



UAS Technologies in Agriculture and Industry

November 2016

Overview

- Introductions
- “How It’s Made”
- Uses in Agricultural Industry and Research
- IGEM

Team

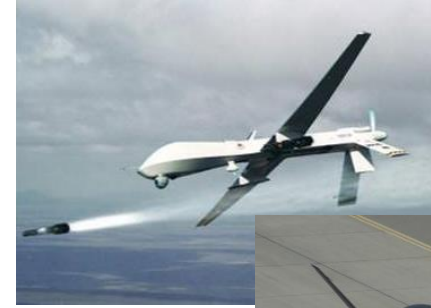


We Can Do That®





- Uniquely qualified UAS experts
- Over 100+ years shared experience
- Over 25,000 hrs of combined UAV time
- 8th company to receive FAA 333 Exemption
- Over 30,000 acres surveyed to date
 - Agriculture
 - Natural Resources
 - Forestry
 - Civil Engineering
 - Mining



Operating Areas

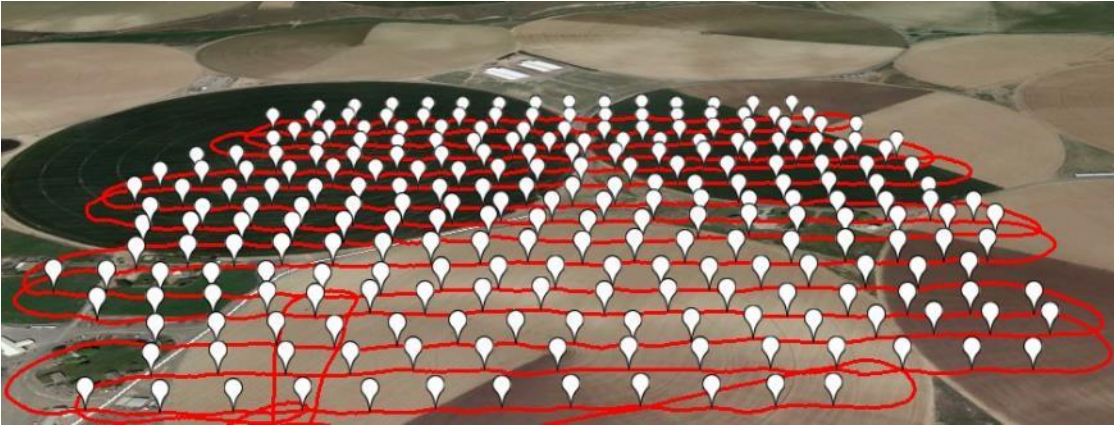


Step 1: Fly the Mission

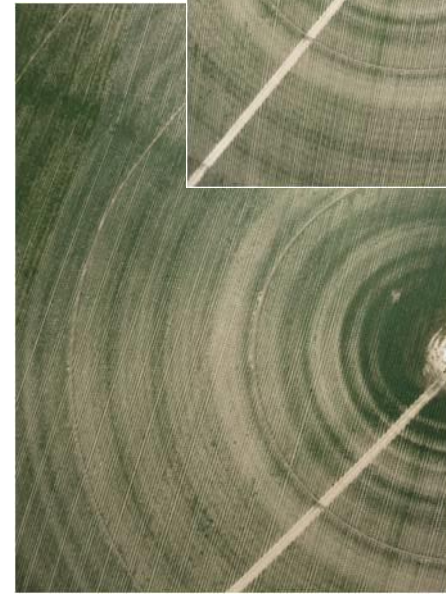
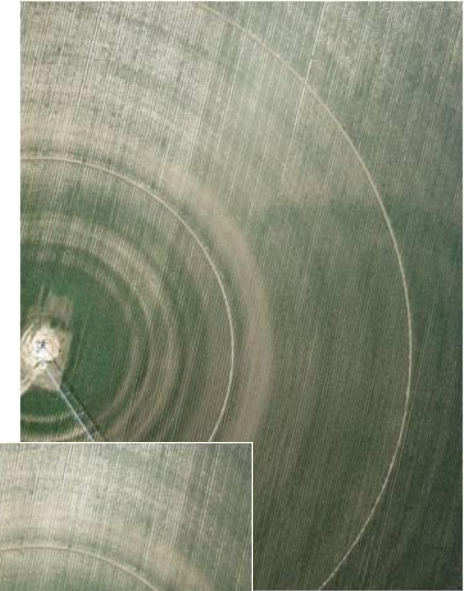
The screenshot displays a drone flight control interface. At the top, a row of buttons includes: WARNING, START MISSION, RESUME MISSION, GO TO START WPT, GO TO HOME WPT, GO LAND, HOLD POSITION, LAND NOW (Click 3x), ABORT LANDING, ROLL, FAST CLIMB, and FAST DESCENT. The main area shows an aerial map with a purple mission path consisting of a grid of horizontal lines with a circular pattern at the start. A small aircraft icon is positioned at the beginning of the path. To the right, a sidebar contains several panels: Home distance (0 ft), Estimated wind (0.0 kts), Link quality (93%), and Flight data (Ground speed: 0.0 kts, Altitude: 1000.7 ft/AMSL, 1164.7 ft/WGS84, Ground sensor height: 0.0 ft, Position: N 46.0569264°, W 119.5568847°). Below these is an Instruments panel with a central digital display showing AIRSPD (0.0 kts) and ALTITUDE (0.0 ft/ATO) with corresponding analog gauges.

- Aircraft is flown in a grid pattern at appropriate overlap
- The entire flight is flown “autonomously”
- Typical flight time is 20-30 minutes for 150-200 acres
- Most agricultural flights occur at 400 ft AGL

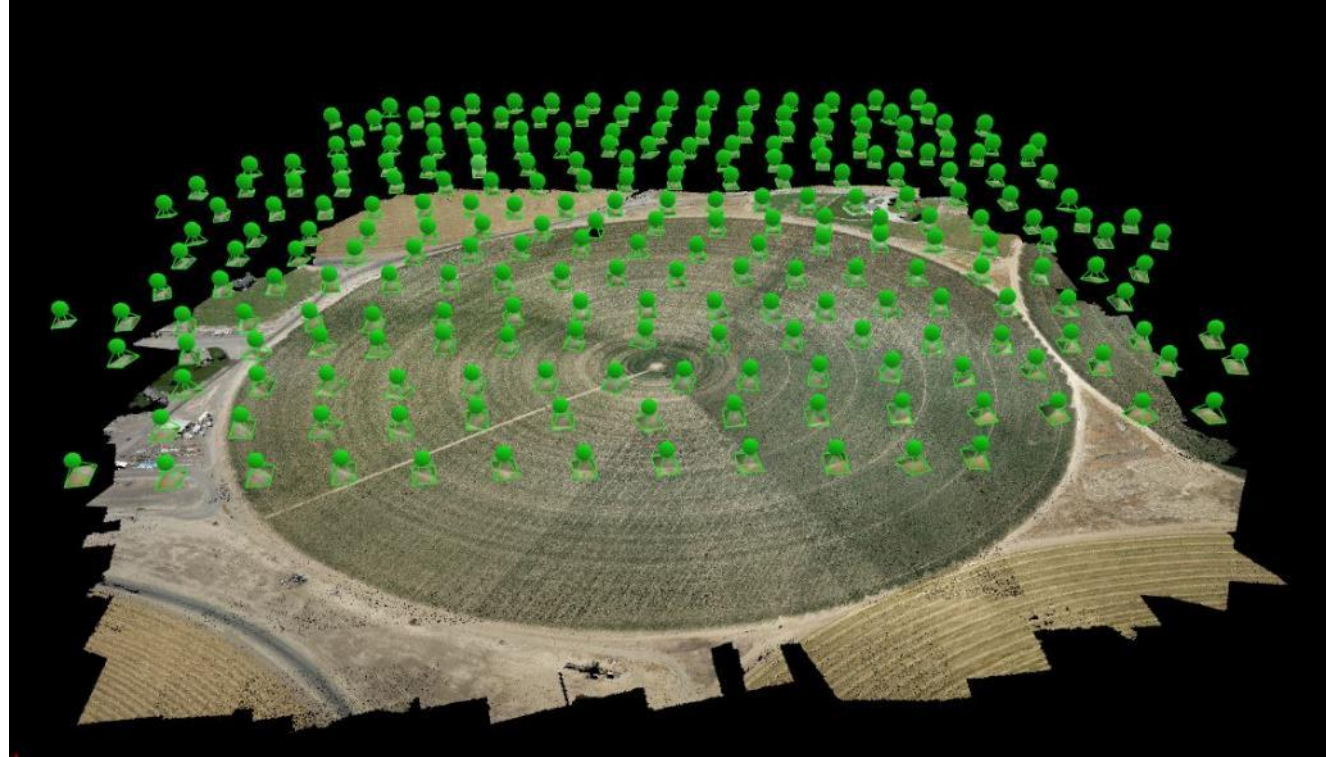
Step 2: Download and Process Images



- Images are loaded from camera's SD card
 - Approximately 5-6 images per acre
- Corrects images for lens distortion
- Correct for color errors
- Correct for atmospheric conditions



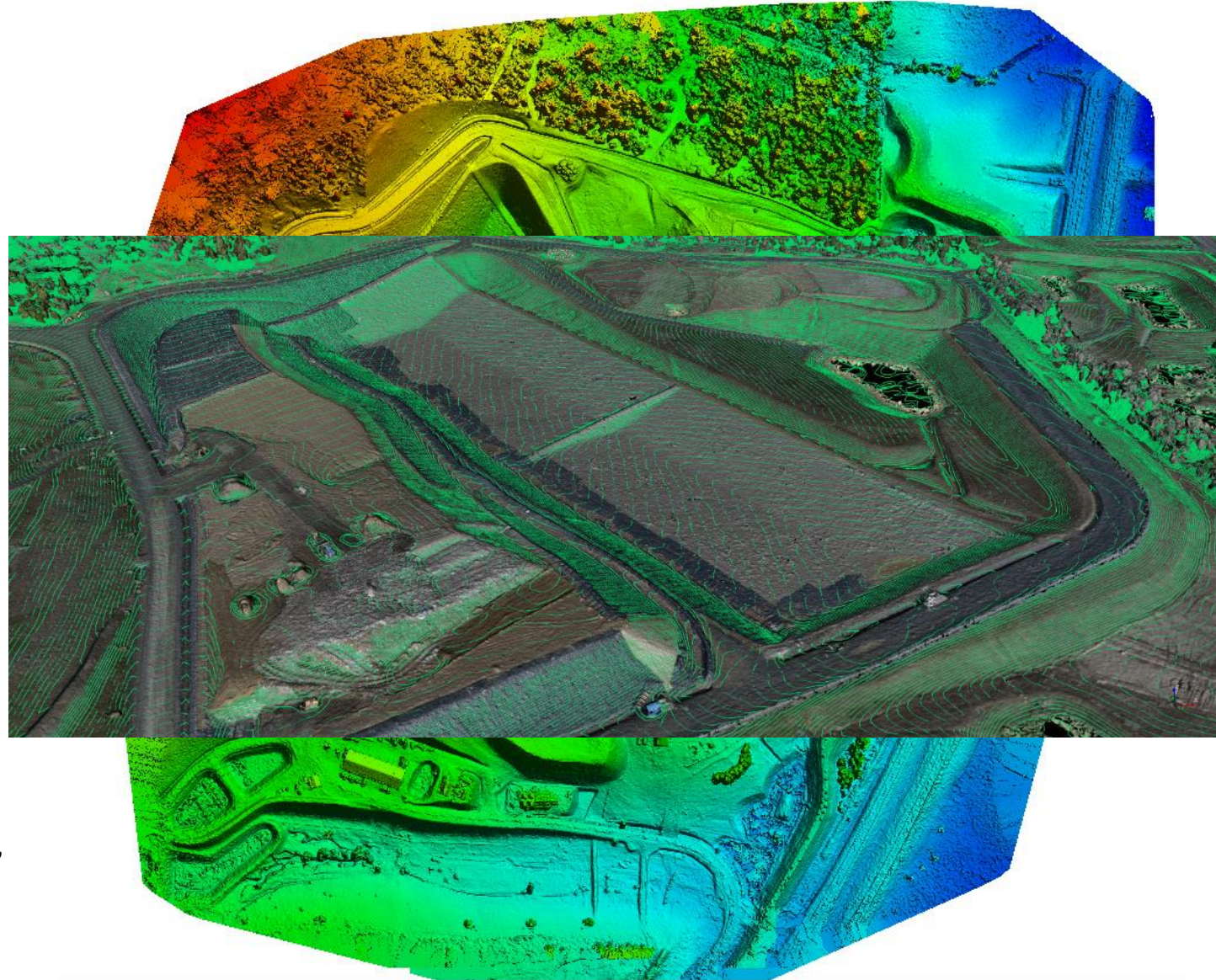
Step 3: Build a Dense Point Cloud and Mosaic



- Pixels are matched and “stitched” into a point cloud
- 3D model provides precise coordinates in X, Y, Z
 - Latitude, Longitude, Elevation
- Geo-rectified ortho-mosaics (.tif) are one of many “export” products available

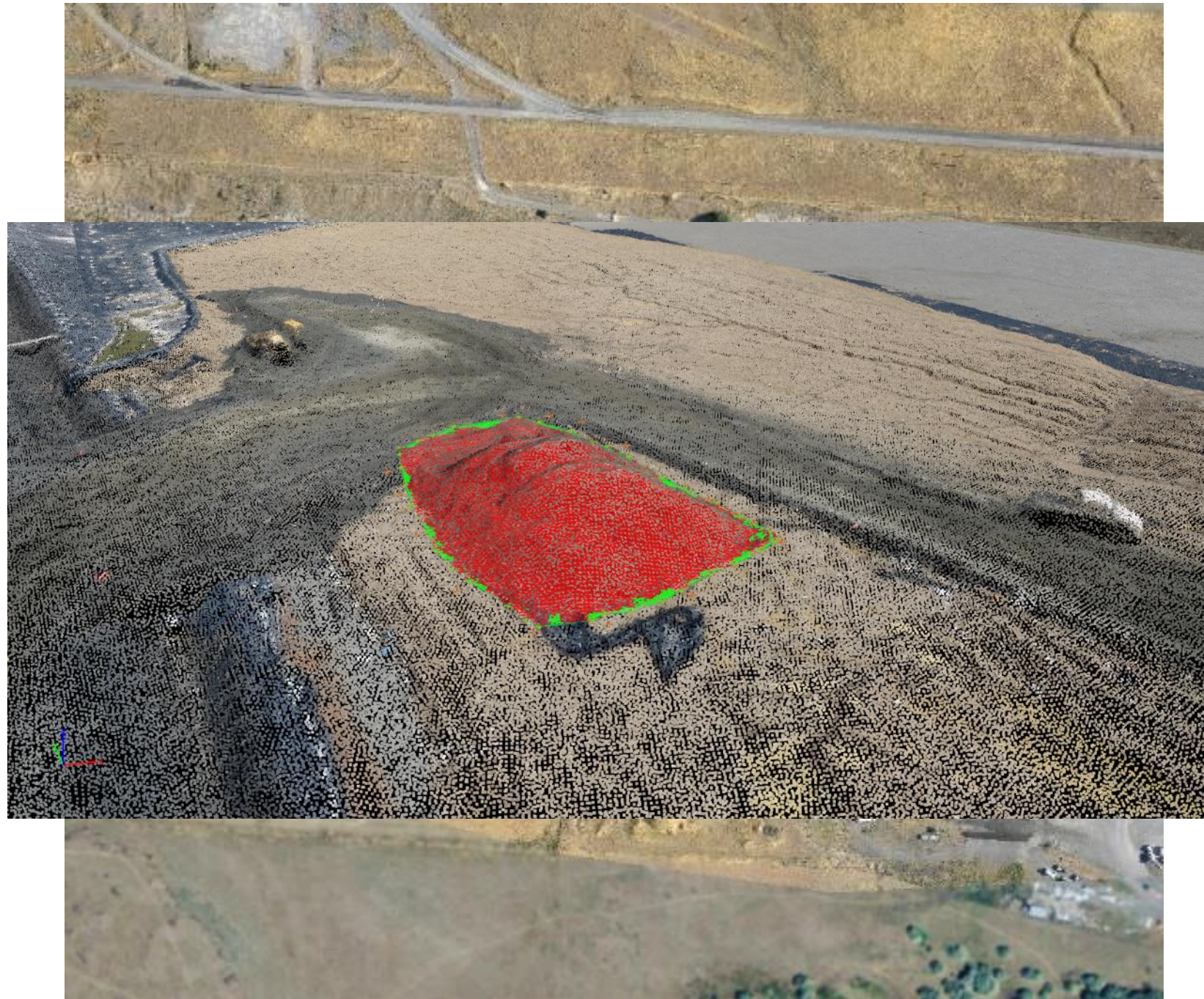
Construction

- Data Uses:
 - Elevation information for computing contour
 - Useful in planning/adjusting timelines
- Check UAS DTM versus field survey shots
 - Z value differences (UAS versus field survey) is +/- 0.15'



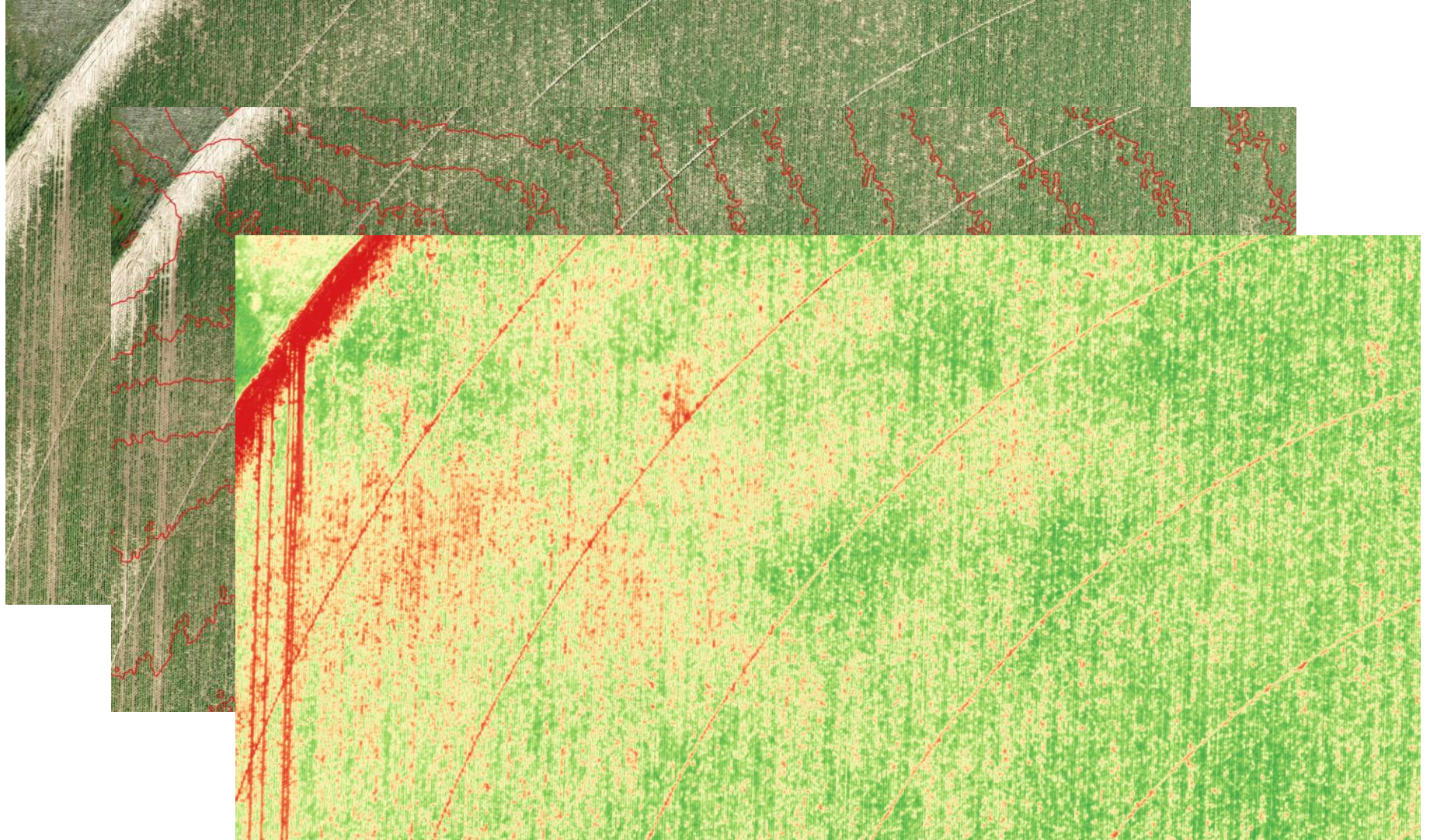
Mining Sites

- Planning Data
 - Provides a digital record of mine
 - Provides elevation data
 - Used to calculate volumes
- Much quicker and safer than ground survey crews
 - No delays in operation for survey



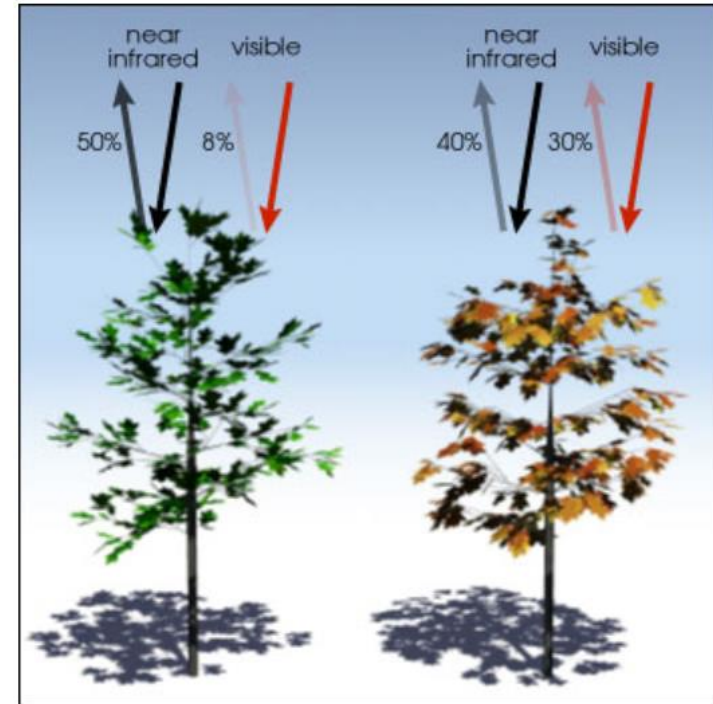
Agriculture

- RGB
- Elevation
- NDVI



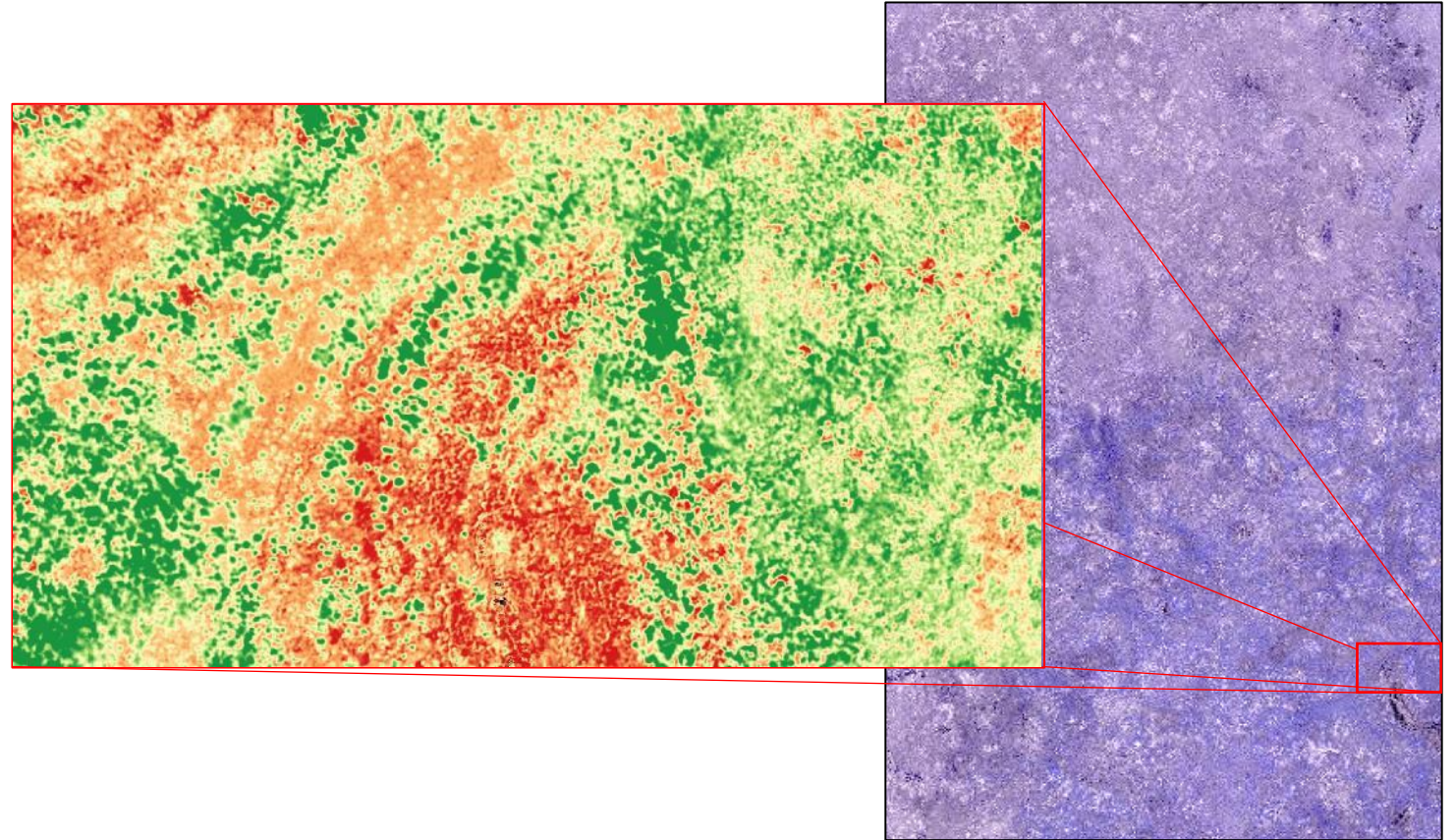
Normalized Difference Vegetation Index (NDVI)

- Calculated from the visible (VIS) and near-infrared (NIR) light reflected by vegetation.
- Healthy vegetation absorbs most of the VIS that hits it, and reflects a large portion of the NIR.
- Unhealthy or sparse vegetation reflects more VIS and less NIR.



Land Management

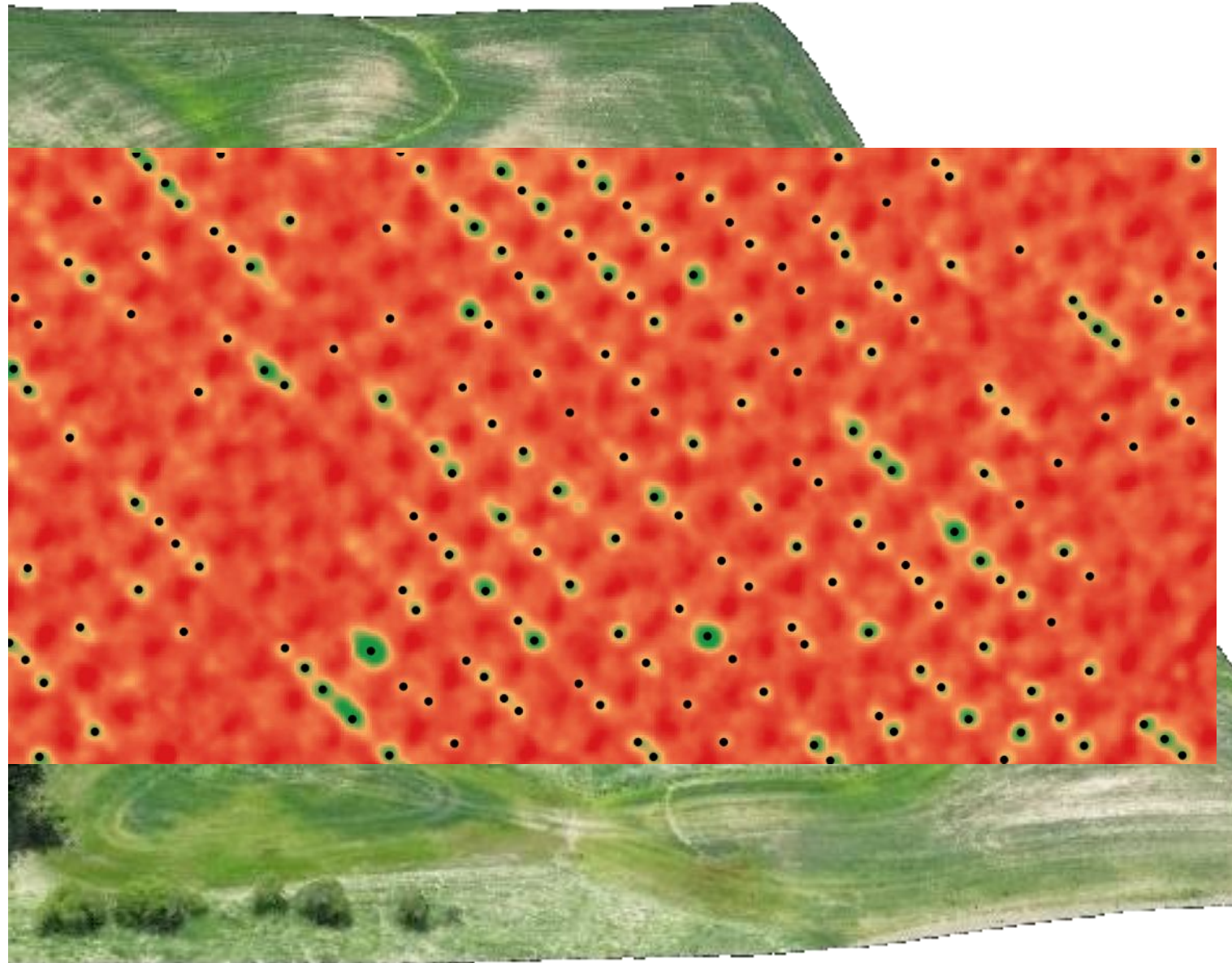
- Acquire Data For:
 - Supporting information for field studies
 - Show vegetation, topography, terrain models, geomorphology, Fires
 - Calculate baseline physical, biological, and cultural surveys



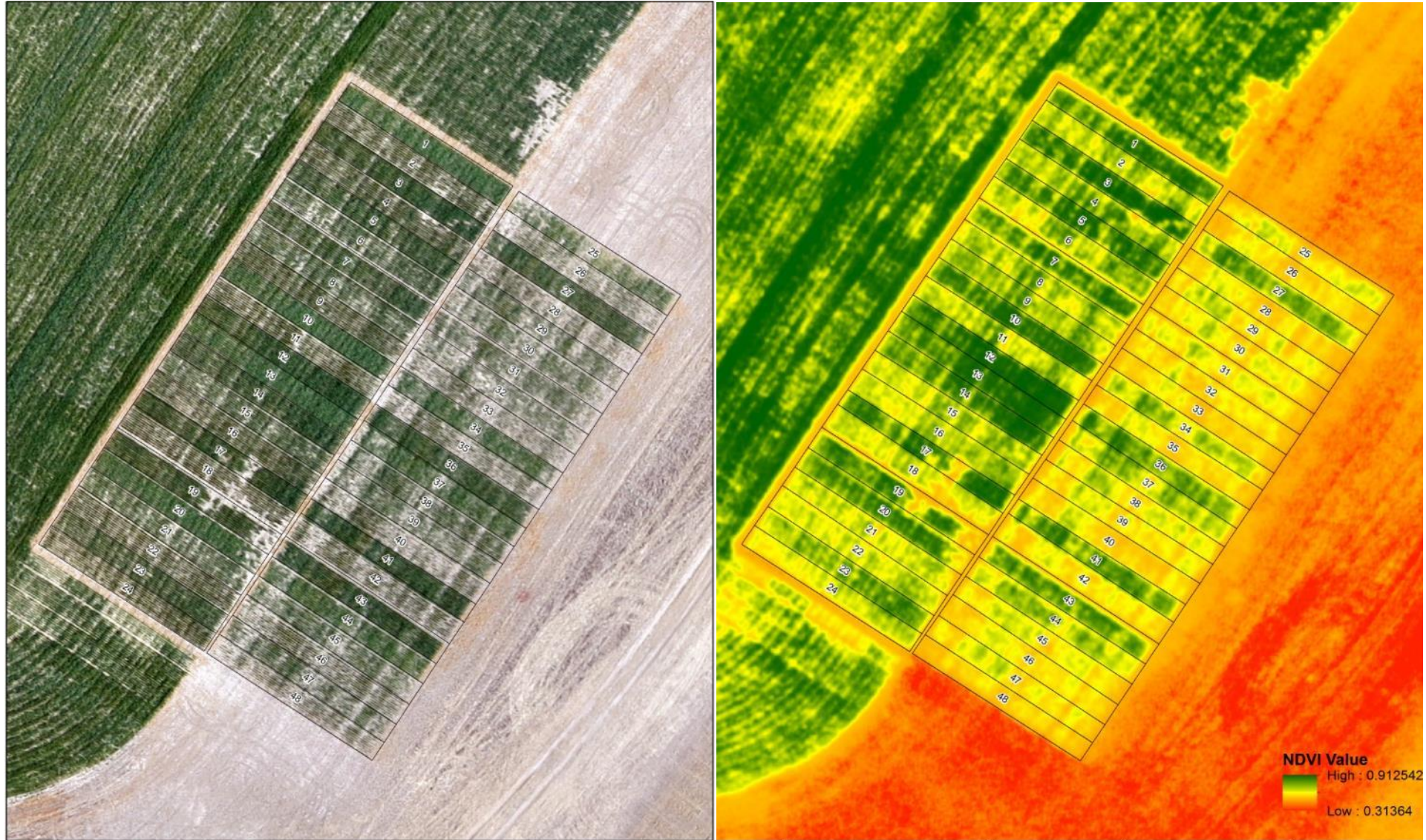


Agriculture

- Data Products Developed:
 - Georectified Mosaics
 - Vegetative Index Analysis
 - Statistical Analysis
 - Digital Surface Models
 - Plant Counts
- Used for:
 - Early Spring Information
 - Replant Recommendations
 - Identify Machine Issues
 - Crop Stress
 - Weed/Disease Detection
 - Chlorophyll Concentration
 - Nitrogen Uptake
 - Comparative Moisture Levels

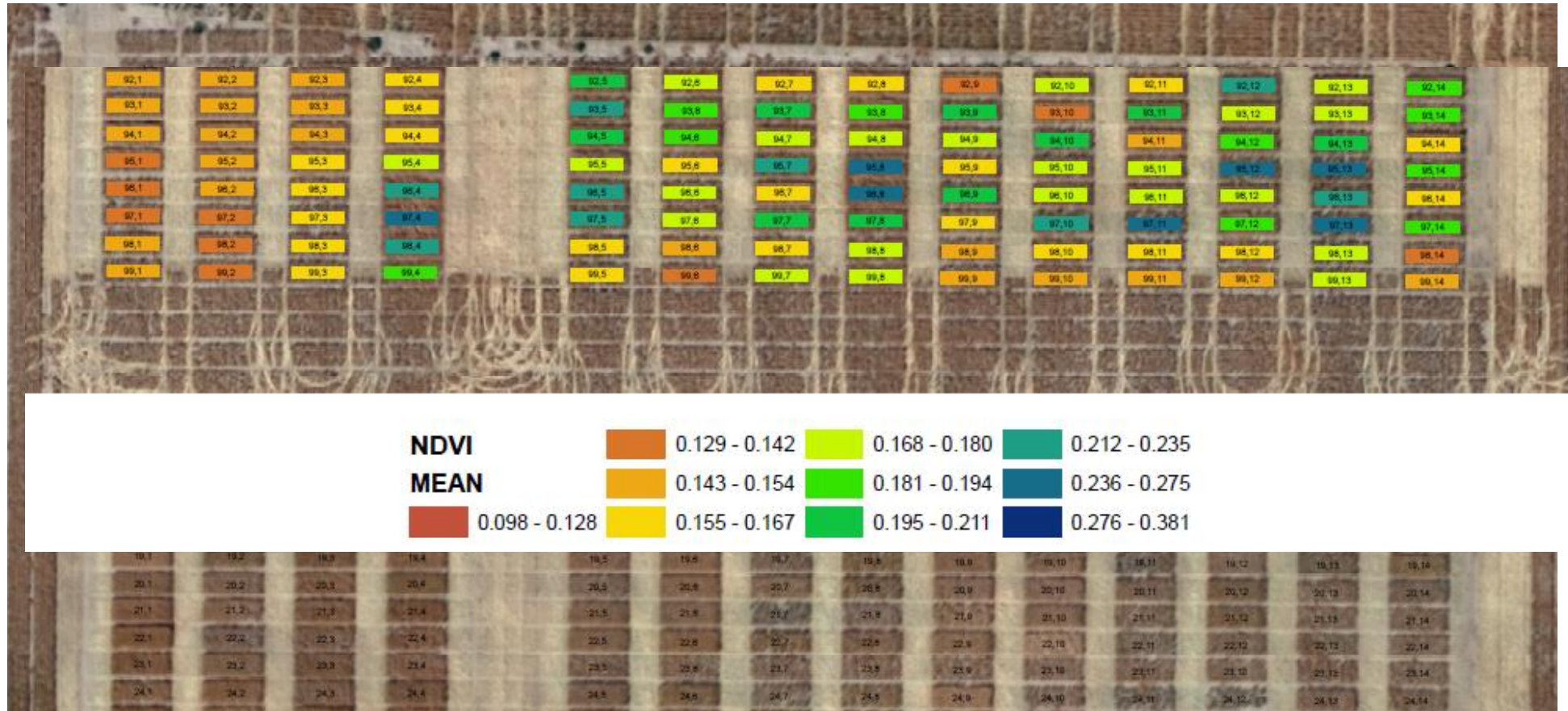


Wheat Test Plots



Statistical Analysis

- Each plot is located and numbered
- An average NDVI value is calculated for each test plot



Benefits

- Rapid deployment
- Cover large areas
- Results in as little as 12 hours
- Data ingested by agricultural software for prescription
- Relatively inexpensive

IGEM

- A \$161,000 grant from the Idaho Department of Commerce's Idaho Global Entrepreneurial Mission (IGEM)
- U of I, INL, Empire Unmanned and zData.
- Phase 1 focuses on improving technologies for acquiring and processing UAS data and distributing that data to end users.

Questions?

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