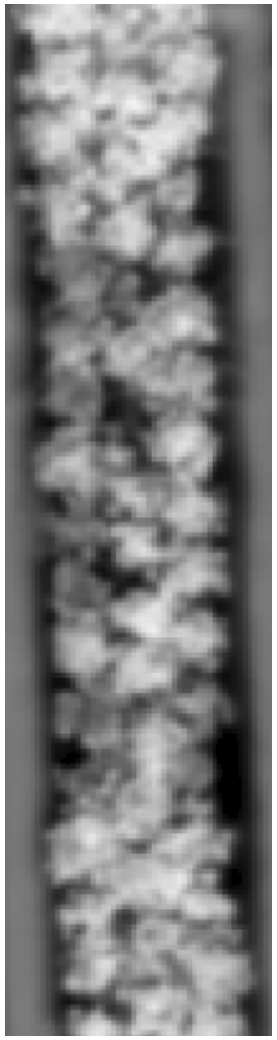
RGB Image

RGB



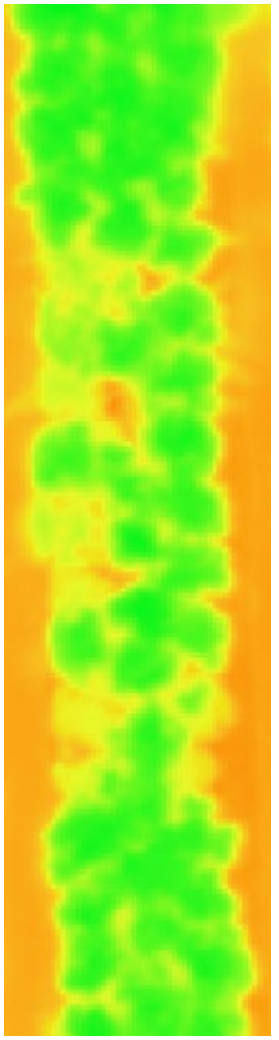
Red

Stressed (0.11-0.14)
Healthy (0.02-0.04)



Near-Infrared

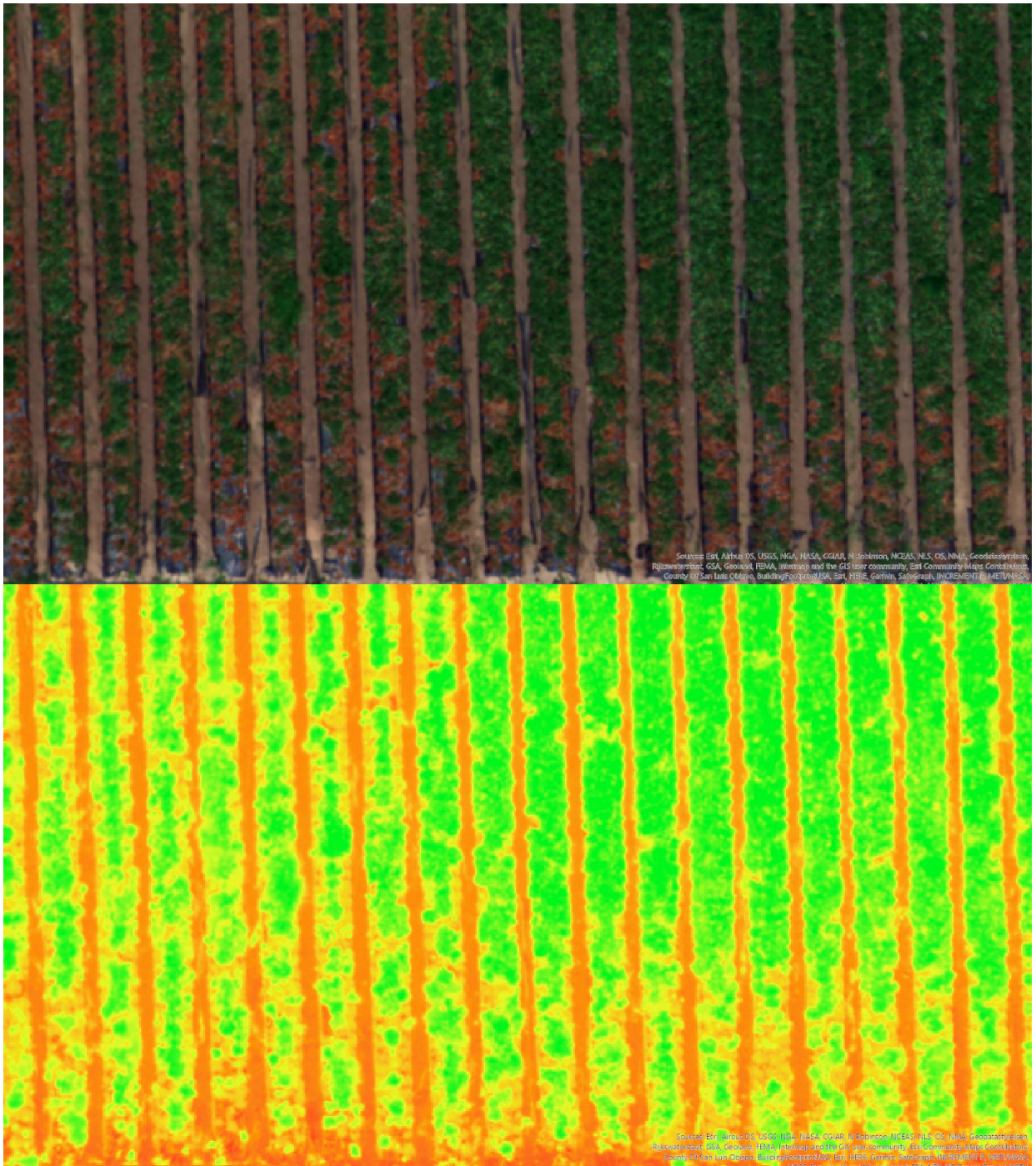
Stressed (0.33-0.42)
Healthy (0.55-0.61)



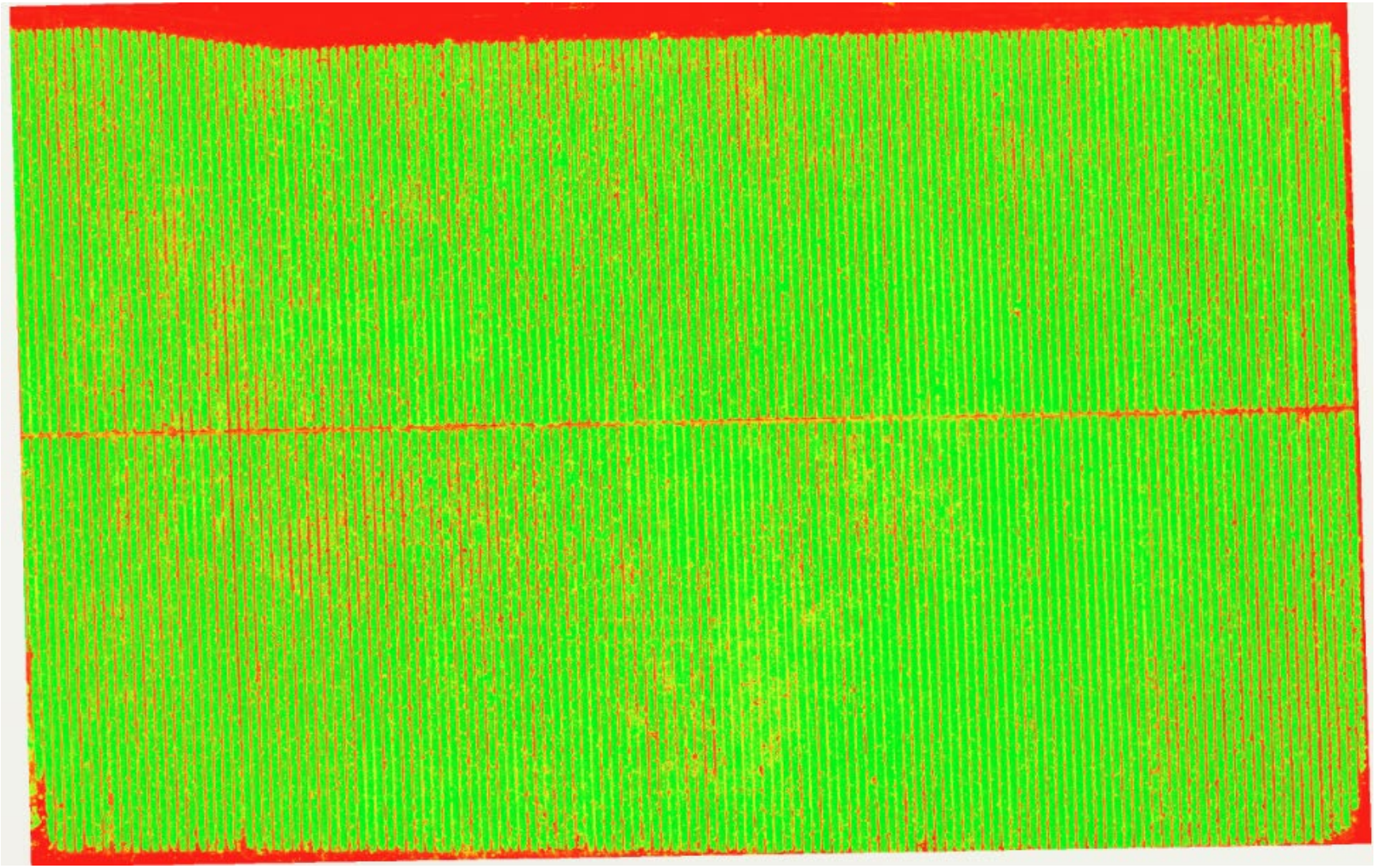
NDVI

Stressed (0.45-0.55)
Healthy (0.85-0.91)

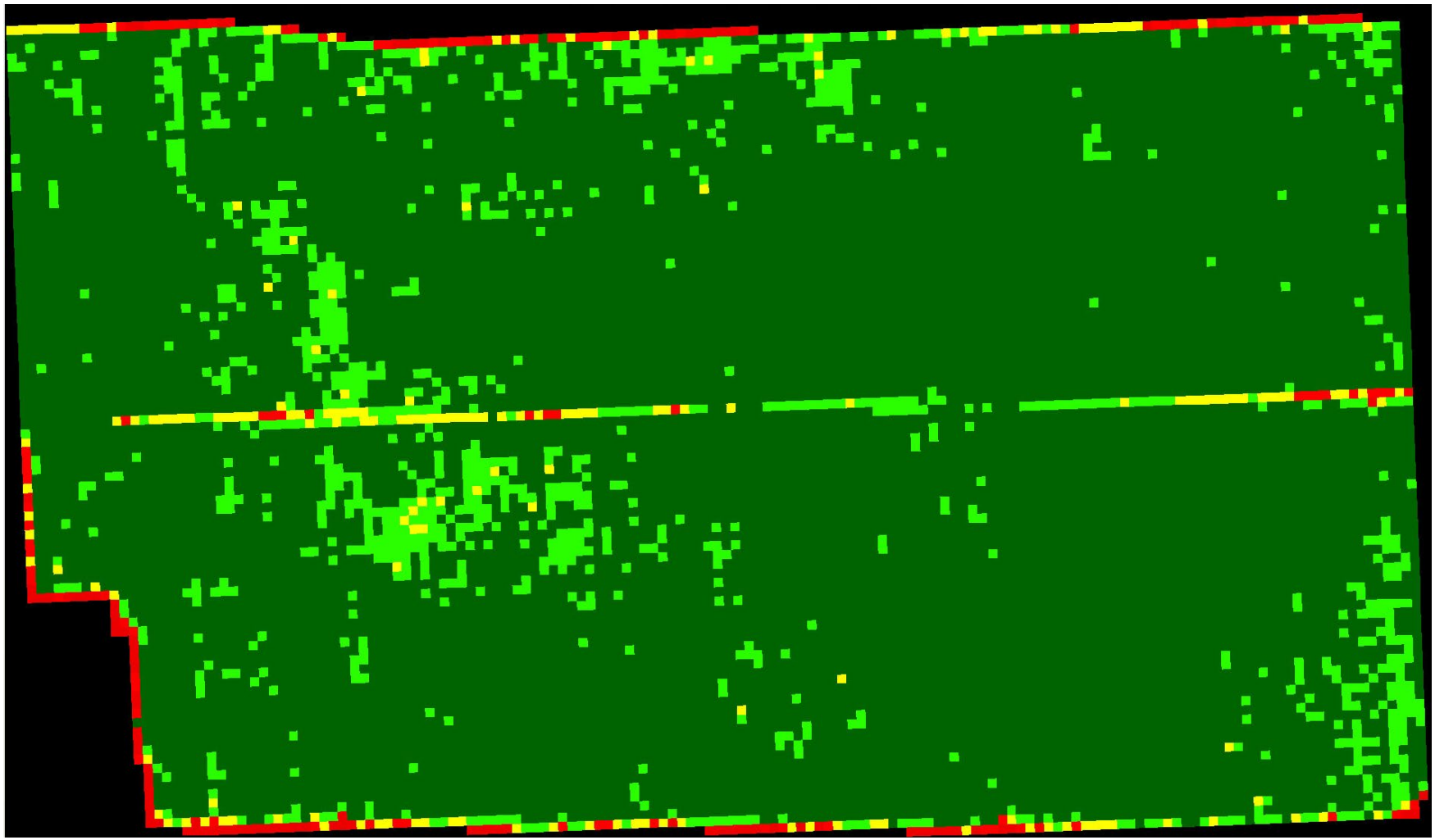
NDVI = (NIR − RED) / (NIR + RED)


Sources: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatastyrelsen, Rijkswaterstaat, GSA, Geoland, FEMA, Intermap and the GIS user community, Esri Community Maps Contributors, County Of San Luis Obispo, BuildingFootprintUSA, Esri, HERE, Garmin, Safegraph, INCREMENT P, METI/NASA,

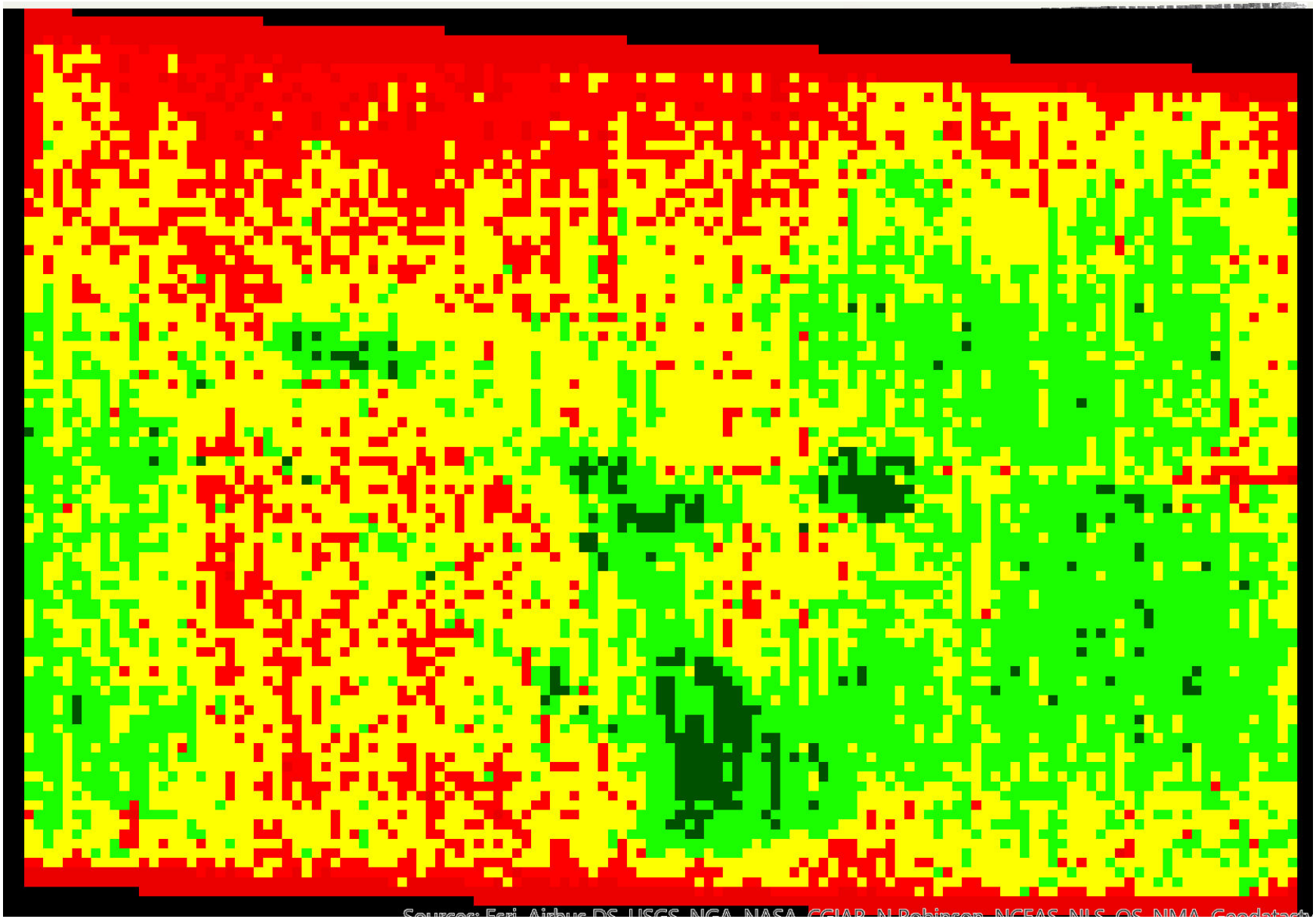
Raw NDVI with 1.07” GSD

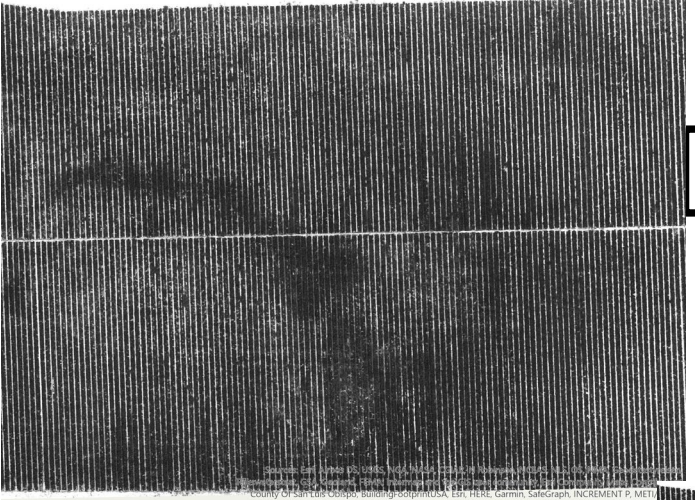


Resampled NDVI - 4.7’ pixel size (mean of ~2,780 of our raw values!)

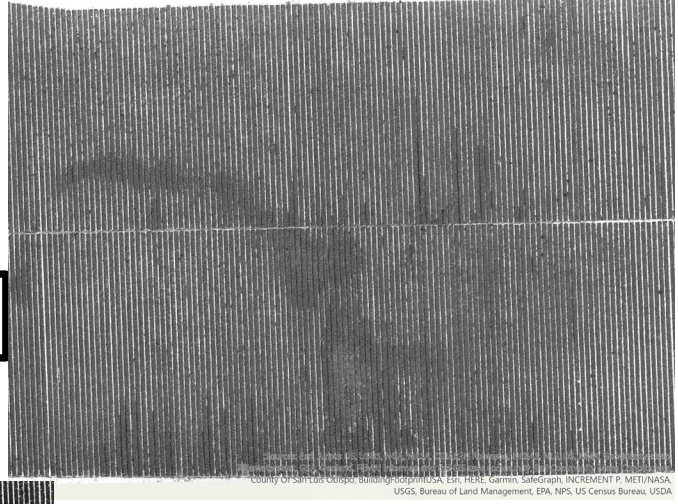


July 23, 2020

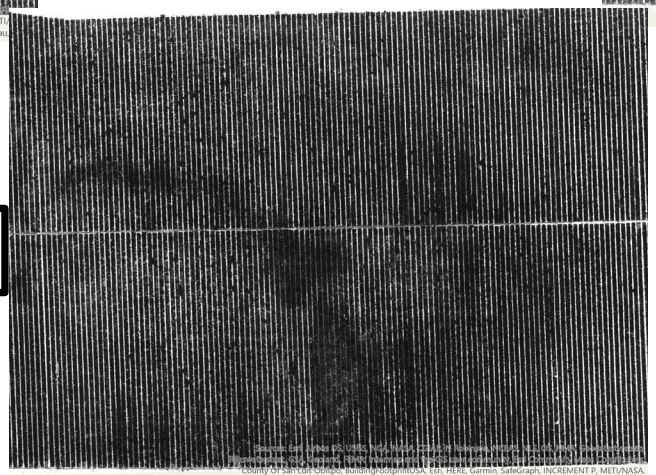

Source: Esri, Airbus DS, USGS, NGA, NASA, CGIAR, N Robinson, NCEAS, NLS, OS, NMA, Geodatast



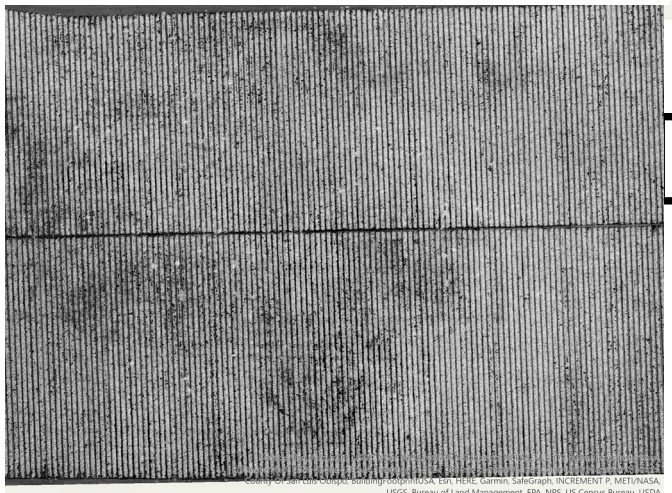
Blue



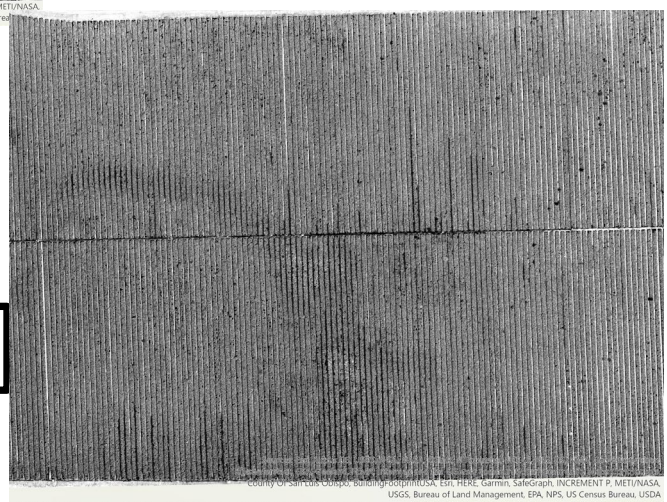
Green



Red



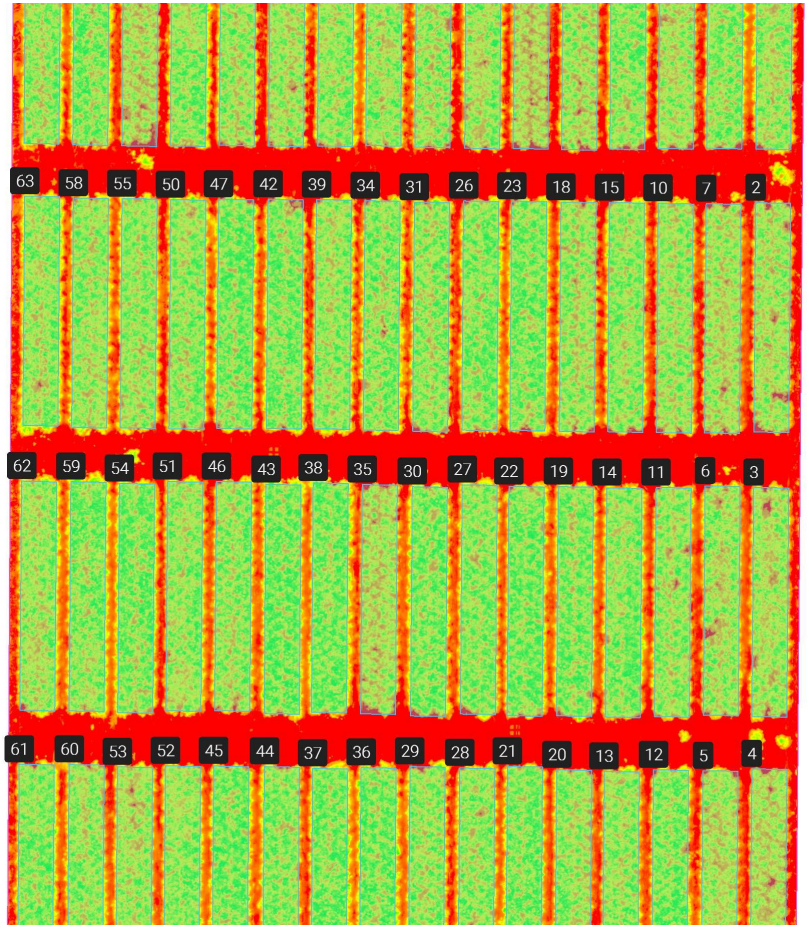
Near infrared



Red edge

Remote Sensing in Research

- Great value as a research tool
  - Each individual pixel is a data point that allows us to analyze data over a field in any sample unit size - individual plant, individual bed, individual experimental unit, or individual block
  - Data has temporal value as it allows us to document changes over time throughout a production season or from season to season



Remote Sensing in Practice

- Improved scouting efficiency for diseases and other pest issues – still need ground validation
- Disease/pest progression in annual or perennial crops with repeated sampling
- Earlier and more accurate disease and pest detection, perhaps even prior to being visible with the naked eye

USDA-ARS Areawide Pest Management Project - SITE-SPECIFIC SOIL PEST MANAGEMENT IN STRAWBERRY AND VEGETABLE CROPPING SYSTEMS

- F. Martin, S. Fennimore, D. Racano, M. Matson, A. Putman, M. Hang, F. Melton, R. Goodhue, P. Henry, S. Vougioukas, N. Dorn, C. Greer, O. Daugovish, A. Biscaro, M. Earles, T. Magneyand, M. Stanghellini

Thank You!

Christopher A. Greer, PhD
University of California Cooperative Extension
Integrated Pest Management Advisor
San Luis Obispo, Santa Barbara and Ventura Counties
cagreer@ucanr.edu
805-888-1355