

AG WATER EFFICIENCY PROGRAM



Kevin Young-Lai
Assistant Project Manager
January 24, 2022



DRONES



PLATFORMS



Multi-rotor Copters

- ▶ Generally 18-25 minute flight time with
- ▶ Vertical take off and landing
- ▶ Typically < 2 pound payload
- ▶ Can cover > 50 acres per flight



Fixed-Wing

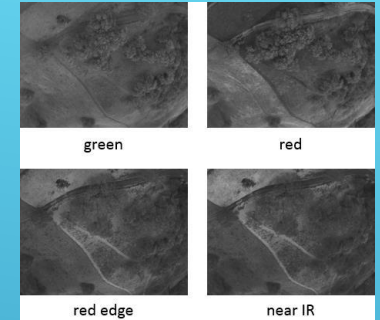
- ▶ Longer flight time (> 40 min)
- ▶ Moves faster and can cover > 100-300 acres per flight
- ▶ Typically can carry more payload
- ▶ Harder to replicate your flight plan

PAYLOADS

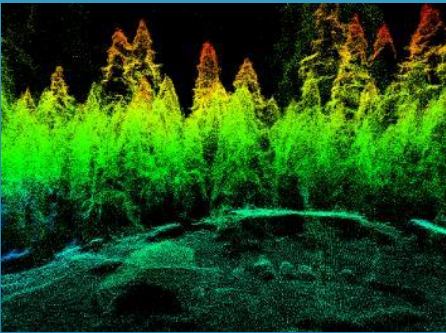
RGB



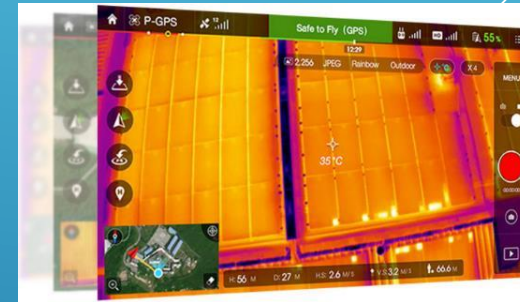
Multispectral



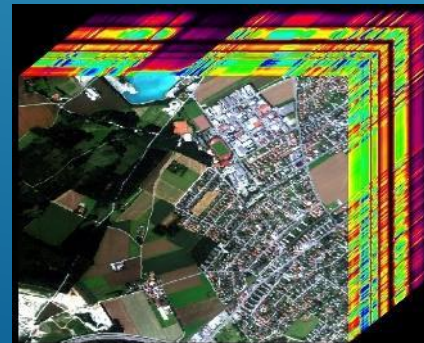
LiDAR



Thermal



Hyperspectral



WHAT KIND OF DRONE WORK DOES SRC D DO?



AERIAL PHOTOGRAPHY AND VIDEOGRAPHY



Glen Cove

**Mostly aerial
photography
and
videography!**



Lake Dalwigk

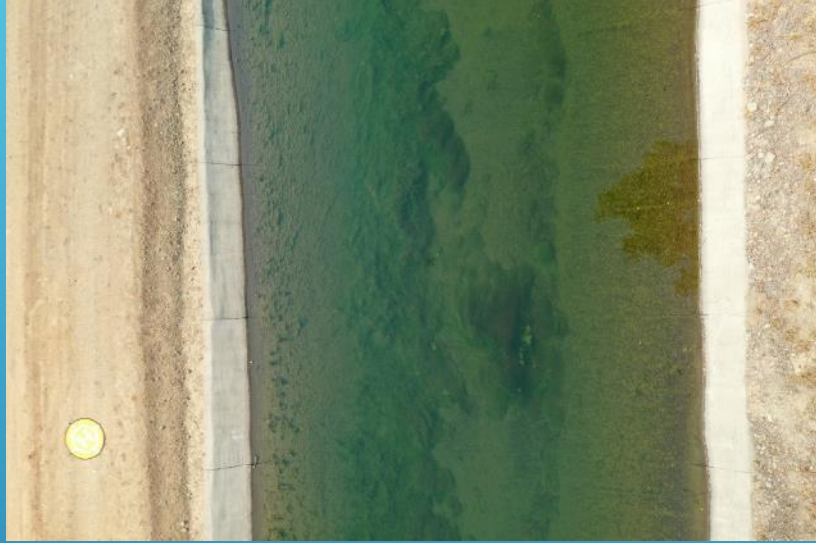


Pond C



Vallejo Waste Water Treatment Plant

PHOTOGRAPHY MONITORING



Algaecide monitoring



Flood monitoring

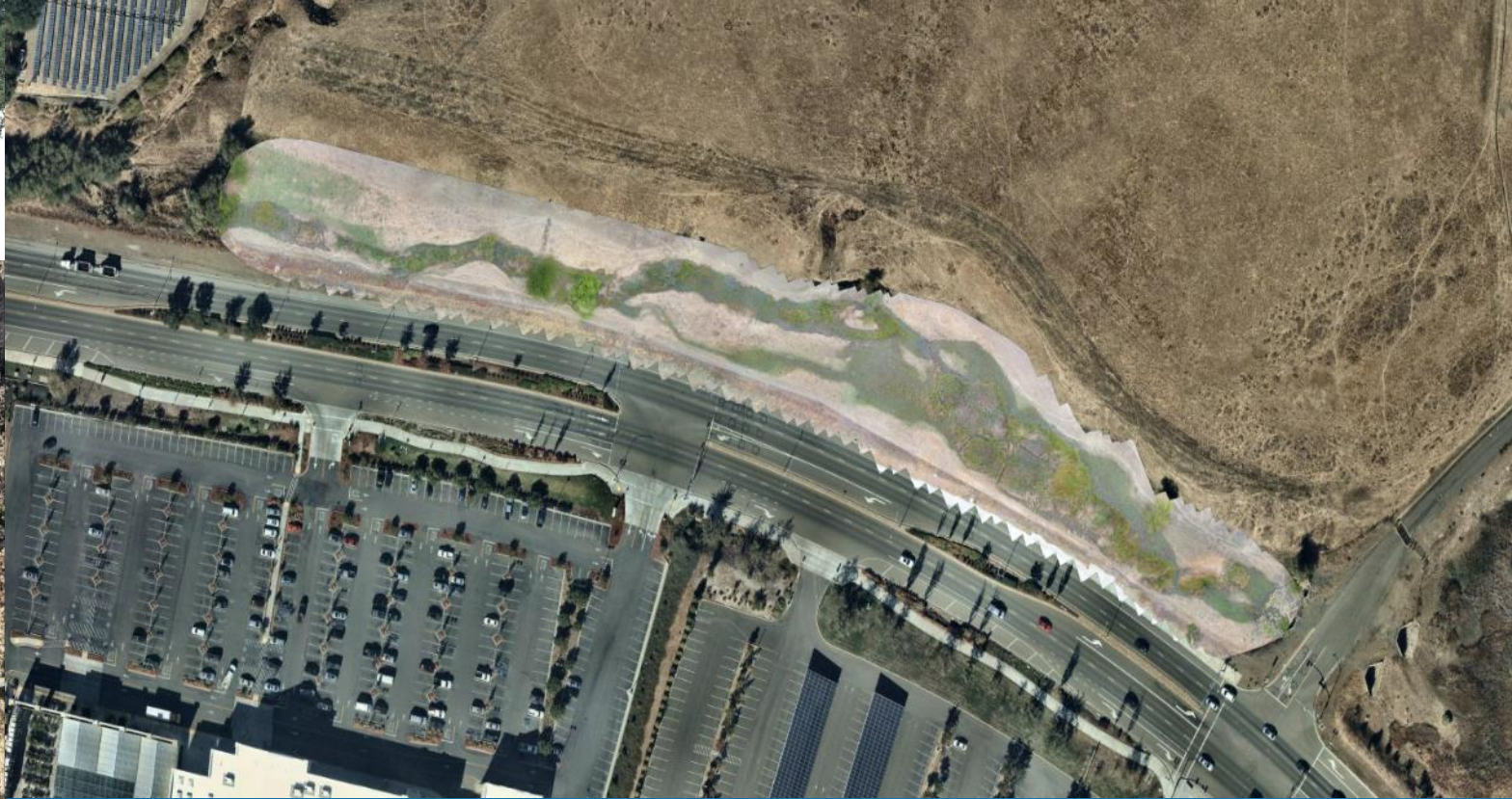
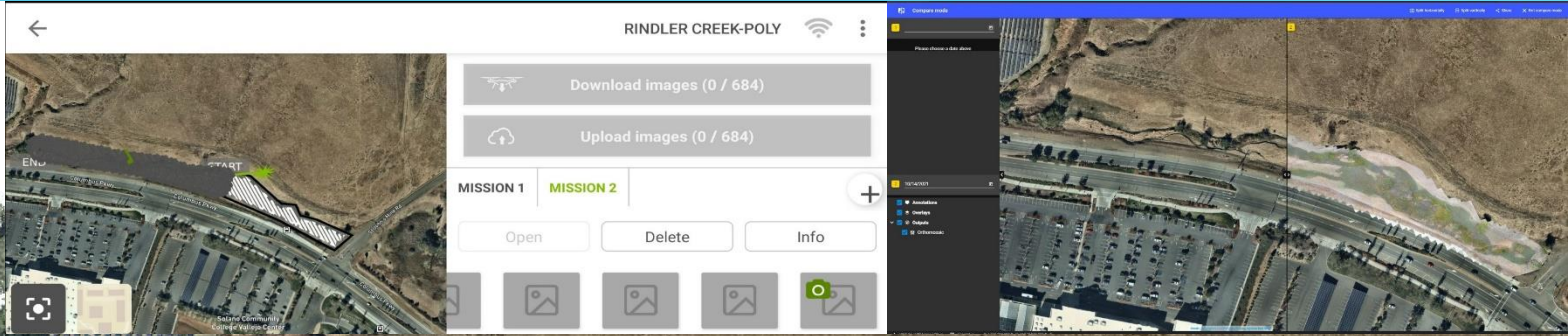
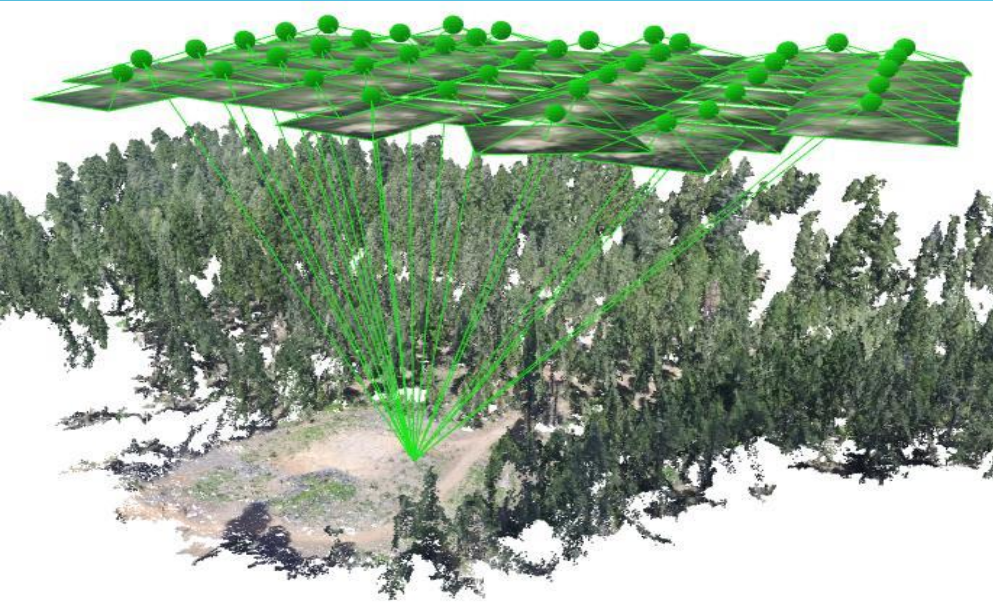


Yolo Arundo monitoring



Yolo Arundo monitoring

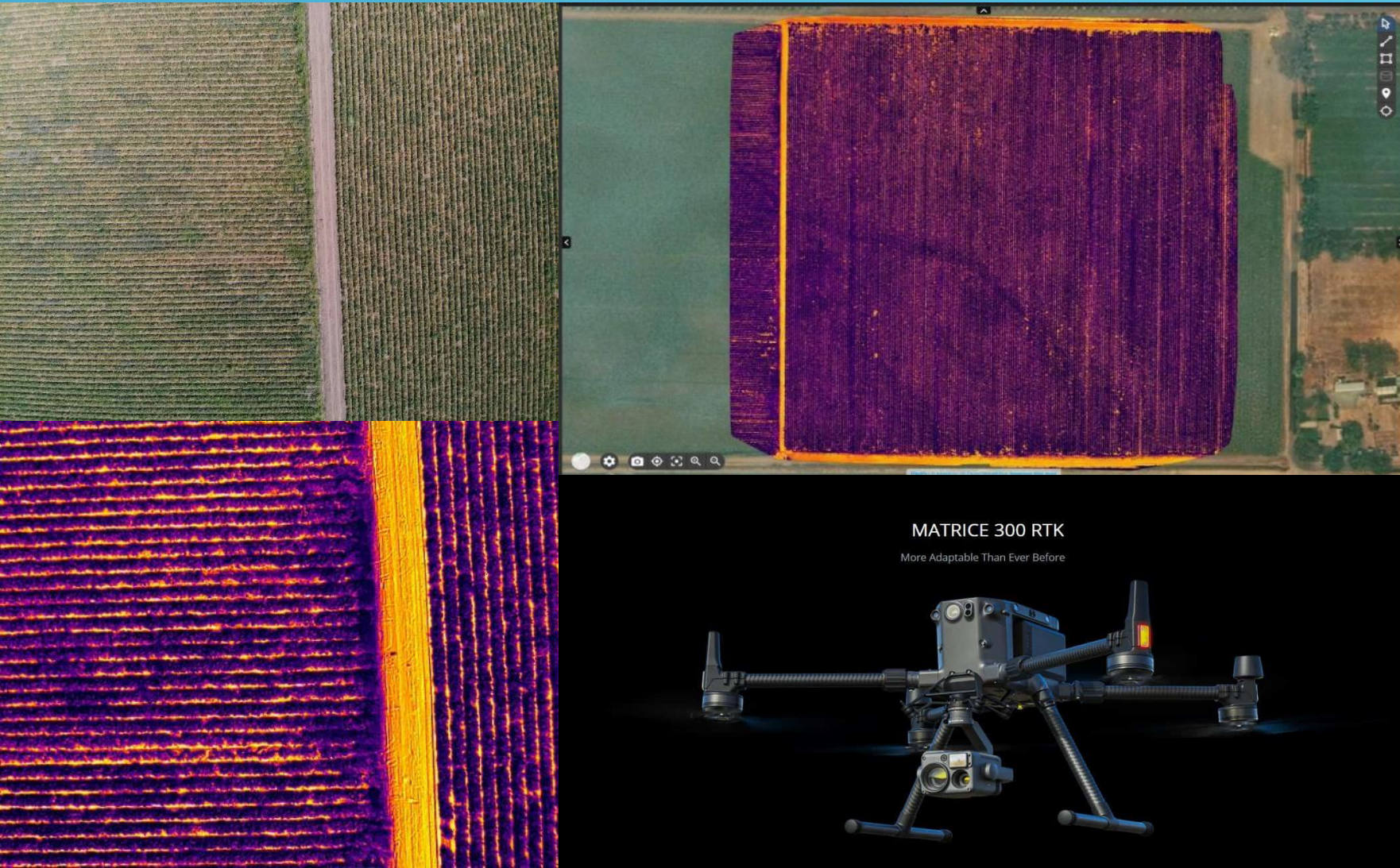
PHOTOGRAMMETRY



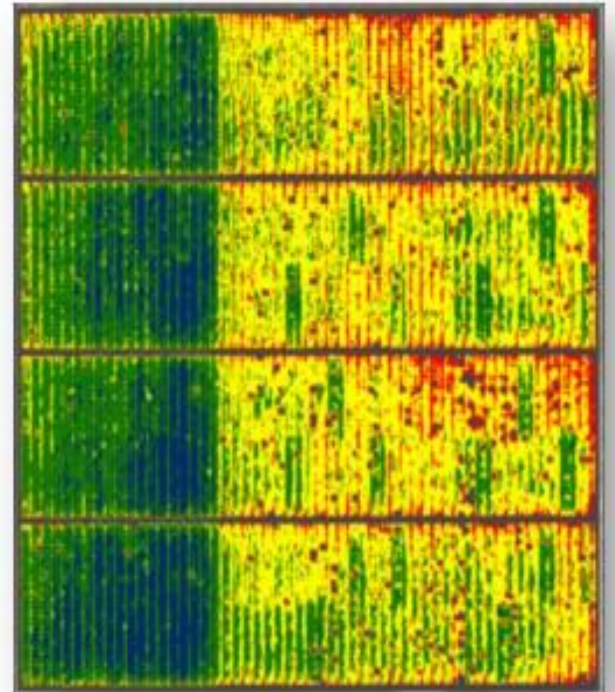
Post-Fire GPS Down Trees

Photogrammetry of Rindler Creek

THERMAL IMAGERY- WATER USE EFFICIENCY

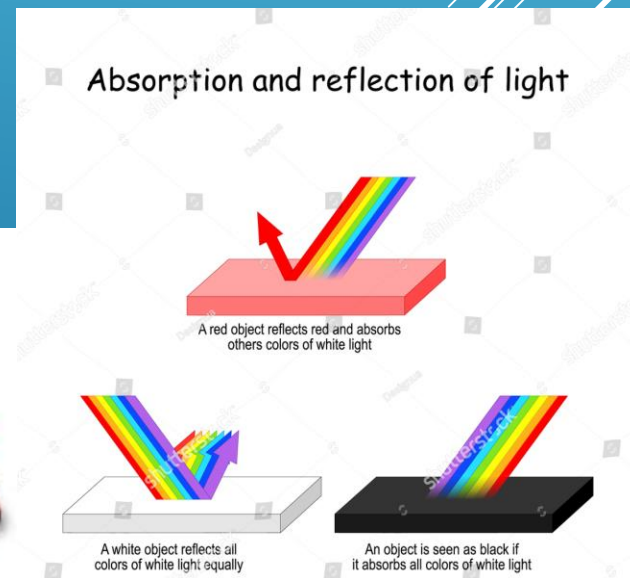
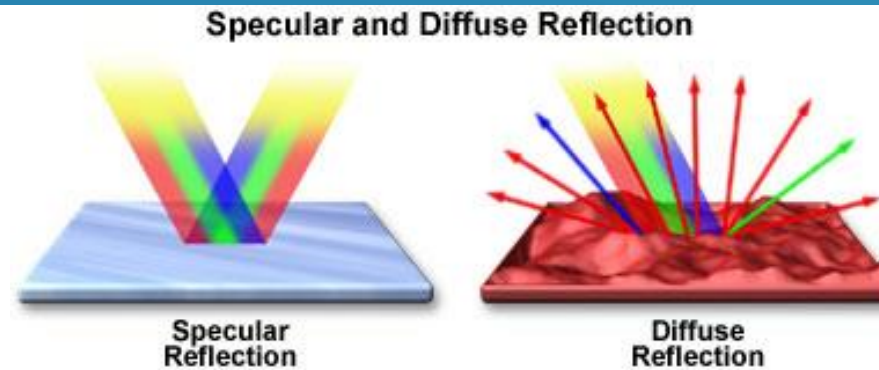
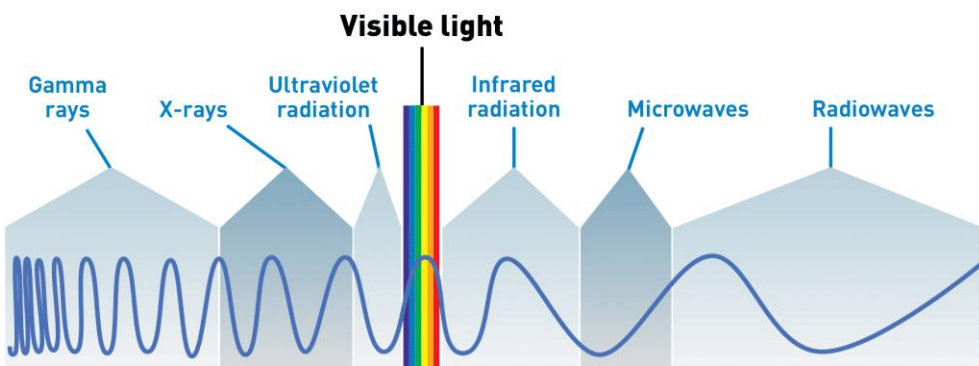


Water Stress Level

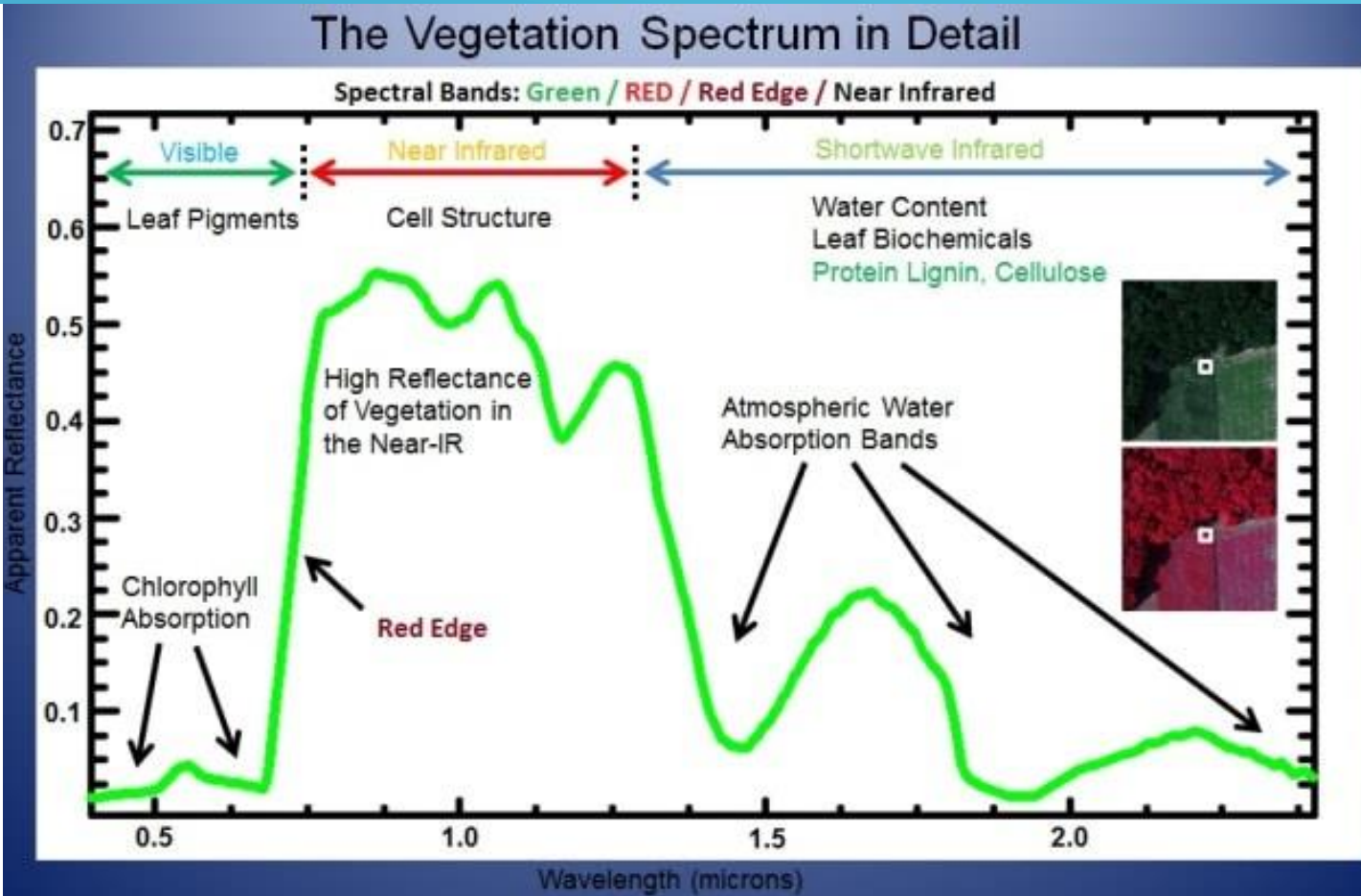
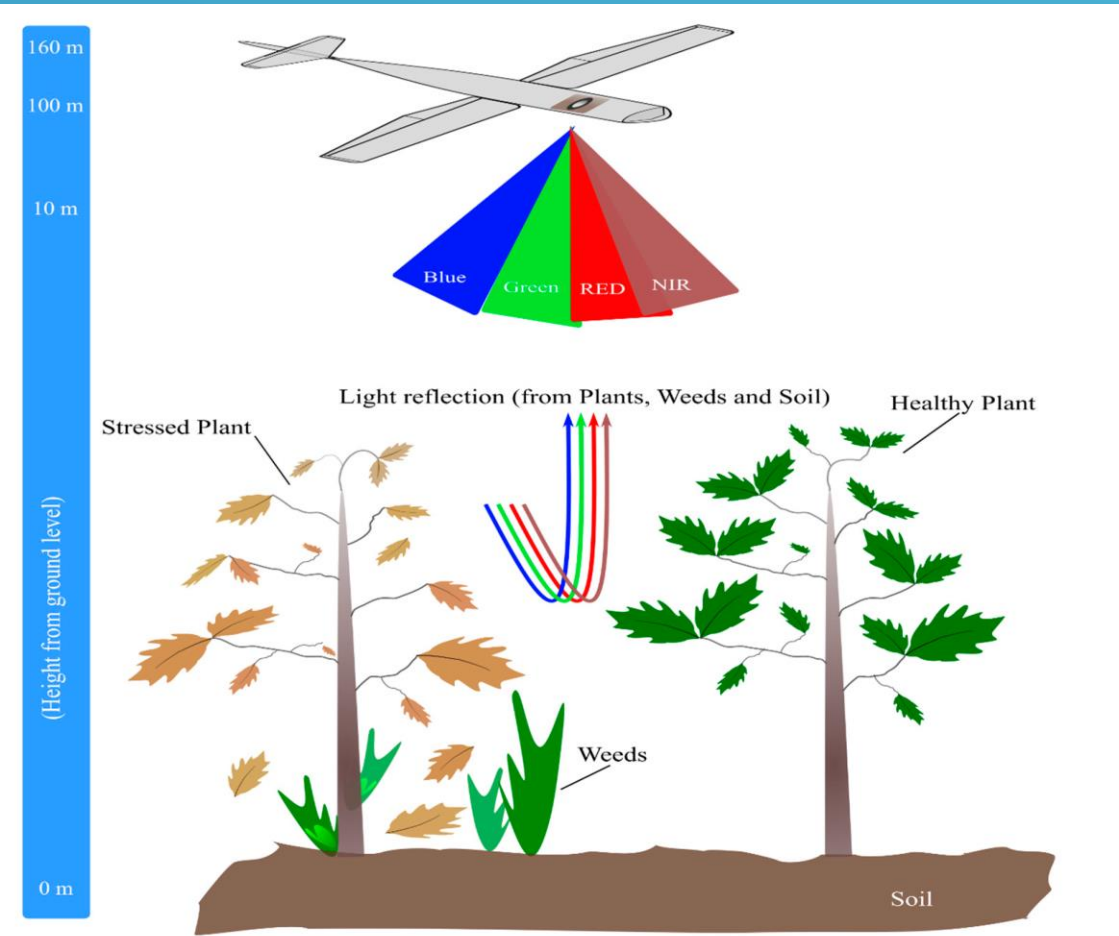


WHAT ARE MULTISPECTRAL/THERMAL IMAGES?

- ▶ Type of image that shows data at specific frequencies across the electromagnetic spectrum.
- ▶ Every surface reflects back some of the light that it receives.
- ▶ Objects that have different surface features reflect or absorb the sun's radiation in different ways.
- ▶ Perceived color of an object corresponds to the wavelength of the visible spectrum with the greatest reflectance.
- ▶ These wavelengths maybe separated by filters or by the use of instruments which are sensitive to particular wavelengths, including light from frequencies beyond our visible sight.



VEGETATION SPECTRUM

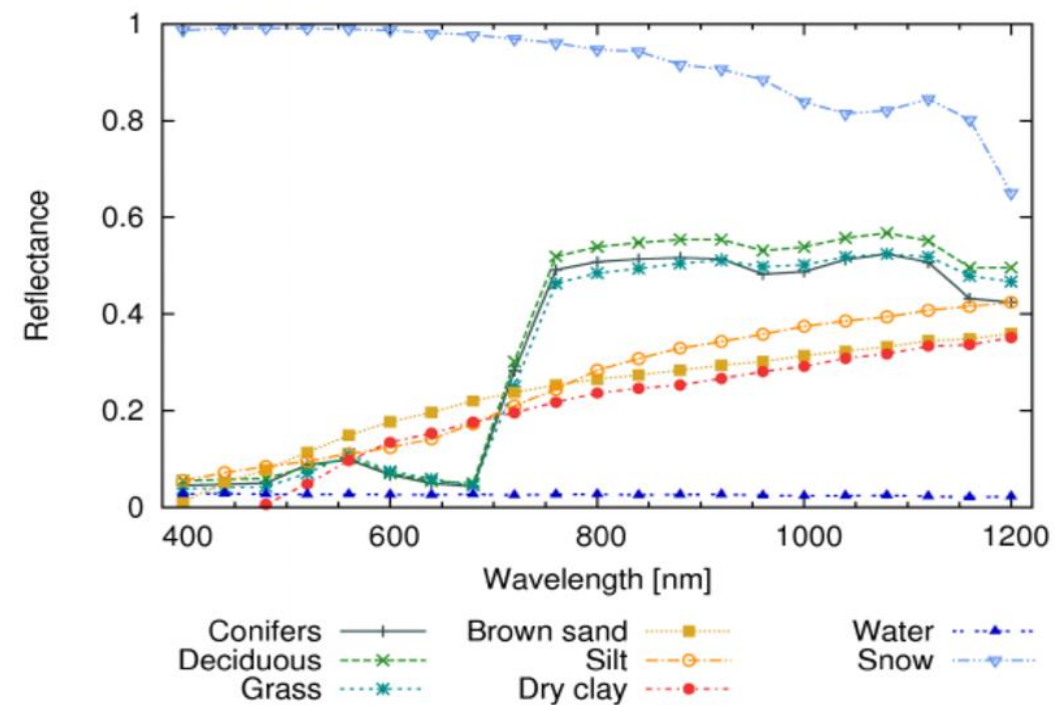
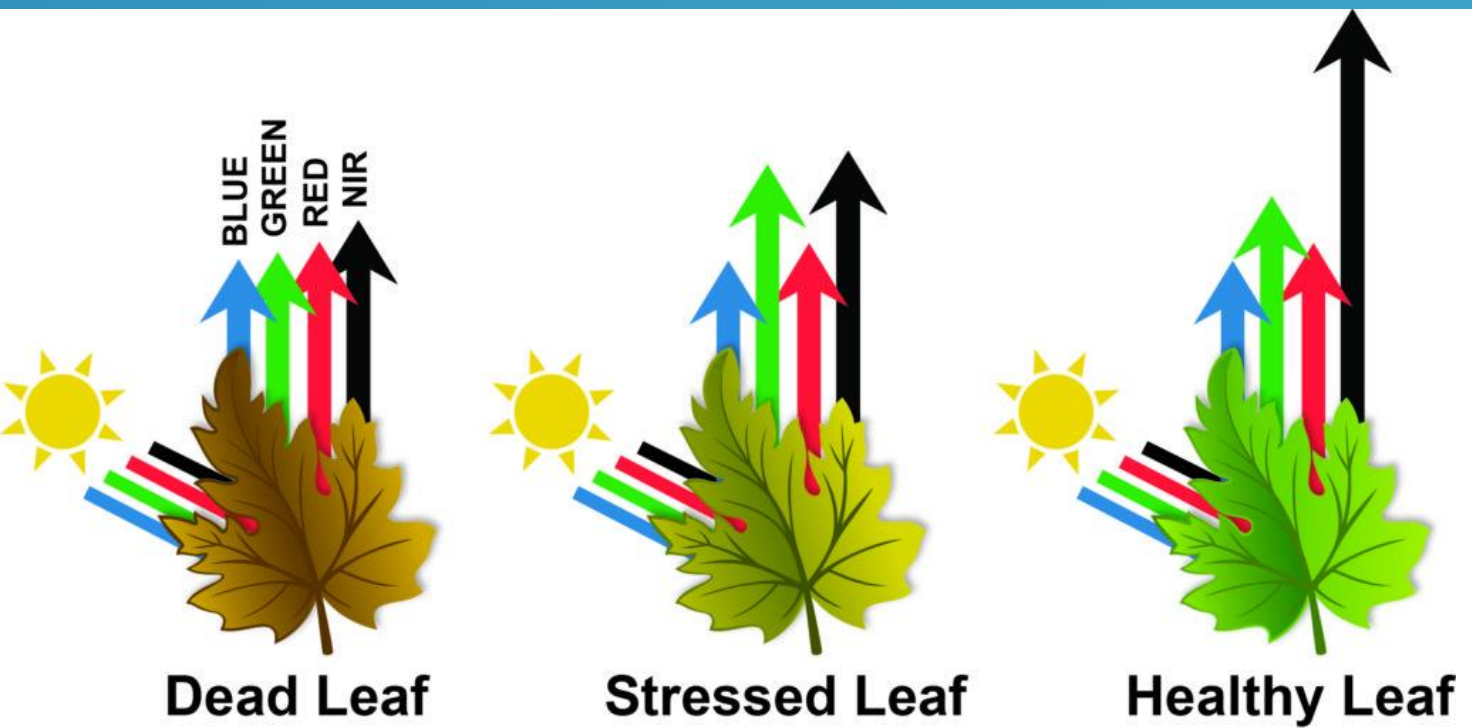


SPECTRAL REFLECTANCE CURVE



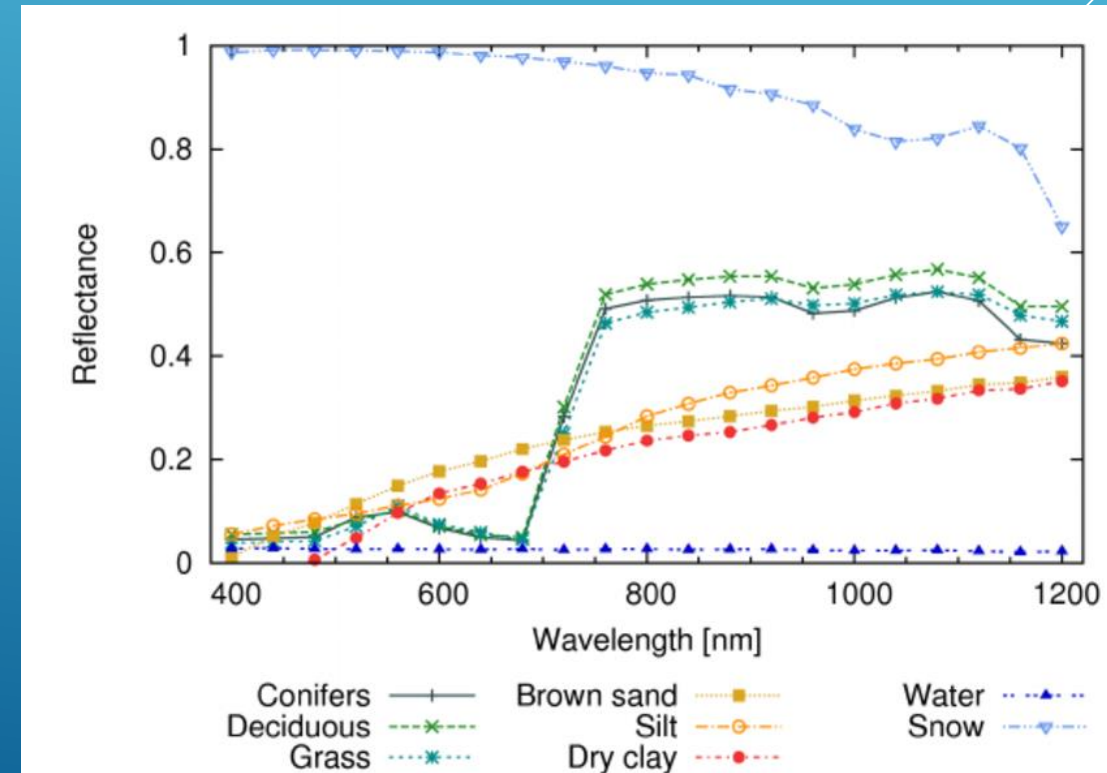
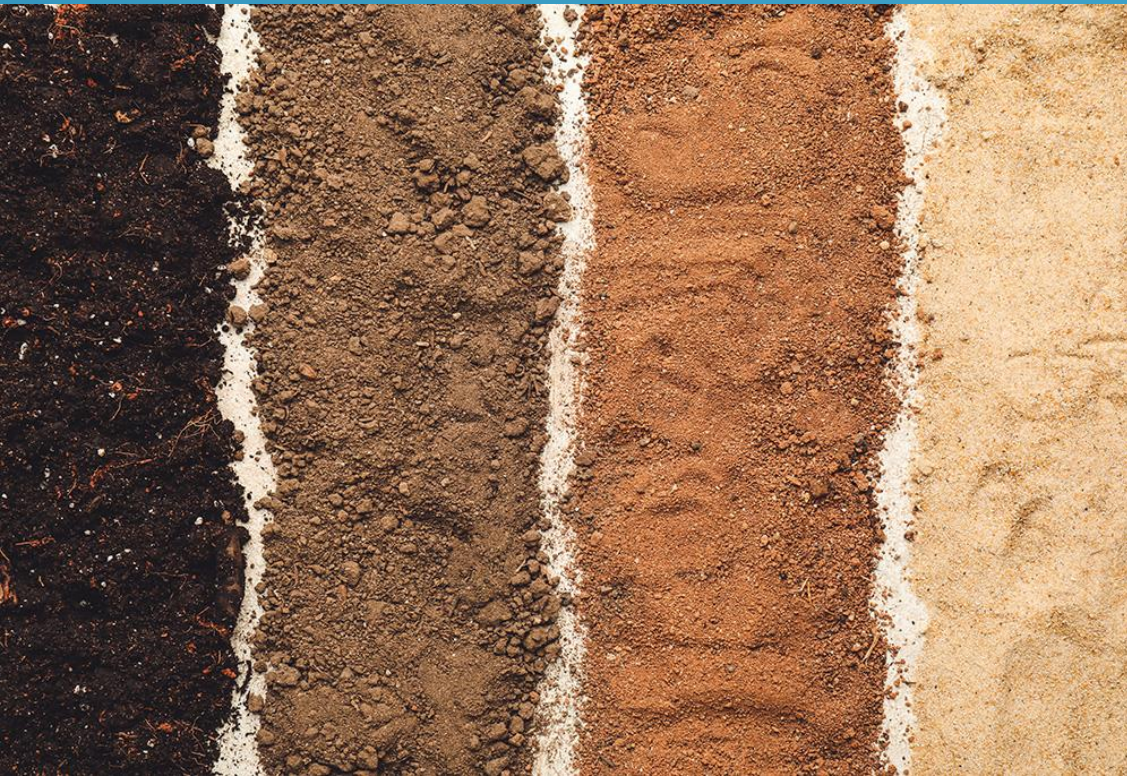
VEGETATION CURVE

- ▶ Significant minimum of reflectance in the visible portion of the electromagnetic spectrum resulting from the pigments in plant leaves.
- ▶ Healthy vegetation will absorb in both the blue and red bands, giving rise to what is called the “green bump of healthy vegetation”.
- ▶ Reflectance increases dramatically in the near infrared. Stressed vegetation can also be detected because stressed vegetation has a significantly lower reflectance in the infrared.



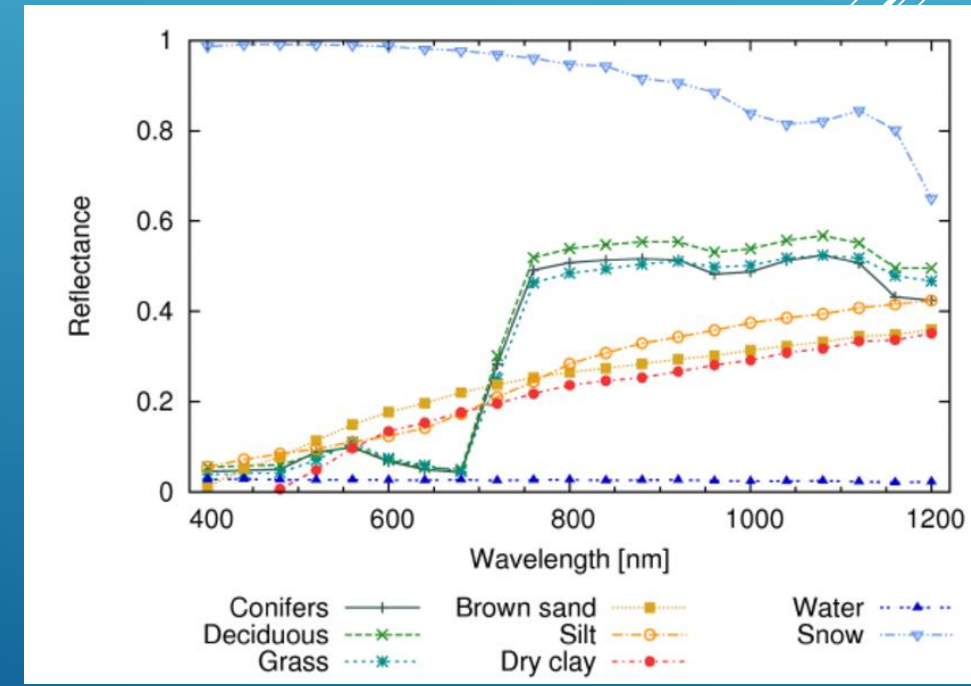
SOIL CURVE

- ▶ Bare soil is considerably less variable.
- ▶ The reflectance curve is affected by moisture content, soil texture, surface roughness, presence of iron oxide and organic matter.
- ▶ These factors are less dominant than the absorbance features observed in vegetation reflectance.



WATER CURVE

- ▶ The water curve is characterized by a high absorption at near infrared wavelengths range and beyond.
- ▶ Because of this absorption property, water bodies as well as features containing water can easily be detected, located and delineated with remote sensing data.
- ▶ Turbid water has a higher reflectance in the visible region than clear water.
- ▶ This is also true for waters containing high chlorophyll concentrations. These reflectance patterns are used to detect algae colonies.

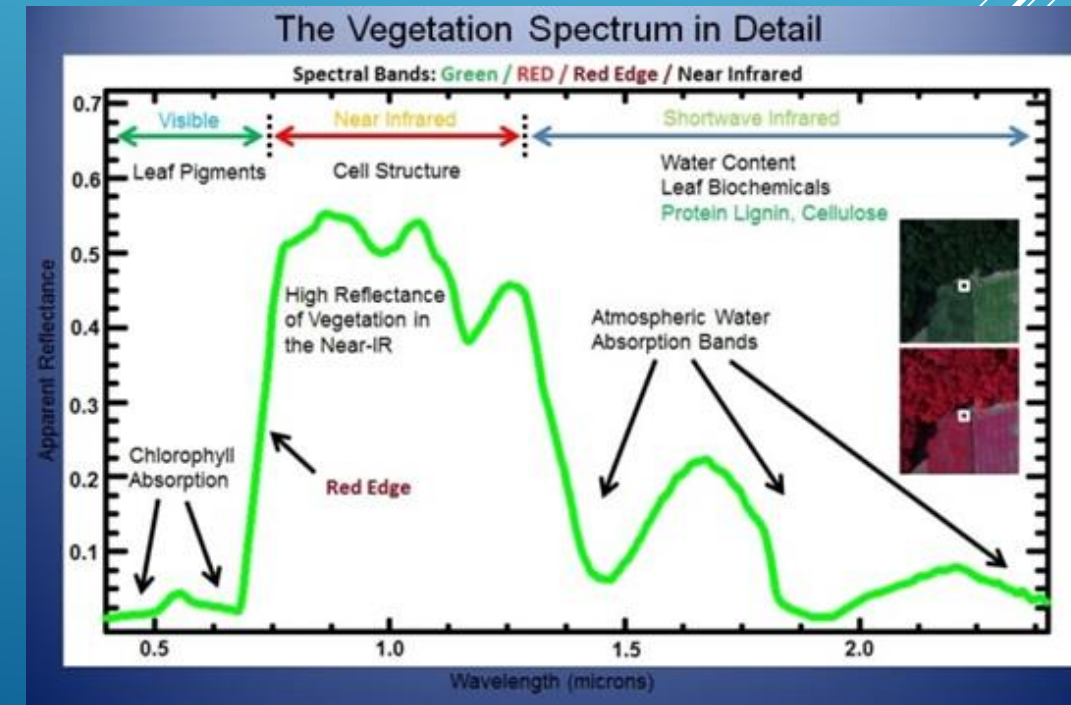
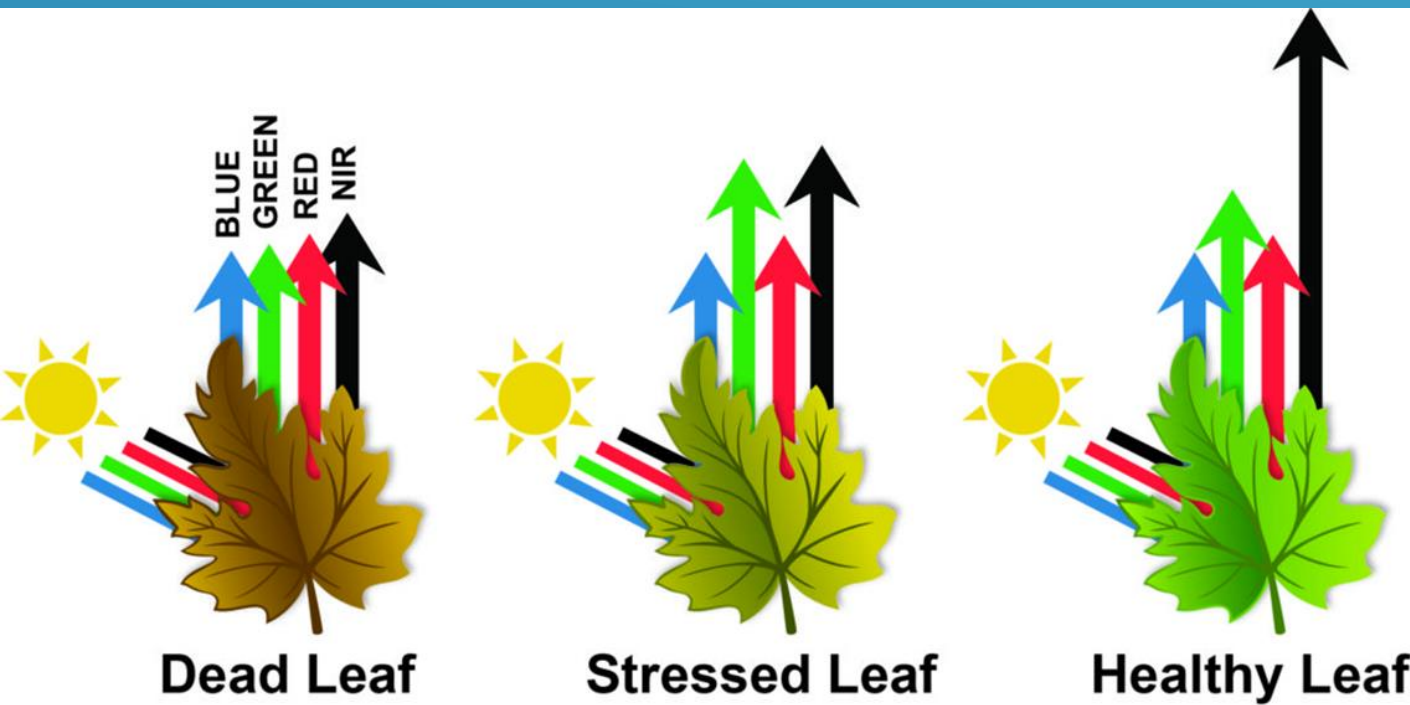


MULTISPECTRAL VEGETATION BANDS



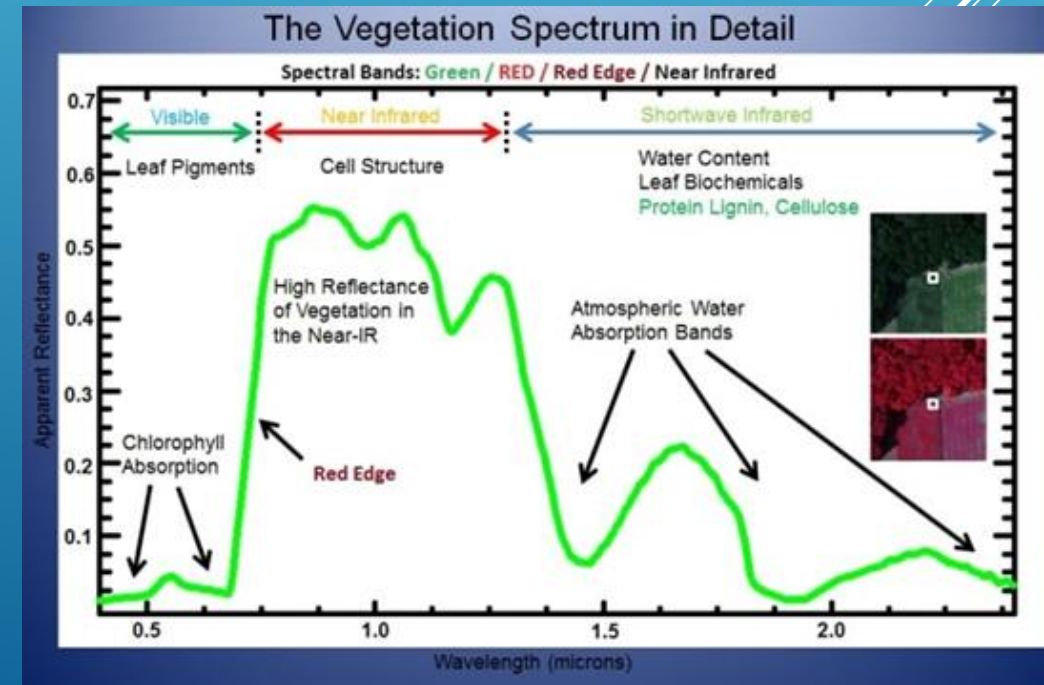
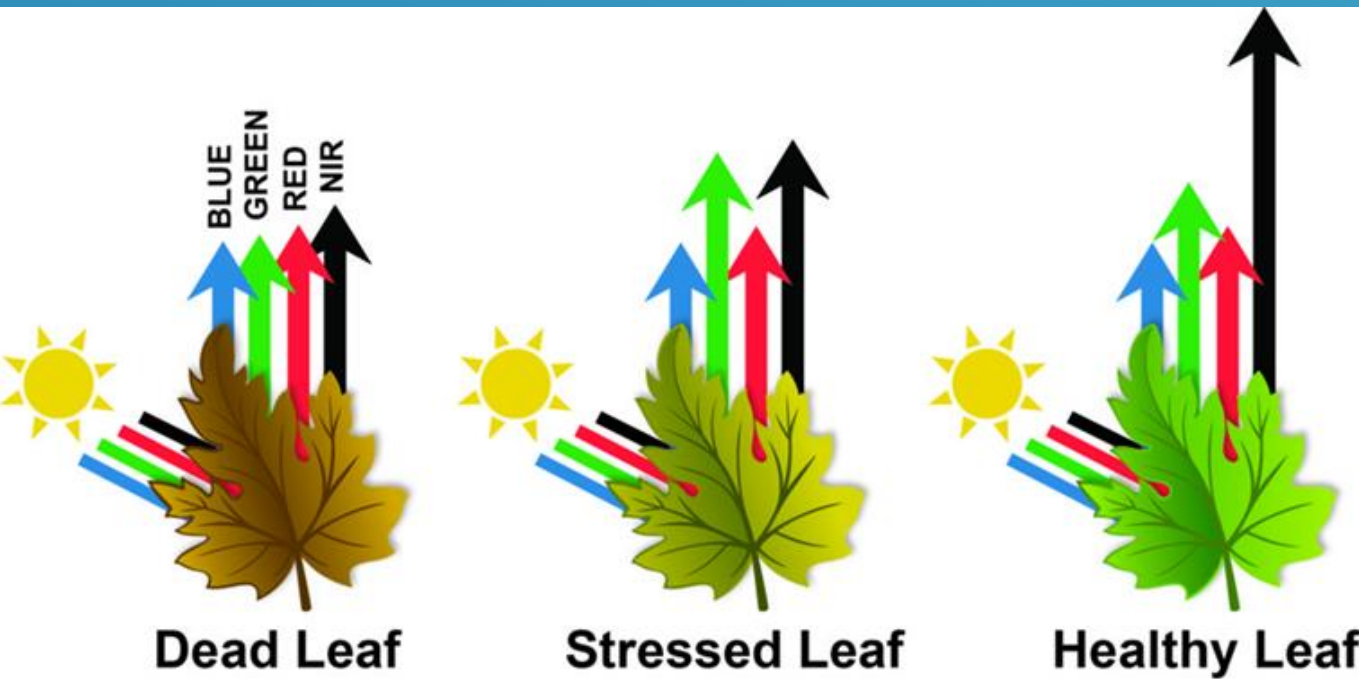
GREEN BAND

- ▶ The reflectance curve of a healthy plant exhibits the greatest reflectance in a green waveband (in the range of 550 nm).
- ▶ Correlated with the amount of chlorophyll contained in the plant.
- ▶ The internal structure of healthy crops act as excellent diffuse reflectors of near-infrared wavelengths. Measuring and monitoring the near-IR reflectance is one way to determine how healthy (or unhealthy) vegetation may be.



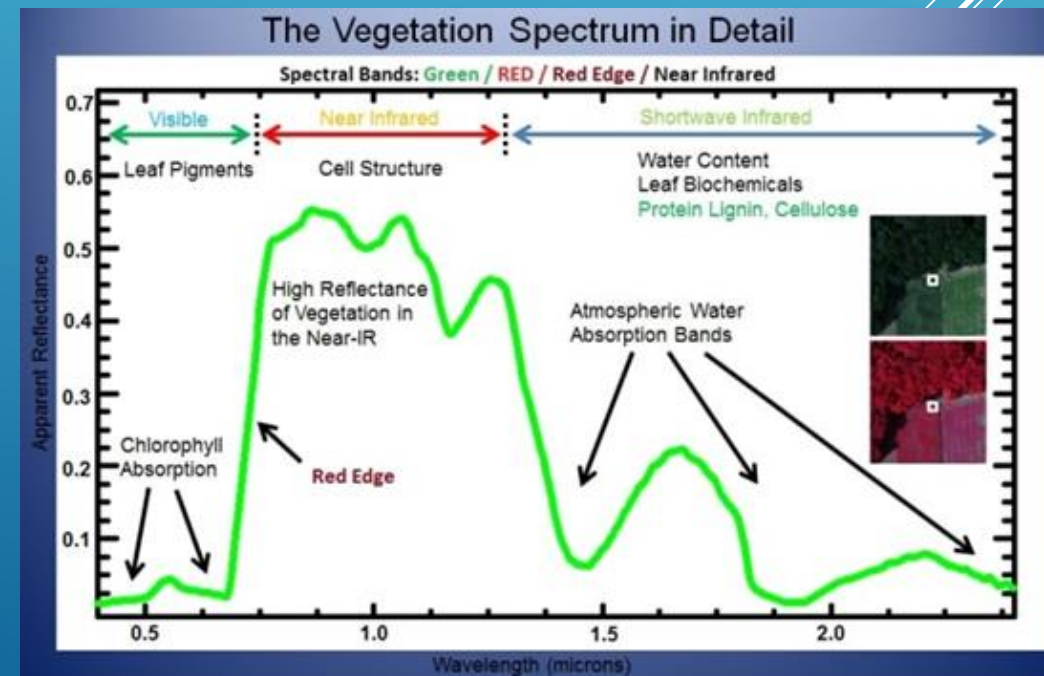
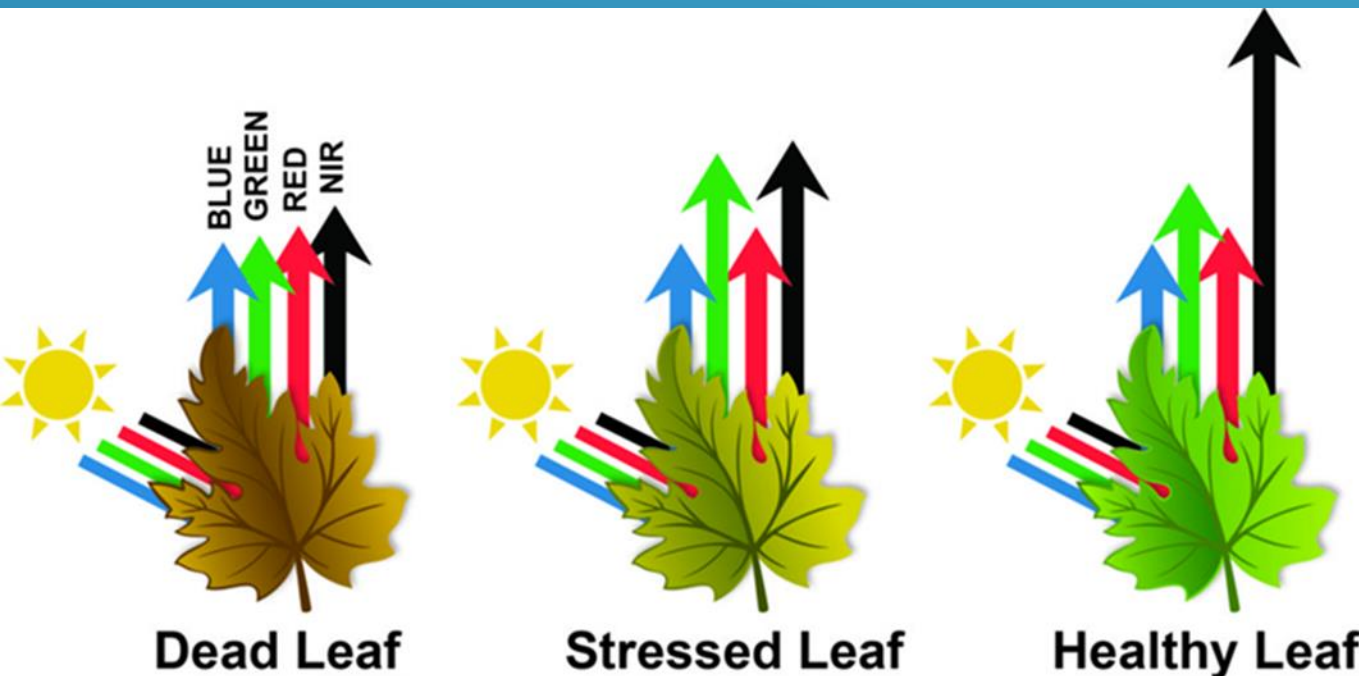
RED BAND

- ▶ Corresponds to the reflected energy in the 600 – 700 nm spectral band.
- ▶ The strong chlorophyll absorption in this band results in a low reflectance.
- ▶ Reflectance varies significantly in relation to factors such as biomass, LAI (Leaf Area Index), soil history, crop type, humidity and plant stress.
- ▶ For most crops this band gives an excellent contrast between the plants and the soil



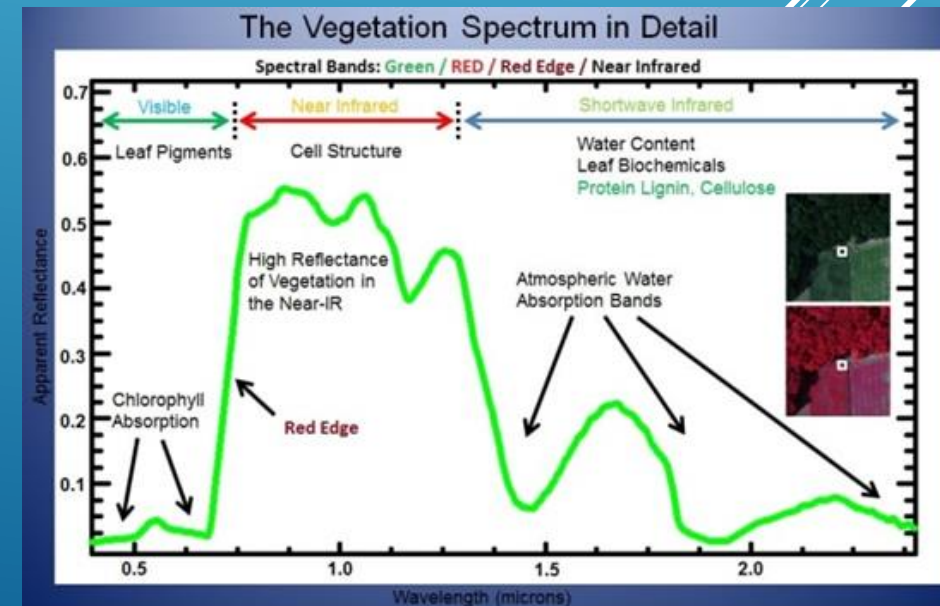
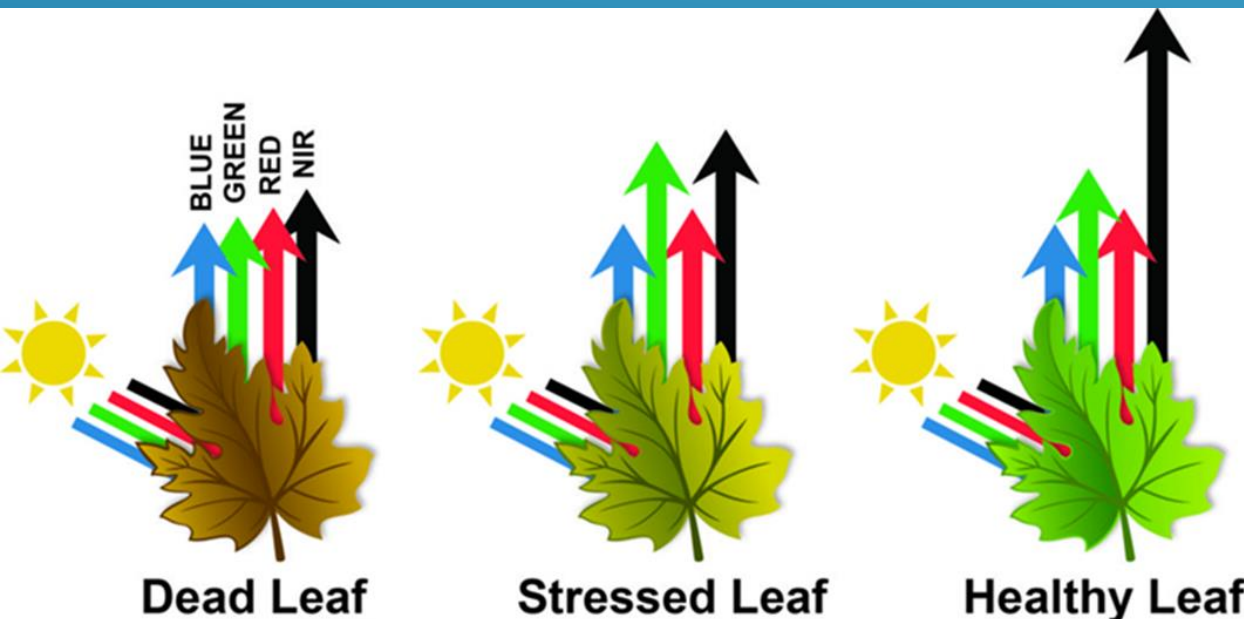
RED EDGE BAND

- ▶ This a very narrow band (700 – 730 nm), which corresponds to the entry point of Near Infrared.
- ▶ It is the point of sudden change in reflectance, from strong absorption of Red to substantial reflection of Near Infrared.
- ▶ This band is very sensitive to plant stress and provides information on the chlorophyll.



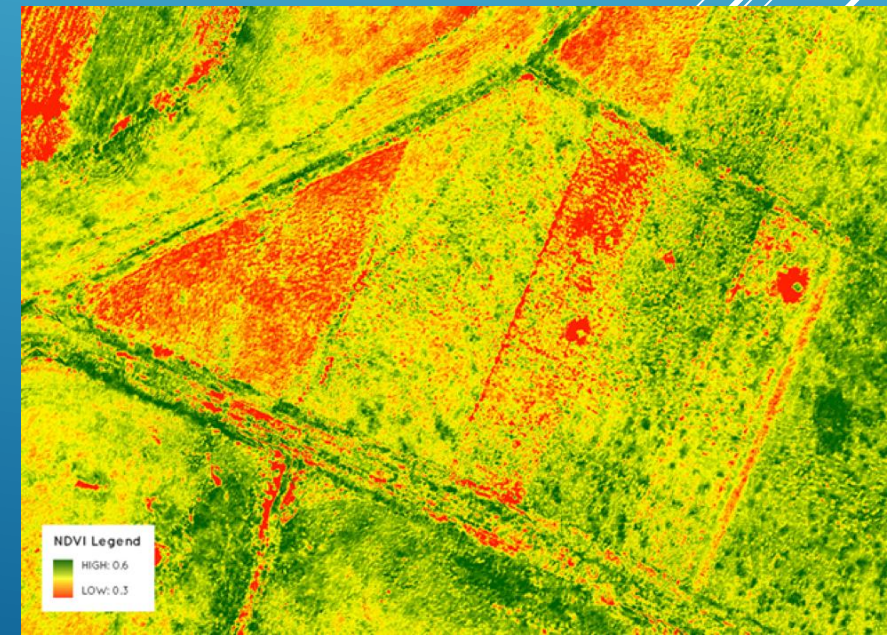
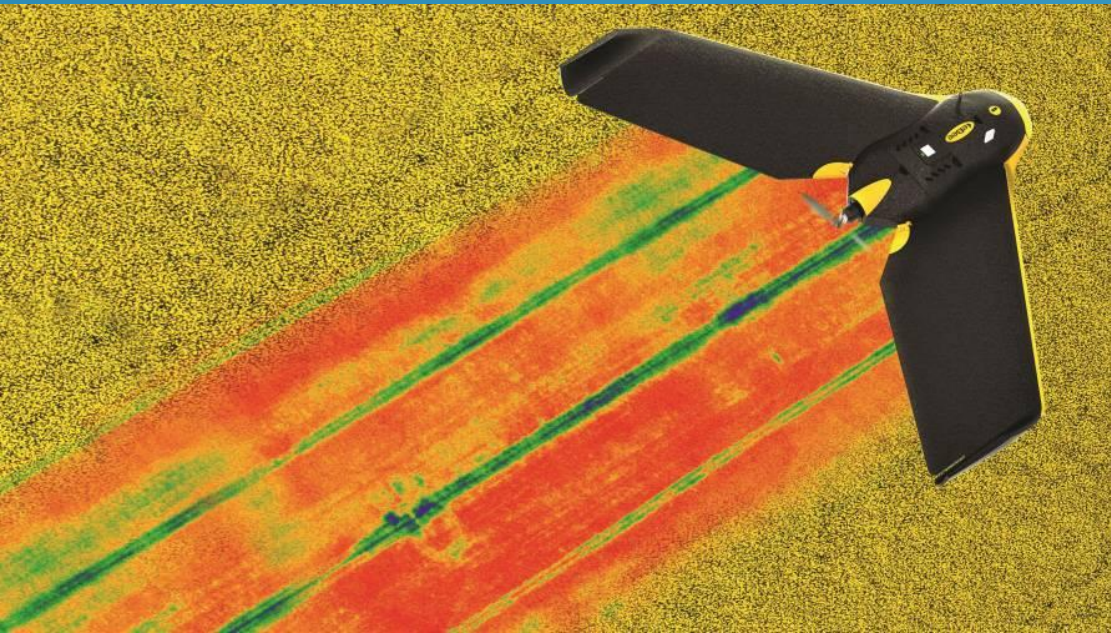
NIR (NEAR-INFRARED) BANDS

- ▶ Corresponds to the wavelengths in the 700 nm to 1.3 μm range.
- ▶ A very strong correlation between this reflectance and the level of chlorophyll in the plant.
 - ▶ Healthy vegetation absorbs blue and red-light energy to fuel photosynthesis and create chlorophyll.
 - ▶ A plant with more chlorophyll will reflect more near-infrared energy than an unhealthy plant.
 - ▶ A highly significant variation of the reflectance in this band is produced when a plant is under stress.
- ▶ NIR is sensitive to the leaf cellular structure and provides critical data to monitor changes in crop health.



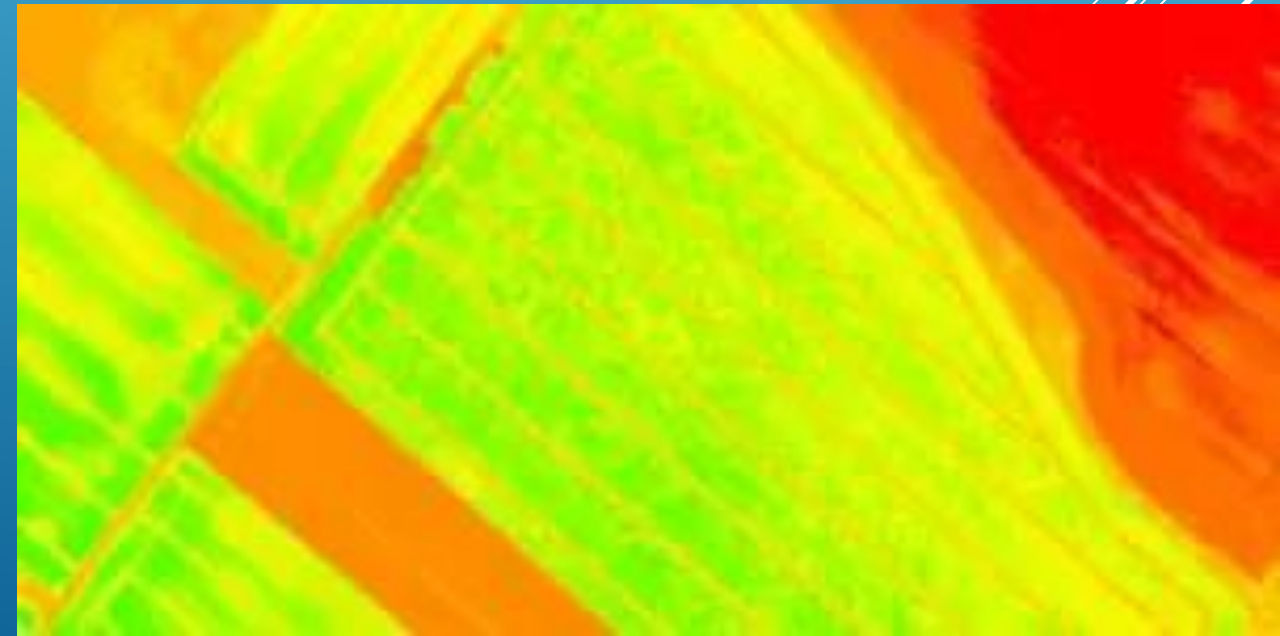
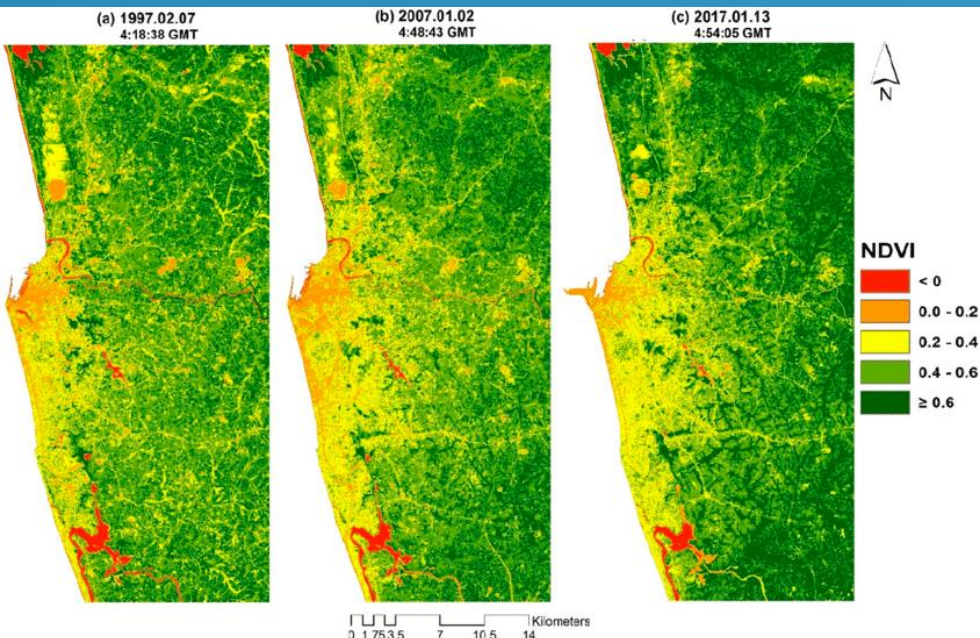
VEGETATION INDICES

- ▶ Vegetation reflectance properties are used to derive vegetation indices (VIs).
- ▶ Analyze various ecologies.
- ▶ Constructed from reflectance measurements in two or more wavelengths to analyze specific characteristics of vegetation, such as total leaf area and water content.
- ▶ The most popular vegetation index is *NDVI* (Normalized Difference Vegetation Index).



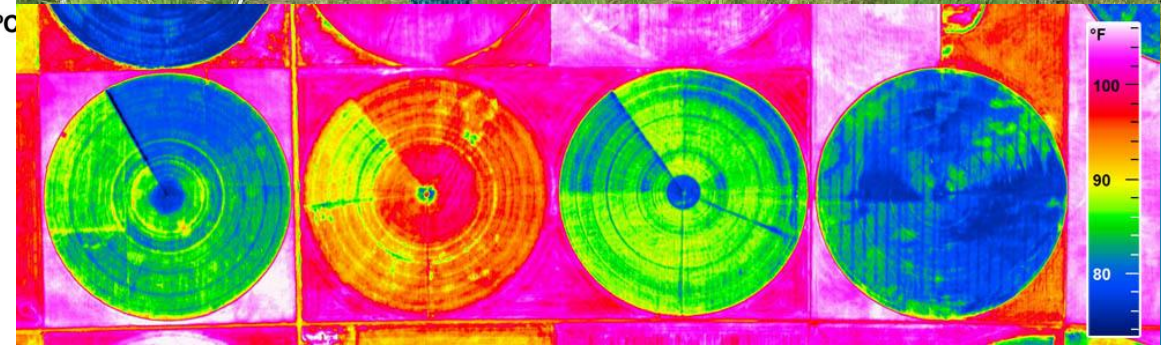
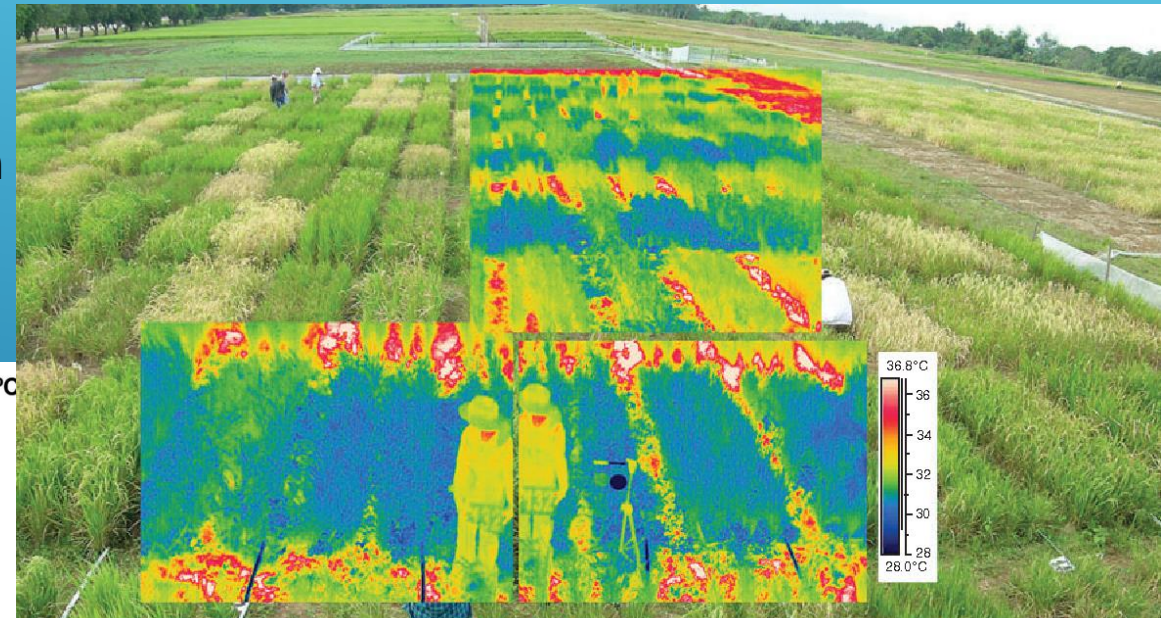
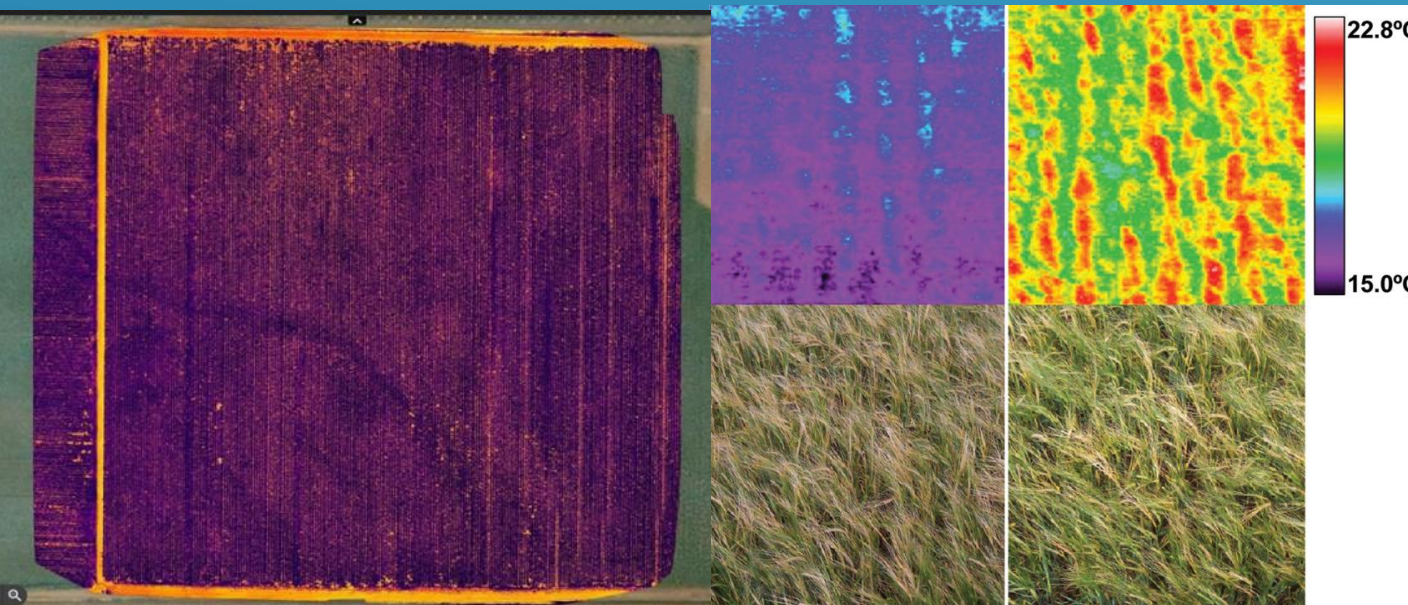
NDVI VEGETATION INDEX

- ▶ Index of plant “greenness” or photosynthetic activity
- ▶ By taking the ratio of red and near infrared bands from a remotely sensed image (calculated on a per-pixel basis), an index of vegetation “greenness” can be defined.
- ▶ Various factors can affect NDVI values like plant photosynthetic activity, total plant cover, biomass, plant and soil moisture, and plant stress. Because of this, NDVI is correlated with both agricultural and ecosystem attributes
- ▶ Because it is a ratio of two bands, NDVI helps compensate for differences both in illumination within an image due to slope and aspect, and differences between images due things like time of day or season when the images were acquired.



THERMAL INFRARED

- ▶ Thermal imagery captured from the air makes visible the heat emitted from objects on the ground, revealing temperature differences.
- ▶ Results can show:
 - ▶ Crop stress
 - ▶ Pinpoint common issues in irrigation systems
 - ▶ Optimize irrigation scheduling and system design for the terrain and soil conditions.



AG WATER EFFICIENCY PROGRAM SERVICES

• Currently, SRCO is working with SCWA and SID on this program to offer various services for free.

• **Type of services offered:**

- General irrigation efficiency plans
- Assistance with monitoring equipment (weather stations, soil moisture sensors, etc.)
- Certification of Irrigation and Nitrogen

Management Plans for the Irrigated Lands Program.

One of the key components of this report is the distribution uniformity (DU) rating, a measure of how evenly water is distributed throughout the irrigation system. The DU is calculated by comparing sprinkler or emitter flow rates collected in at least 3 different locations across the system. The closer the DU rating is to 100% equates to the higher the efficiency (uniformity) of the system.

This irrigation system's performance:

Distribution Uniformity (global)	95%
Distribution Uniformity (flow)	93%
Application Rate	0.067 in/hr

The global system DU of 95% is excellent for a micro sprinkler system. For all practical purposes, 100% is not possible; however, highly efficient micro systems typically have DUs above 92%. Global DU values are calculated through the use of an irrigation evaluation program while flow DU values are determined through the use of a low quarter formula located in the 'Application Rate and Flow DU' section of this report.

For this evaluation the MIL has identified several issues that include:

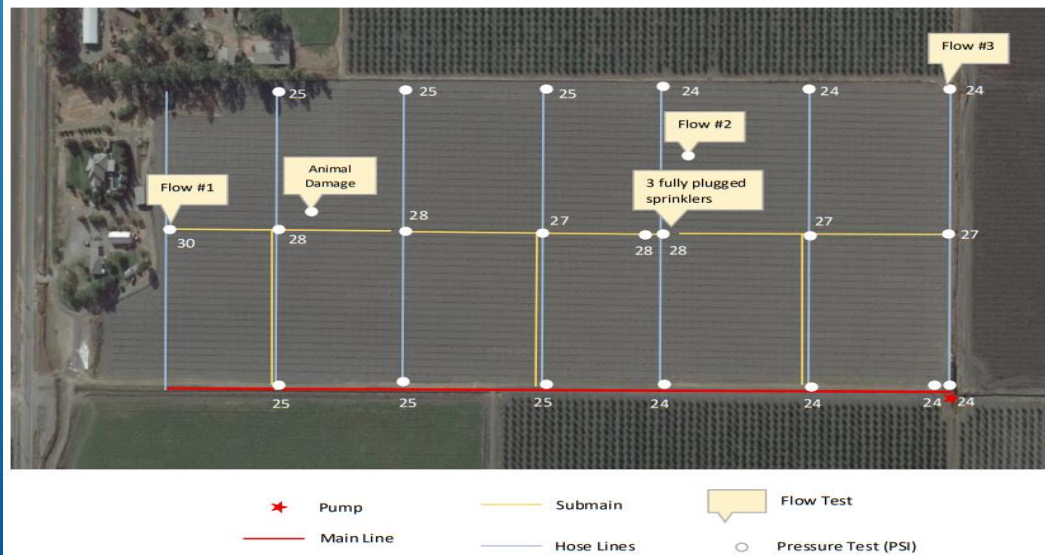
- Minor sprinkler plugging
- Slight pressures variability at manifold valve inlets
- Inaccurate pressure gauges at manifold valves

- Sprinklers close to minimum pressure recommended from manufacturer

System Pressures

Balanced pressures are an incredibly important factor that determine flow rates at each sprinkler or emitter (unless pressure compensating or flow control devices are used). When

Pressure and Flow Test Location Map



PUMP EFFICIENCY TEST

What is a pump test?

- A pump test measures various aspects of the pump's operation and provides an estimation of the overall efficiency of the pump and cost of running it under *test conditions*.

Who does the pump testing?

- Currently, SRCD is working with a contractor to provide pump efficiency tests to landowners.

Why should I do a pump test?

- Regular pump testing can identify problems before a breakdown occurs, energy bills climb, and increase water efficiency.

How often should I test my pump and use the data from a pump test?

- A pump should be tested every 1-3 years depending on the annual usage and severity of operating conditions. While booster pumps being supplied with clean water should be tested once every 2-3 years.
- When comparing the results of the pump test and original pump's performance curve, it will show if a pump adjustment or repair is needed.

How can I obtain a pump test?

- Please contact Kevin Young-Lai at Solano RCD in order to get scheduled for a pump test.




TECHNICAL ASSISTANCE FOR PLANNING ON-FARM PRACTICES

Solano RCD staff can brainstorm with you about:

- Carbon farm planning
- Preventing soil erosion
- Applying for financial assistance programs to implement your ideas:
 - USDA NRCS
 - CDFA Healthy Soils
 - Other State/Federal funds
- Cover crops, hedgerows, windbreaks, wildlife habitat, pollinator projects, etc!

1170 N Lincoln, Suite 110
Dixon, CA 95620
(707) 678-1655 x 3
FAX (707) 678-5001
www.solanorcd.org



Conservation Plan

Date: May 14, 2021
Name: [REDACTED]
Address: [REDACTED]
Contact: [REDACTED]

Resource concerns

Water conservation in vineyard alleys: Landowner received a Healthy Soils grant to incorporate cover crops and mulch in vineyard operations. The perennial cover is difficult to establish, as the soil is extremely rocky and hard to prepare for seeding. Perhaps mulching the alleys would be more efficient?

Rodent management: Gophers are an issue and owl boxes are of interest to attract natural predators to the area.

Sources for mulch: Wood chips are always useful and sources for them would be helpful.

Plants to avoid near winegrapes: If native plants, or garden plants, are established in the vineyard area it would be good to avoid species that are known hosts for grapevine pests.

This conservation plan will address the following topics in individual sections:

1. Soils map and description
2. Options for vineyard alleys and sources for mulch
3. Owl box plans and recommendations
4. "Do not plant" list for grapevines

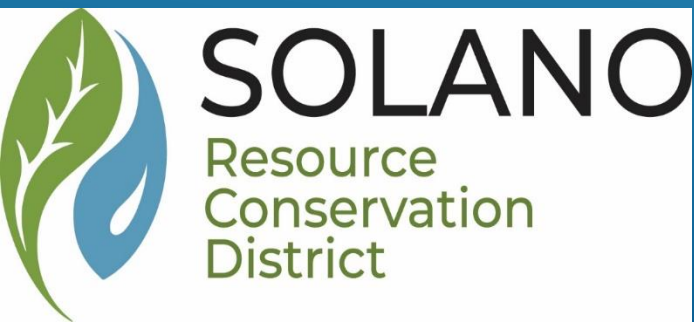
PESTICIDE DISPOSAL PROGRAM



PESTICIDE DISPOSAL PROGRAM

- **FREE** disposal of legacy pesticides/herbicides
 - Currently, we will work with you individually for disposal of such hazardous waste.
- First come first serve.
- Pilot program will end when grant funds are depleted, or on December 31st, 2023
- Pesticide disposal will be set up by appointment only.

Partners: Solano County Resource Management, Solano Ag Commissioner's Office, Dixon Resource Conservation District, and Cal Recycle.



INFORMATION NEEDED FOR SIGN-UP?

- Name
- Contact information
 - Phone number
 - Email address
- List of what legacy pesticide you would like to have disposed of.
 - Pesticide/herbicide name
 - Quantity of the legacy pesticide

Kevin Young-Lai's contact information:

Solano Resource conservation District
 1170 N. Lincoln Street Suite 110
 Dixon, CA 95620
 Office: (707) 678-1655 x 123





AGRICULTURAL PESTICIDE INVENTORY FOR DISPOSAL

PRINT CLEARLY to avoid processing delays.

First Name: _____ Last Name: _____
 Address: _____ City/Zip: _____
 Home: _____ Mobile: _____ Email: _____

If multiple containers of the same product exist, you must list each container separately:

Product Name	Container Contents and Size		Container Condition (check one)	
List name on label and if label is removed, state "unknown"	List estimated remaining volume in qt. or gal.	List date in qt. or gal. are sealed, or estimate date if label is removed	Seal intact can be moved and transported safely	Pest. requires handling location due to deterioration, leaks
EXAMPLE: Diazinon 4 Spray	1 gallon	5 gallons	✓	

ACKNOWLEDGMENT: I, the undersigned, agree to hold the County of Solano and Solano Resource Conservation District harmless in my participation in the Pesticide Disposal Pilot Program and follow the U.S. Department of Transportation's rules related to the transport limits of hazardous waste as a small quantity generator.

Signature of Participant

Date



