DOCKETED

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ceresimaging

We use aerial spectral imagery to optimize water and nitrogen

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209-471-1118

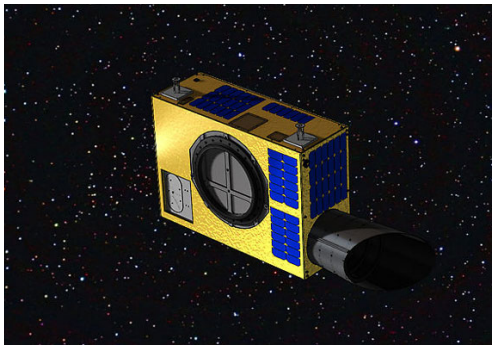
Ceres Provides imagery *as a service*

- **Efficient Data acquisition:** Partner with local aircraft services to acquire imagery

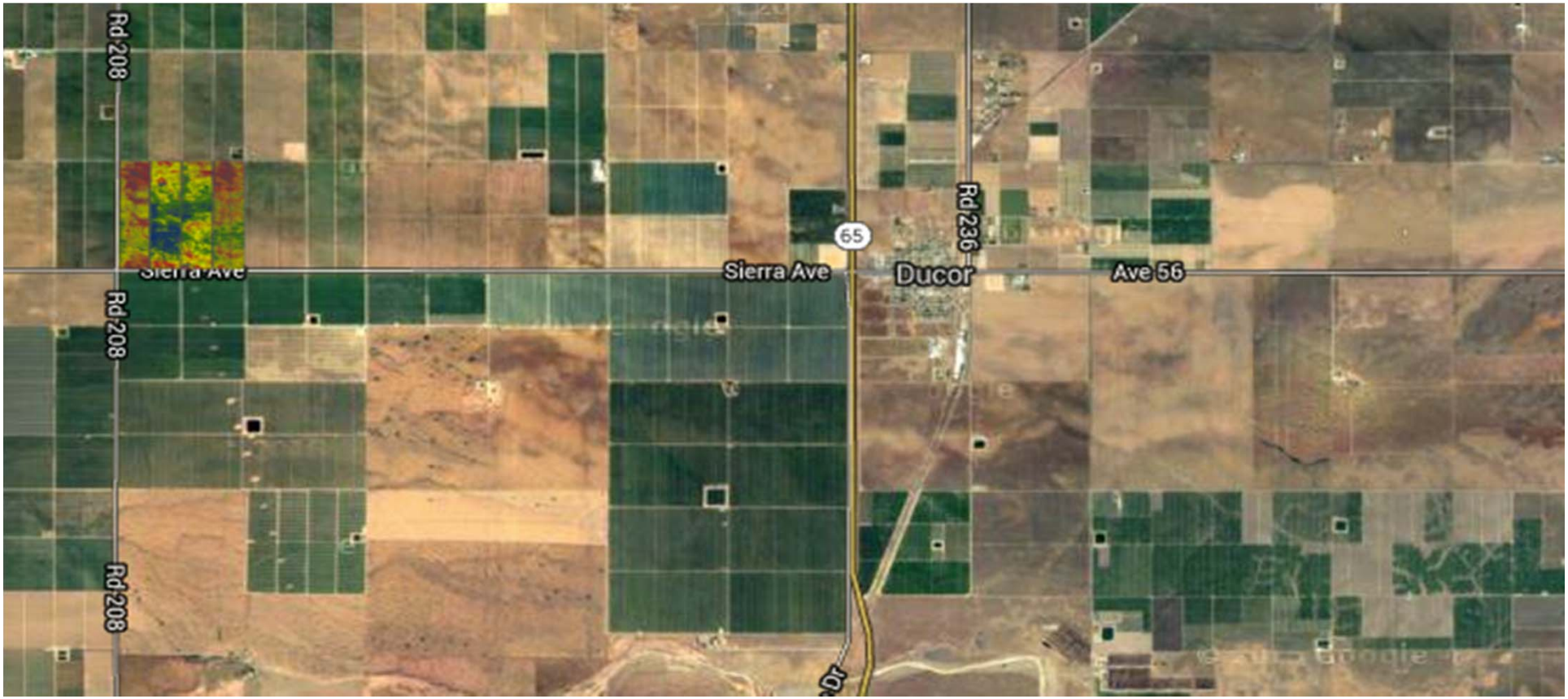
- **Rigorous processing and image analysis:** Developed next generation imaging products – water stress, chlorophyll
  - Validated through UC Cooperative Extension, UC Davis, Australian research partners

- **Market Success:**
  - 200,000+ acres flown, 3,000%+ ROI

Three imaging platform options

Drone	*Satellite*	*Airplane*
		
$1.00-10.00+ per acre	Cents per acre	$0.20-5.00 per acre
1 to 200 acres	50,000+ acres	200 to 10,000 acres
Legal issues, high resolution	Low resolution Suboptimal frequency	High resolution

Our Market: Success with Broad Commodities, Locations, and Crop Sizes

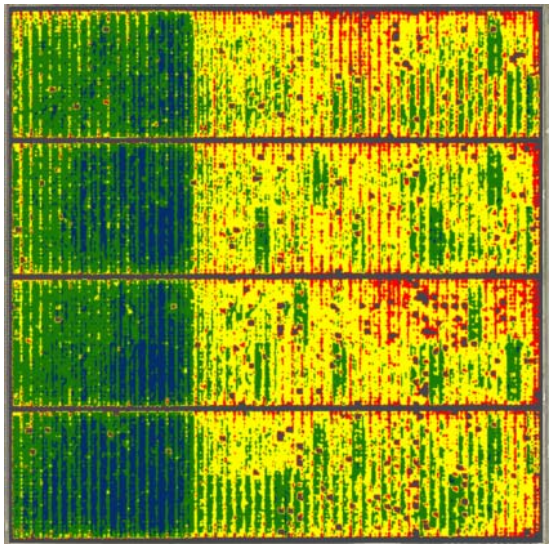


- **Crop Clientele:** Walnuts, Almonds, Grapes, Pistachios, Peaches, Cherries, Tomatoes, Corn, Cotton, Alfalfa, Sweet Potatoes, Cattle, etc.
- **Crop size Range:** 30 acres – 30k+ acres
- **Location:** Aerial imaging enables accessibility of coverage to geographically diverse terrain (North Coast), expansive fields (500 acres+), and non-contiguous blocks

Solution: We measure water stress, canopy vigor, and chlorophyll

160 acre almond orchard

Water stress



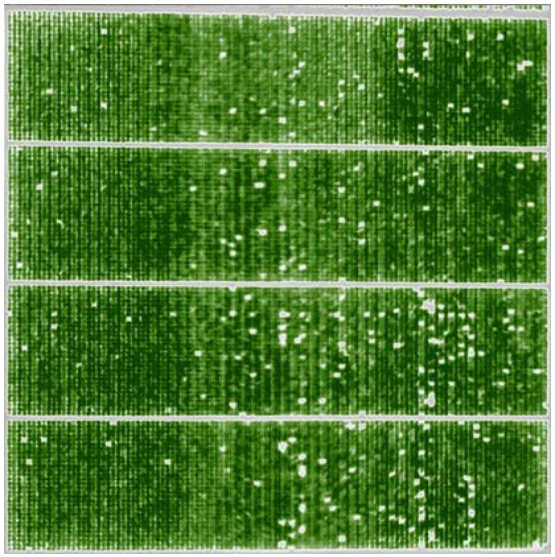
High

Moderate

Low

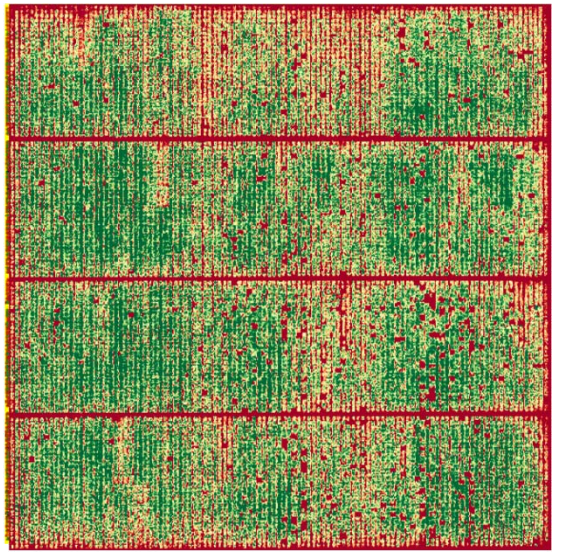
Unstressed

Canopy vigor (NDVI)



Low vigor ⟷ High vigor

Chlorophyll content

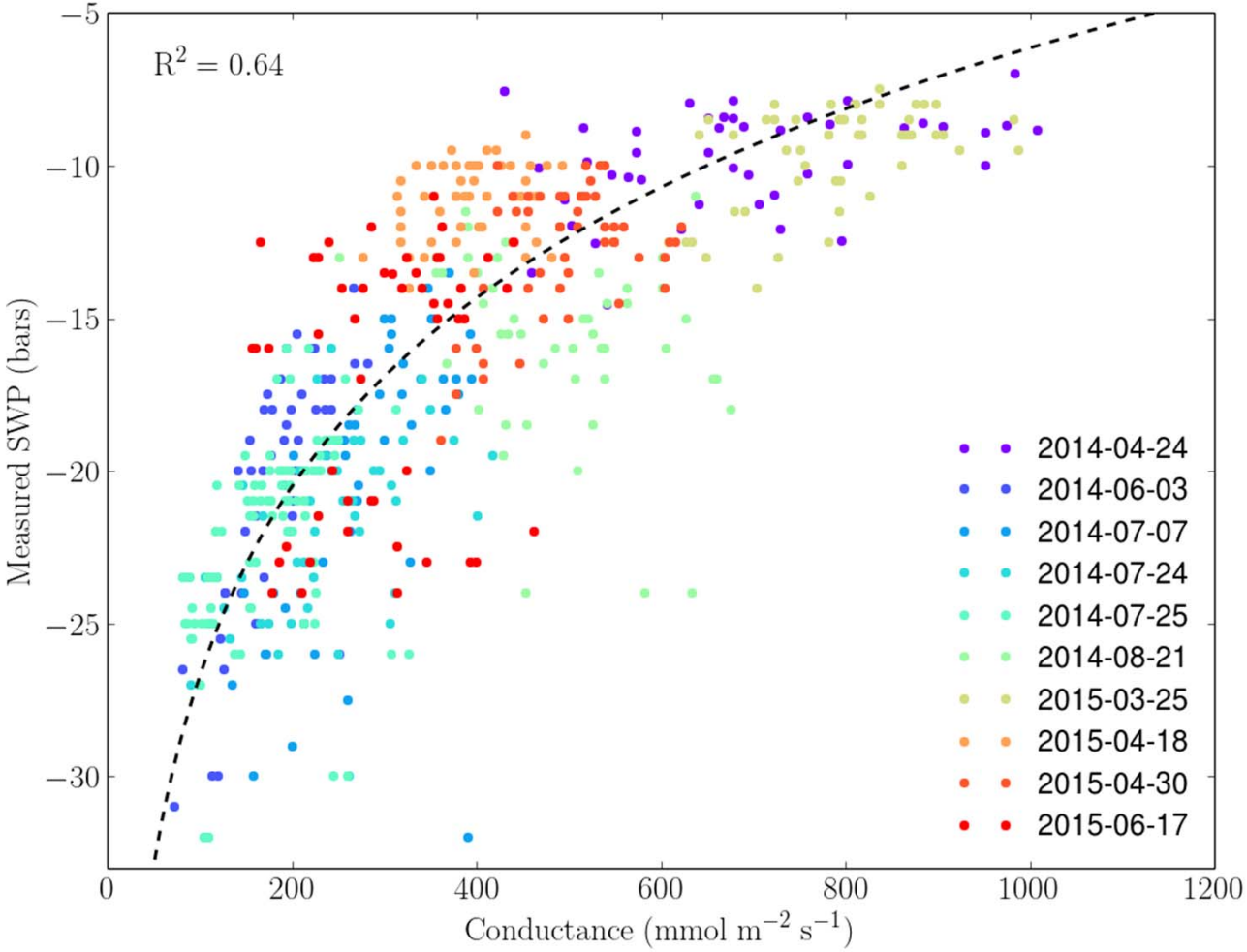


High

Low

Data validation in University of California Cooperative Extension test fields

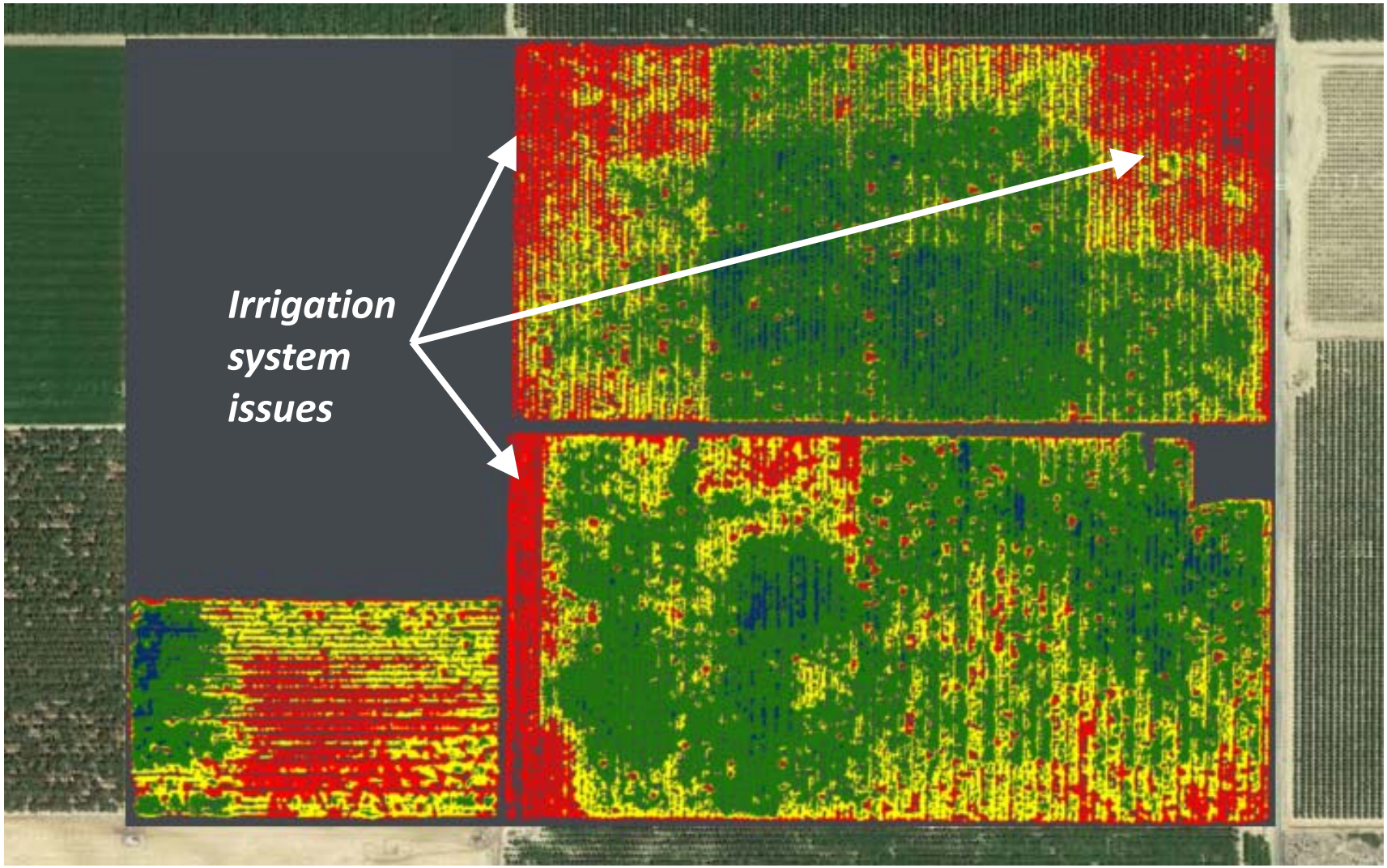
Aerial measurements vs UC Davis ground truth data



Strong relationship between conductance and Stem Water Potential

Conductance measured with aerial thermal data and local weather data. SWP readings taken by UCCE technicians.

Distribution uniformity – 160 acre almonds



Stem water potential
(negative bars)

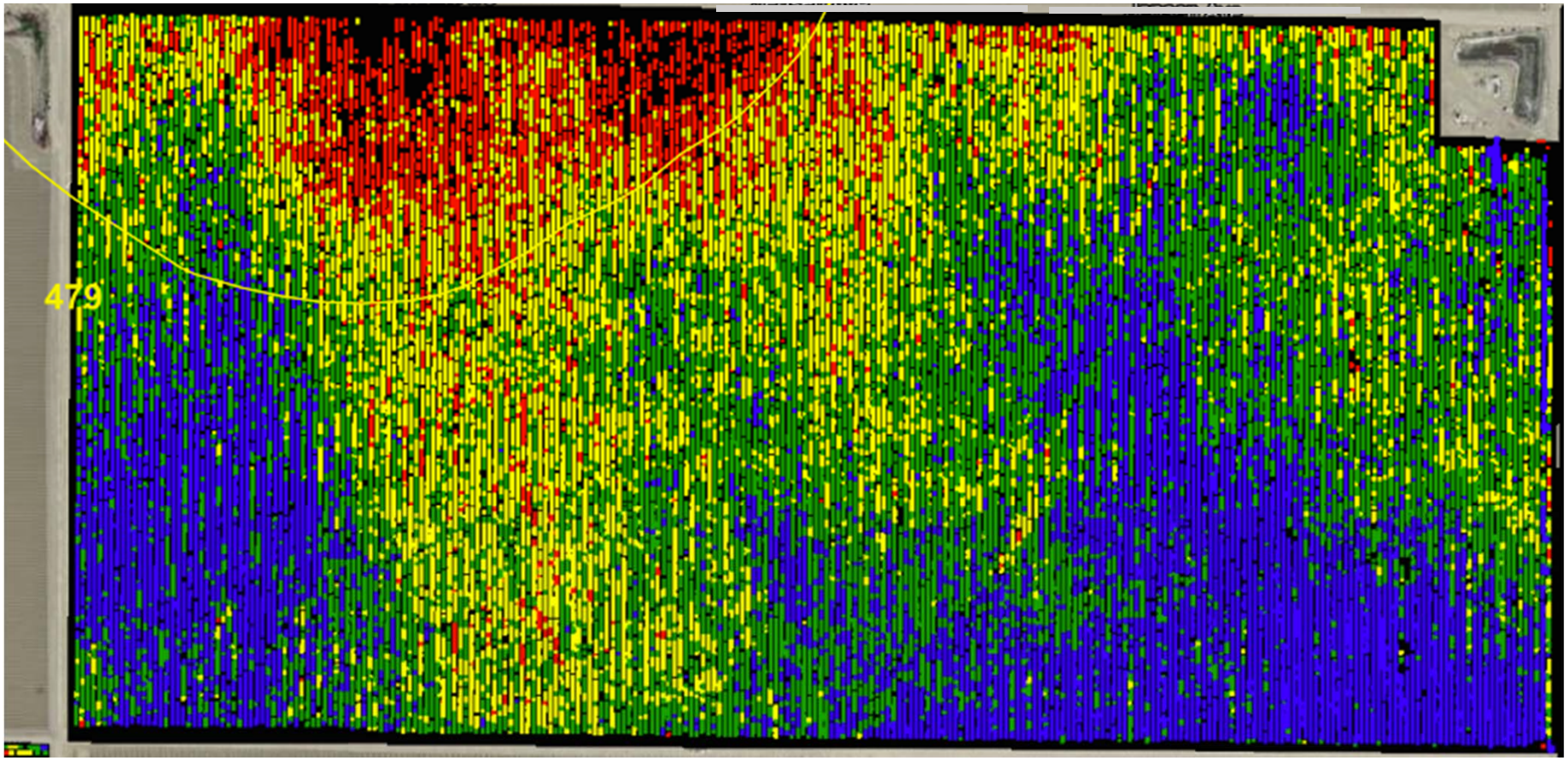
20-24 16-20 12-16 8-12

Soils issue – 80 acre vineyard

Water stress imagery

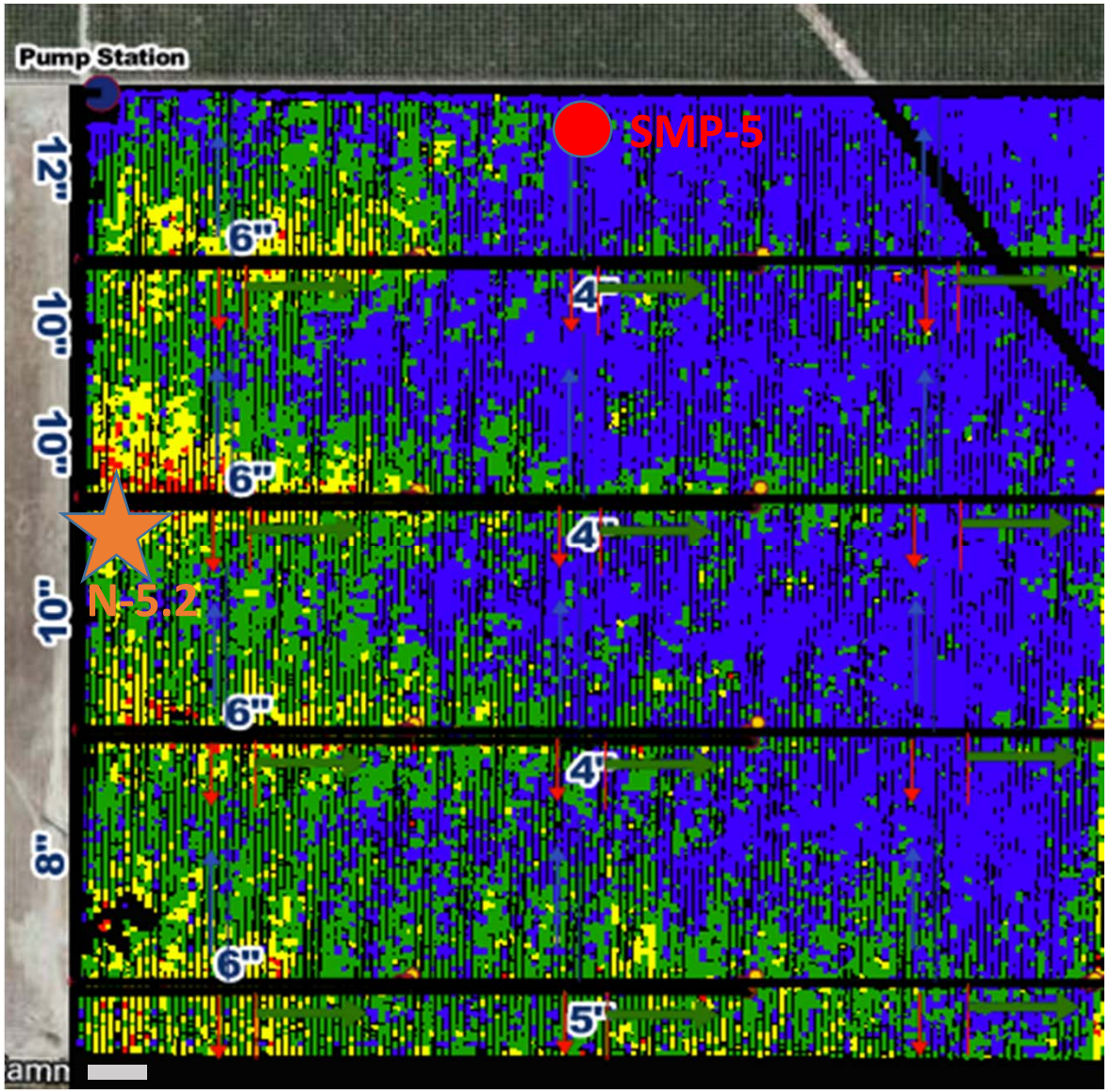
479
Unit Name: Cerini clay loam, 0 to 2 percent slopes
Available Water Storage (0-100cm): Excelsior 17.18 cm
Drainage Class: Kimberlina Well drained

459
Unit Name: Ciervo clay, 0 to 2 percent slopes
Available Water Storage (0-100cm): Ciervo 16.69 cm
Drainage Class : Cerini Moderately well drained



Maps orient our decision-making

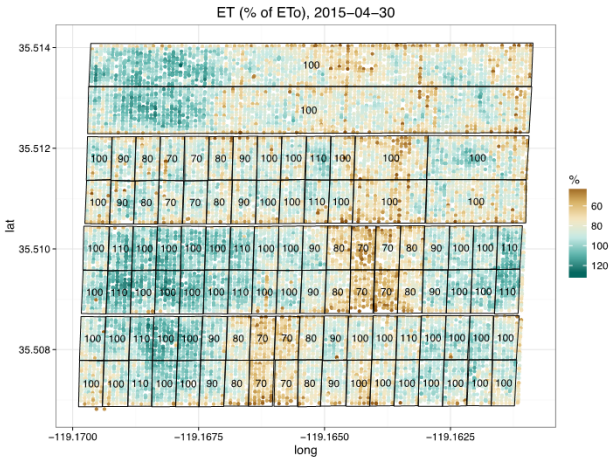
- Targeted sampling locations
- Soil changes
- Zone management
- Quantify economic opportunities



Roadmap: Next-generation product development

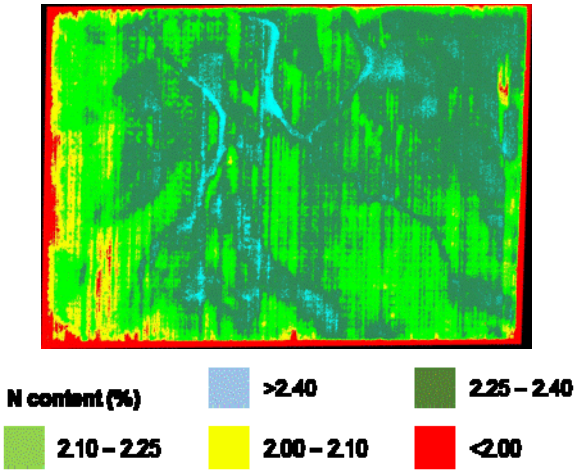
Irrigation recommendations

Evapo-transipration and irrigation crop coefficients



Major and micro-nutrient estimates

NPK and key micronutrients



Yield prediction

Collaboration with Patrick Brown / UC Davis: yield model uses imagery, agronomic, and environmental data