Opportunities for Improved Crop Management Using Remote Sensing

December 17, 2015
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UAV's in the News!

- What is a UAV?

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UAV's in the News!

Drone ace has day in court

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Photo by Joe Pruski

Posted: Friday, October 9, 2015 9:16 am

By Joe Pruski | Associate Editor | 0 comments

A Windsor man accused of using an unmanned aerial vehicle (UAV) to harass residents in a DeForest neighborhood last May was found guilty on five of six municipal citations Sept. 30 in DeForest.

Alexei Strelchenko, 29, was found guilty on four disorderly conduct citations and a citation for unlawful use of a drone after a nearly four-and-a-half hour bench trial that featured nine witnesses.

The citations came in response to numerous residents reporting that a drone was flying near their windows and observing them on their private property.

Strelchenko, who lives in Windsor, was reportedly visiting his father on Campbell Hill Ct. and was operating the UAV from that location.

Drone Trial

UAV's in the News!

DJI Introduces Company's First Agriculture Drone

by Press • 27 November 2015

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DJI, the world leader in unmanned aerial vehicle technology, Friday announced the launch of a smart, crop-spraying agricultural drone.

The DJI Agras MG-1 is dustproof, water-resistant and made of anti-corrosive materials. It can be rinsed clean and folded up for easy transport and storage after use.

The eight-rotor Agras can load more than 10 kilograms of liquid for crop-spraying and can cover between seven and 10 acres per hour. It is over 40 times more-efficient than manual spraying. The drone can fly up to eight meters per second and adjusts spraying intensity to flying speed, ensuring even coverage.

"The launch of DJI's agricultural drone displays our unmatched knowledge base and development skills," said DJI CEO and founder Frank Wang. "With this new product, we've shown that DJI can not only offer the ultimate aerial experience for the mass consumer, but also improve the efficiency of production and benefit so many others in all walks of life."

- > 10 kg (22 lb) load capacity
- Cover 7 – 10 ac/hr
- 40 times more efficient than manual spraying*
- 8 m/s (18 mph) while spraying*

UAV's in the News!

TECH DRONES

Tokyo Police to Deploy Net-Carrying Drone to Catch Rogue Drones

Keith Wagstaff / NBC News
Dec. 11, 2015

The security measures come after a drone with minute traces of radiation was found

Tokyo police are hoping to snare rogue drones with a net carried by its own unmanned aerial vehicle.

Bloomberg / Getty Images

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UAV's in the News!

Holiday drone sales are big boon for producers

Jacob Pramuk | @jacobpramuk
Tuesday, 17 Nov 2015 | 12:49 PM ET

CNBC

Forget the sounds of crumpling wrapping paper, loud video games or musical instruments during the holidays. More parents this year will be dealing with drones buzzing around their homes.

Roughly 700,000 drones are expected to ship in the United States in 2015, a 63 percent increase from the previous year, according to the Consumer Electronics Association. About 7 percent of consumers surveyed plan to purchase a drone as a gift this year, a "pretty significant" portion, said Steve Koenig, director of industry analysis at the CEA.

Drones — known as unmanned aerial vehicles — have become more popular for recreation, so much so that regulators are scrambling to keep track of them in case of misuse. As more prominent tech companies sell consumer craft, some fast-growing producers stand to reap the benefits of holiday fervor.

UAV's in the News!

Drones

FAA drones task force recommends online registration system

By Mark Rockwell Nov 23, 2015

The owners of small aerial drones will have to register with the Federal Aviation Administration, based on the recommendations the Unmanned Aircraft Systems Registration Task Force made to the Transportation Department on Nov. 23.

DOT and FAA formed the task force of public and private stakeholders in October to address increasingly common close encounters between large aircraft and small, privately owned drone aircraft.

The agencies wanted to make the case that operating private drones in national airspace is potentially dangerous and that they need to be able to trace drones back to their owners in the event of a mishap with a larger aircraft or other incident.

- Announced 12/14/15!
- Registration website live 12/21/15
- Free for first 30 days…$5 per operator afterwards
- Registration required by 2/19/16
- Registration number must be attached to aircraft
- Civil and criminal enforcement for non-compliance.
- www.faa.gov/uas/registration

B4UFLY App!

Carrier
4:19 PM
Update
Map
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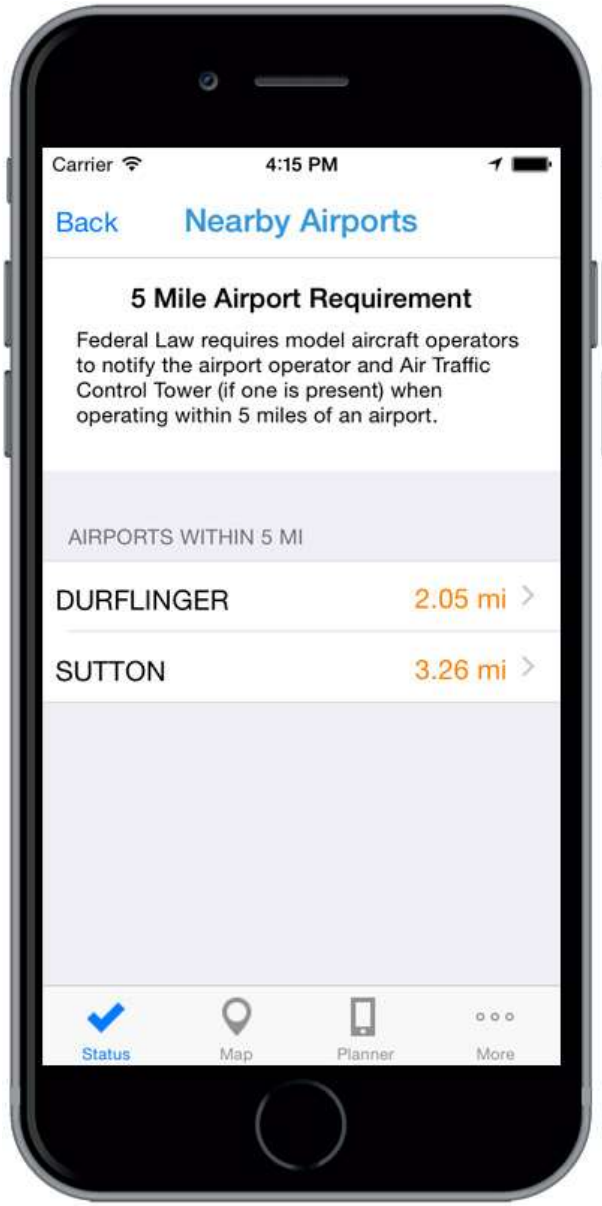
Carrier
4:15 PM
Back
Nearby Airports
5 Mile Airport Requirement
Federal Law requires model aircraft operators to notify the airport operator and Air Traffic Control Tower (if one is present) when operating within 5 miles of an airport.
AIRPORTS WITHIN 5 MI
DURFLINGER 2.05 mi
SUTTON 3.26 mi
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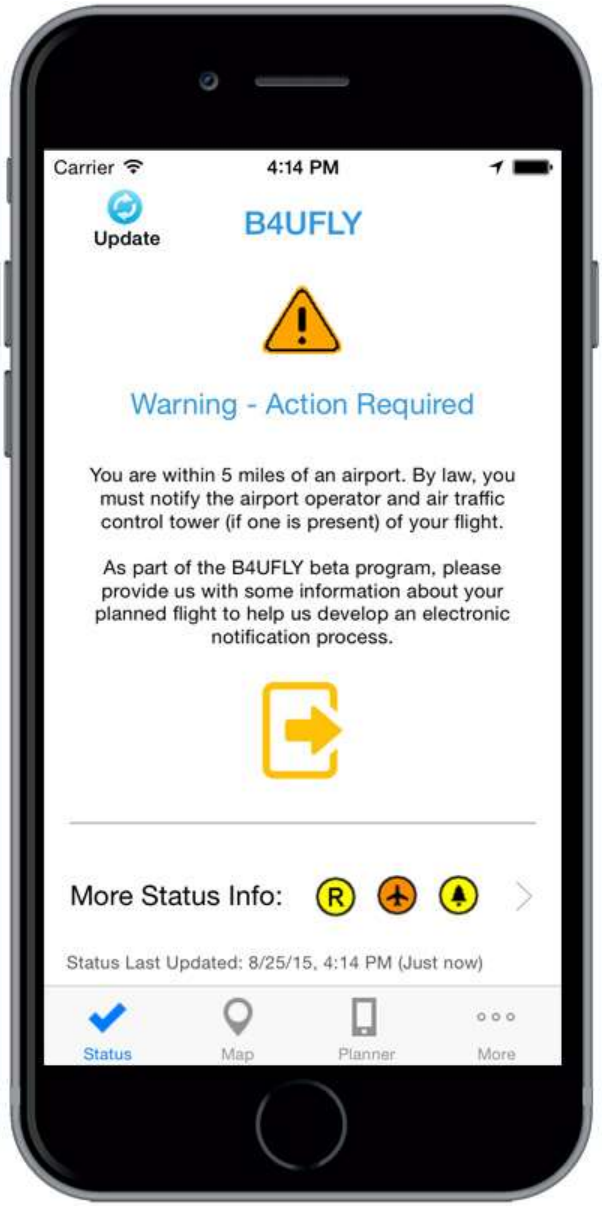
Carrier
4:14 PM
Update
B4UFLY
Warning - Action Required
You are within 5 miles of an airport. By law, you must notify the airport operator and air traffic control tower (if one is present) of your flight.
As part of the B4UFLY beta program, please provide us with some information about your planned flight to help us develop an electronic notification process.
More Status Info:
Status Last Updated: 8/25/15, 4:14 PM (Just now)
Status
Map
Planner
More

UAV's in the News!

GoFlyZone

A community-based flight planning and management system for small UAS operations that is scalable across the globe.

GoFlyZone will empower small UAS operators to fly safely, obey the law, and focus on the enjoyment, profit, or public benefit that comes with un- manned aircraft. We aim to provide services that allow operators to clearly see how regulations, weather, man-made hazards, and the limitations of the UAS itself affect the operations of small UAS. Through data management and networking tools, we strive to bring transparency, efficiency, and simplicity to unmanned aircraft operations.

A PROTOTYPE SYSTEM IS CURRENTLY IN TESTING THAT INCORPORATES:

- Desktop and mobile device interfaces
- A central flight management server
- Push notifications to end users

MARKET OPPORTUNITY

Online retailers are shipping an estimated 2,000-15,000 sUAS a month. It is currently estimated that 500,000-750,000 sUAS, are currently flying in the U.S. airspace. Goldman Sachs estimates the sUAS market is worth $1.4B in 2015, but forecasts it to more than triple by 2017. GoFlyZone will offer services that fill the needs of hobbyists and professional operators alike with a connected, community-based sUAS solution that provides safety, data logging, and connections with other users.

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What is remote sensing?

- Measurement or analysis of a phenomena without being in direct contact with it
- Relies on measurement of electromagnetic energy reflected or emitted from objects
- Most common index is NDVI (Normalized Difference Vegetative Index)
- Used to identify:
  - Nutrient deficiencies, disease, water deficiency or surplus, weed infestations, insect damage, hail and wind damage, herbicide damage, plant populations, yield prediction, etc.
  - i.e. Plant Stress

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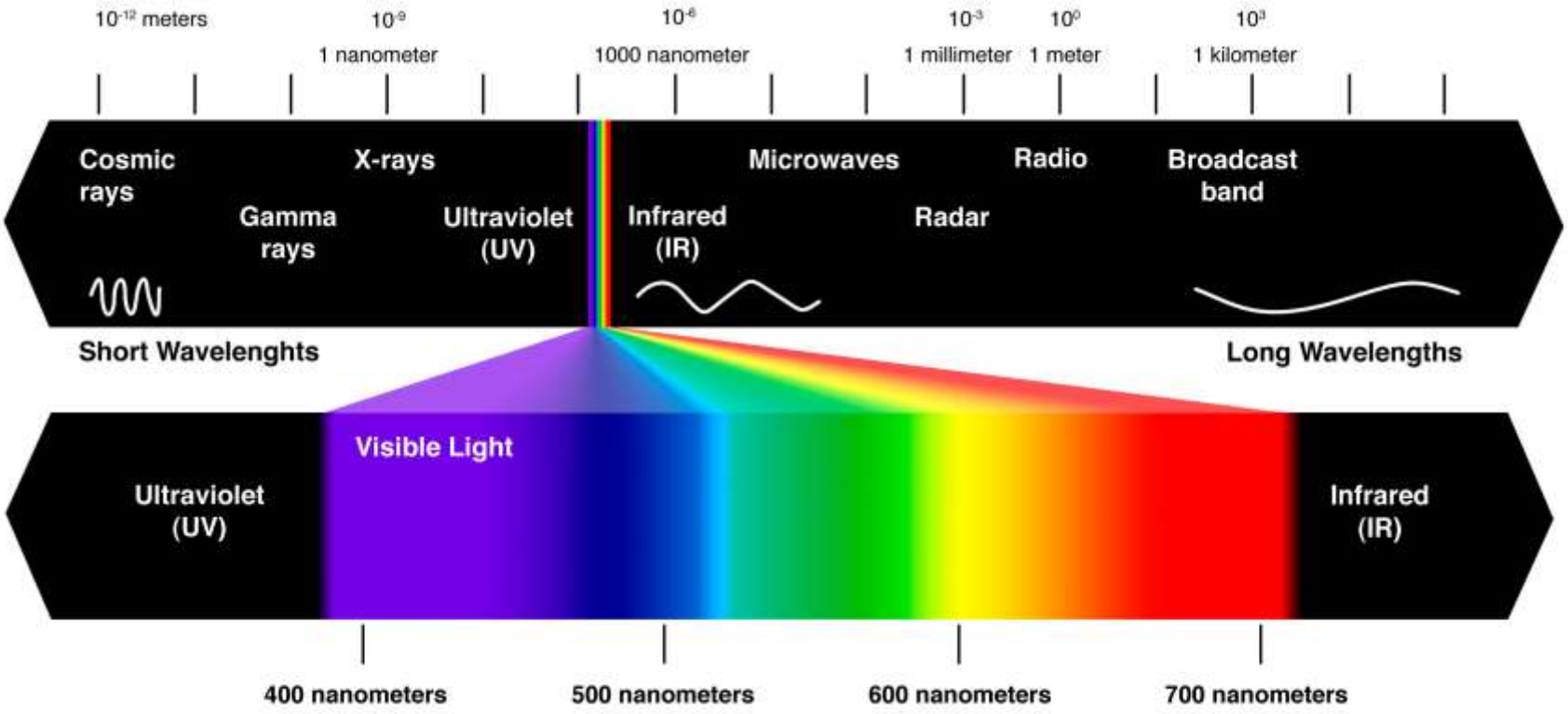
The Light Spectrum



Source: deserthighlandspr.com
Accessed: 2-25-2014

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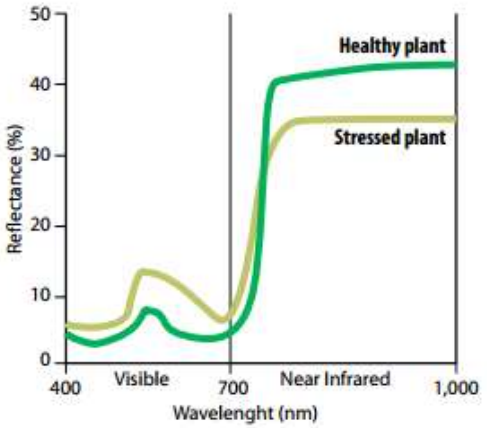
- Plants reflect light differently at differing wavelengths.



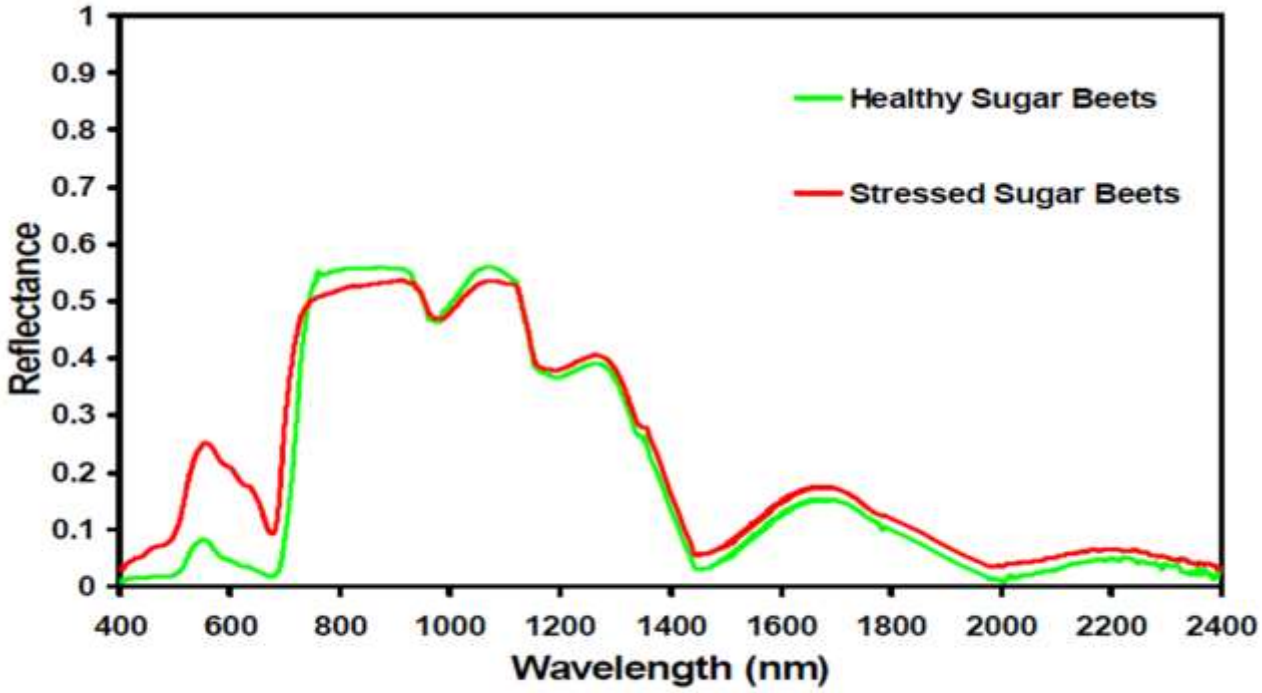


Figure 3. Spectral signatures of healthy and stressed sugarbeets (Kyllo, 2003).

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How is it done currently?

- Normalized Difference Vegetation Index (NDVI)
- $NDVI = \frac{L_{NIR} - L_V}{L_{NIR} + L_V}$
  - L_{NIR} = Near Infrared (0.725 – 1.10 µm)
  - L_V = Visible (0.58 – 0.68 µm)
- Values range from -1.0 – 1.0
  - Rock, sand, snow = < 0.1
  - Dense vegetation = 0.6 – 0.9

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Types of sensors

- Passive Sensors
  - Sun provides energy source
  - Sensor measures energy reflected
- Active Sensors
  - Provide their own light source
  - Must be in somewhat close proximity to subject
  - Less affected by ambient conditions
- Most sensors account for incident solar radiation present

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Issues with Remote Sensing

- Capability to measure crop health/vigor in real time
- Current machinery can only go over the crop so many times
  - Too tall
  - Compaction
  - Etc.
- Temporal variations are the most beneficial pieces of information from remote sensing

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Crop isn’t too tall anymore!

Different Types of UAV's

What can be gained?

- Information at times during the growing season that we have not previously had access except on foot
- Information about plant stress over time within the growing season
- Opportunities to adjust inputs for profit optimization over the entire growing season!

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Data and Data Analysis

- Types of data
  - Point Data (i.e. Lat, Long, Value)
  - Image Data
- Calibration
  - Sensors require calibration
  - Cameras require reference measurements for calibration as well
- Data transfer
  - Manual?
  - Automated?
  - Wireless?

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Data and Data Analysis

- Software
  - Most UAV's come fitted with software to analyze the data that they collect
  - Question where the data is stored
    - On UAV
    - PC
    - Cloud
- Can the results of this analysis be imported into my current GIS package?
- Are there any conversions that need to take place before the data will match up and make sense?

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Final Thoughts

- UAV data collection will provide us more information about our crops than we have ever had before
- Implementation
  - Two different types of UAV's for efficiency
  - Data transfer and analysis – streamline
  - Follow-up spot check to confirm analysis
  - Identify minimum effective delay between flights

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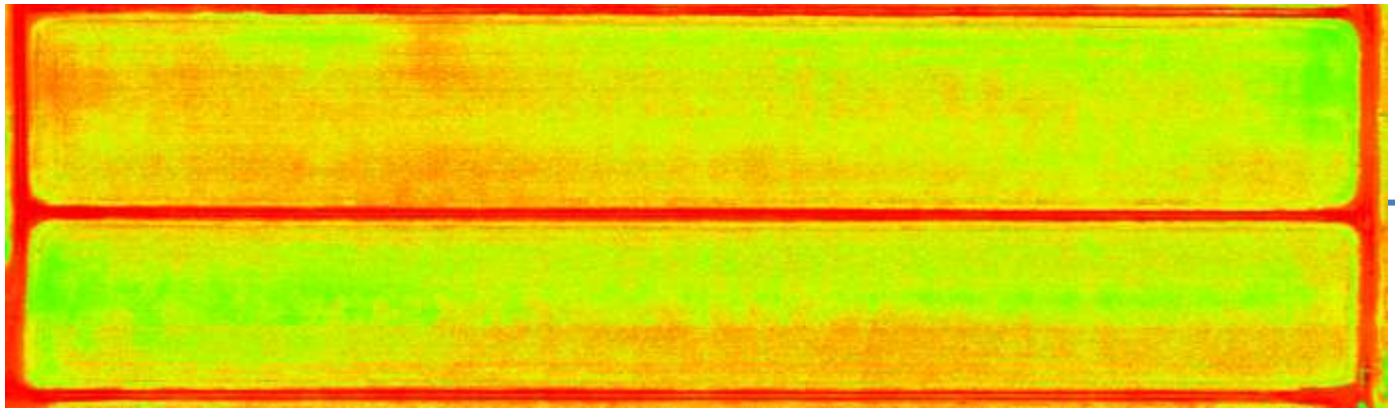

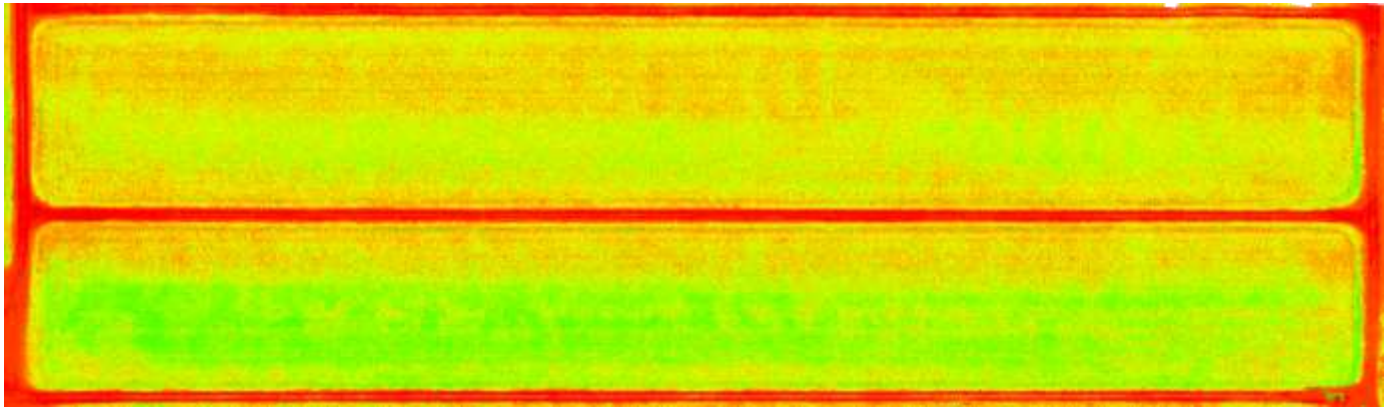

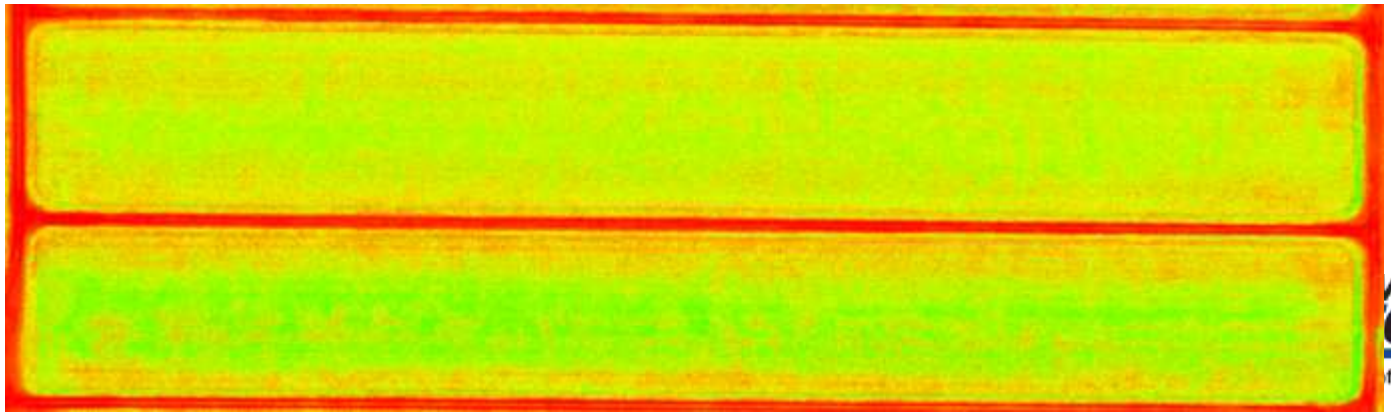

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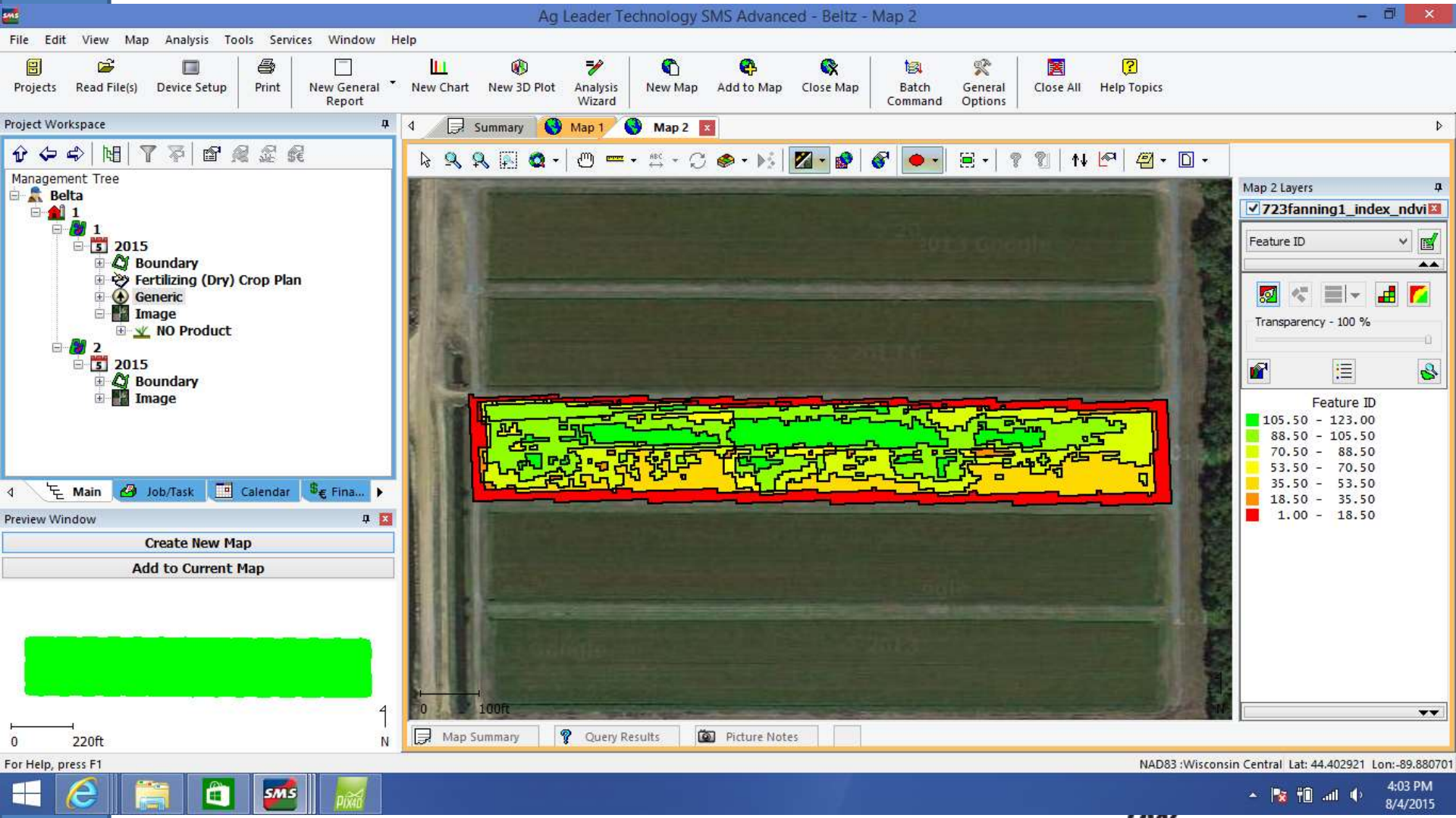
Current Research



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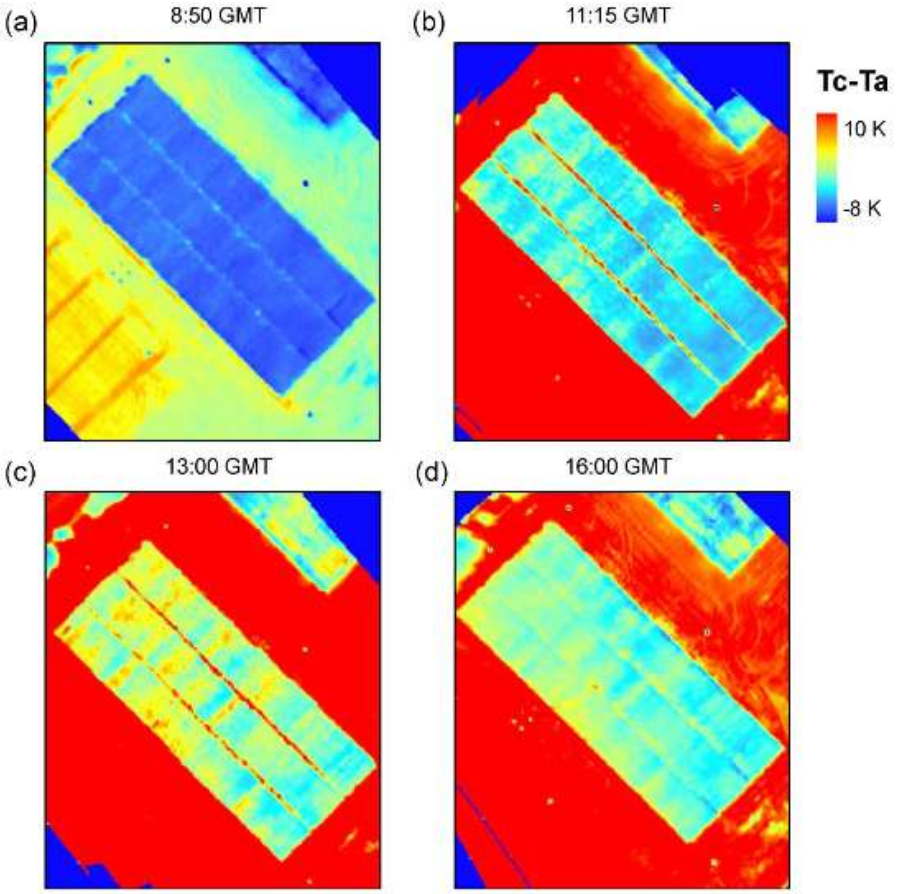
Thermal Imagery

- Good indicator of water stress
- Also plant respiration
- Difficult to measure accurately
  - Relative differences
- Could provide good information for irrigation scheduling



esa
space solutions
FREE ACCURACY,
WIDELY AVAILABLE
Satellite
Navigation

AEROLUTION GmbH
UAS FOR AGRICULTURE & FORESTRY
SB 500AG

greenbird
RUCON
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RUCON
engineering

Bonus Material…

- More from AgriTechnica!

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Promoting success in agriculture for farmers and farm families affected by disabilities

AgrAbility of Wisconsin is a cooperative partnership between The University of Wisconsin-Extension and Easter Seals Wisconsin. AgrAbility of Wisconsin exists to assist farm workers and farm families affected by disabilities by providing education, technical assistance, on-site consultation services, and identification of potential funding resources. Since 1991 we have served over 2,000 clients with a 97% success rate- meaning that 97% of our clients continue to farm after our services are provided.

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