New Water - Stress Management Technology From

Water is the Problem

- When to Irrigate?
- How Much to Irrigate?
- Water is scarce. Pumping costs up.

- Our Advanced Sensors

-Let the plants Talk to You !

Agenda

- Sap Flow Solutions for Plant Stress Monitoring
- New Technology to Supply Answers to Growers with Critical Issues
- With the right data, you will know how or when to irrigate or improve methods.

Why is this Different?

How does it Work?

What is Important?
What is Needed?

How do I Benefit from this?

What Is Sap Flow?

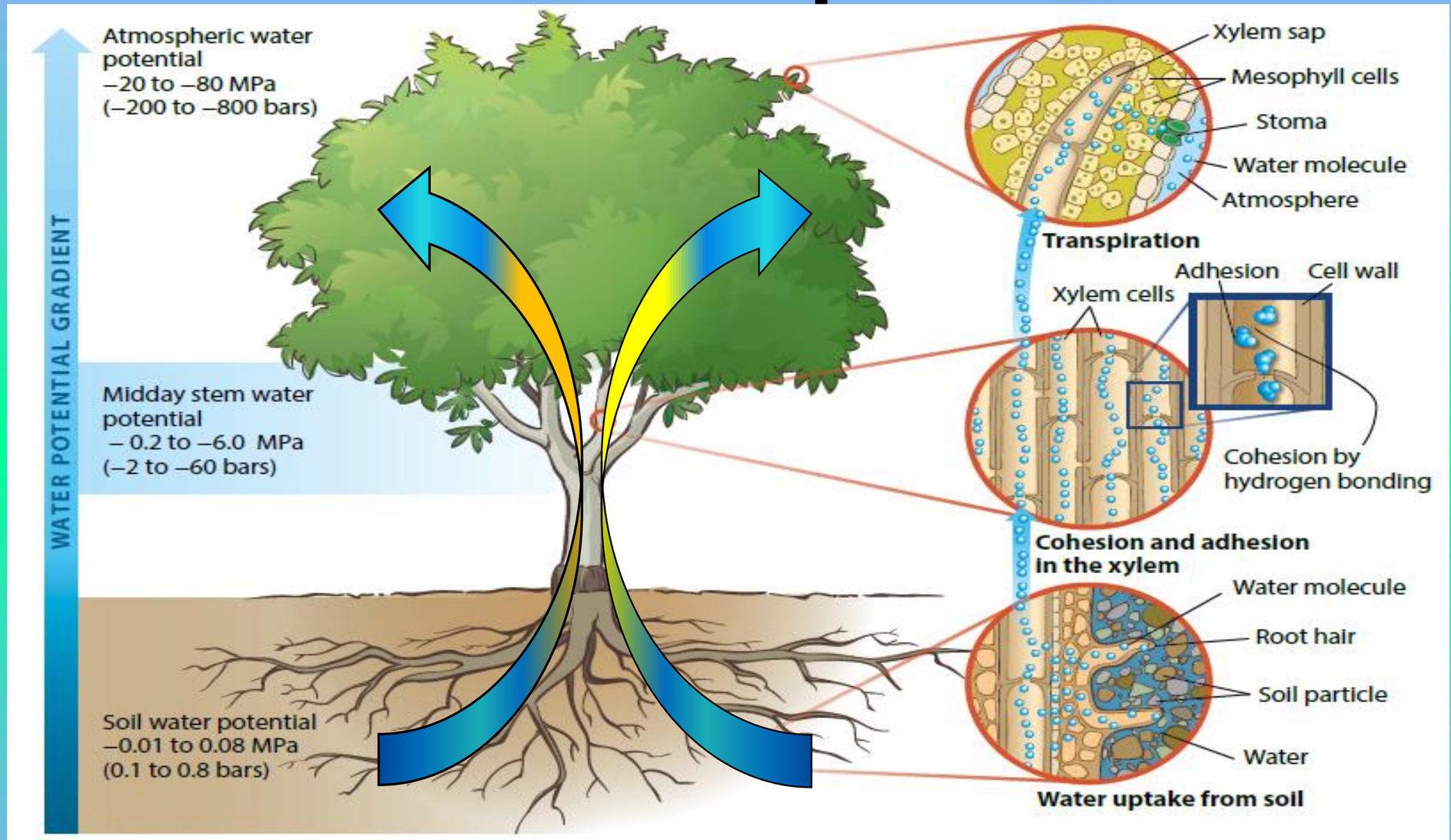
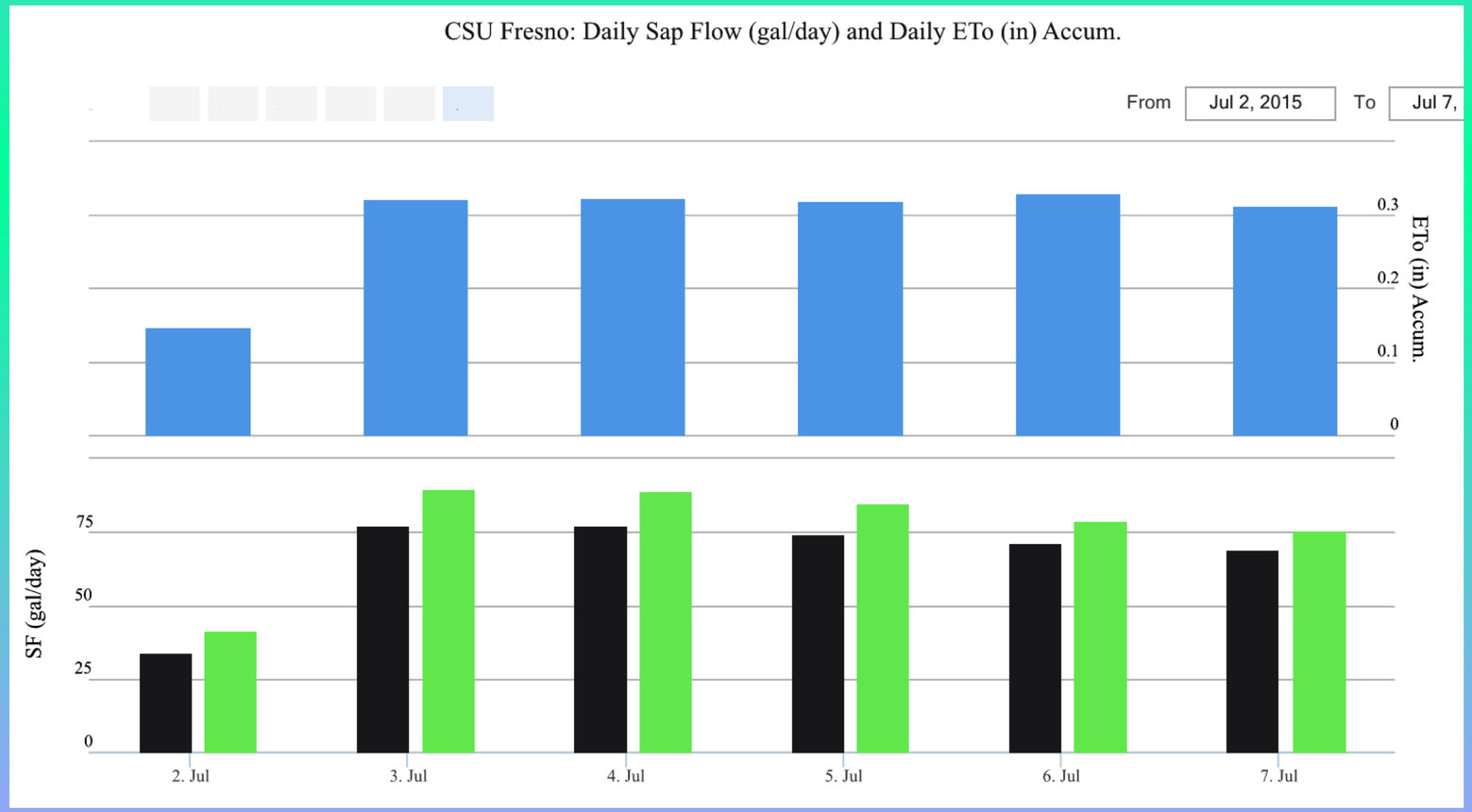


Figure 1. Conceptual illustration of how water moves from the soil through an irrigated tree and into the atmosphere, from both a whole tree and cellular perspective. SWP measures the water-potential gradient that drives this movement of water through the tree. *Source:* Adapted from Pearson 2008.

Sap Flow is the Plant Response to ALL ENVIRONMENT

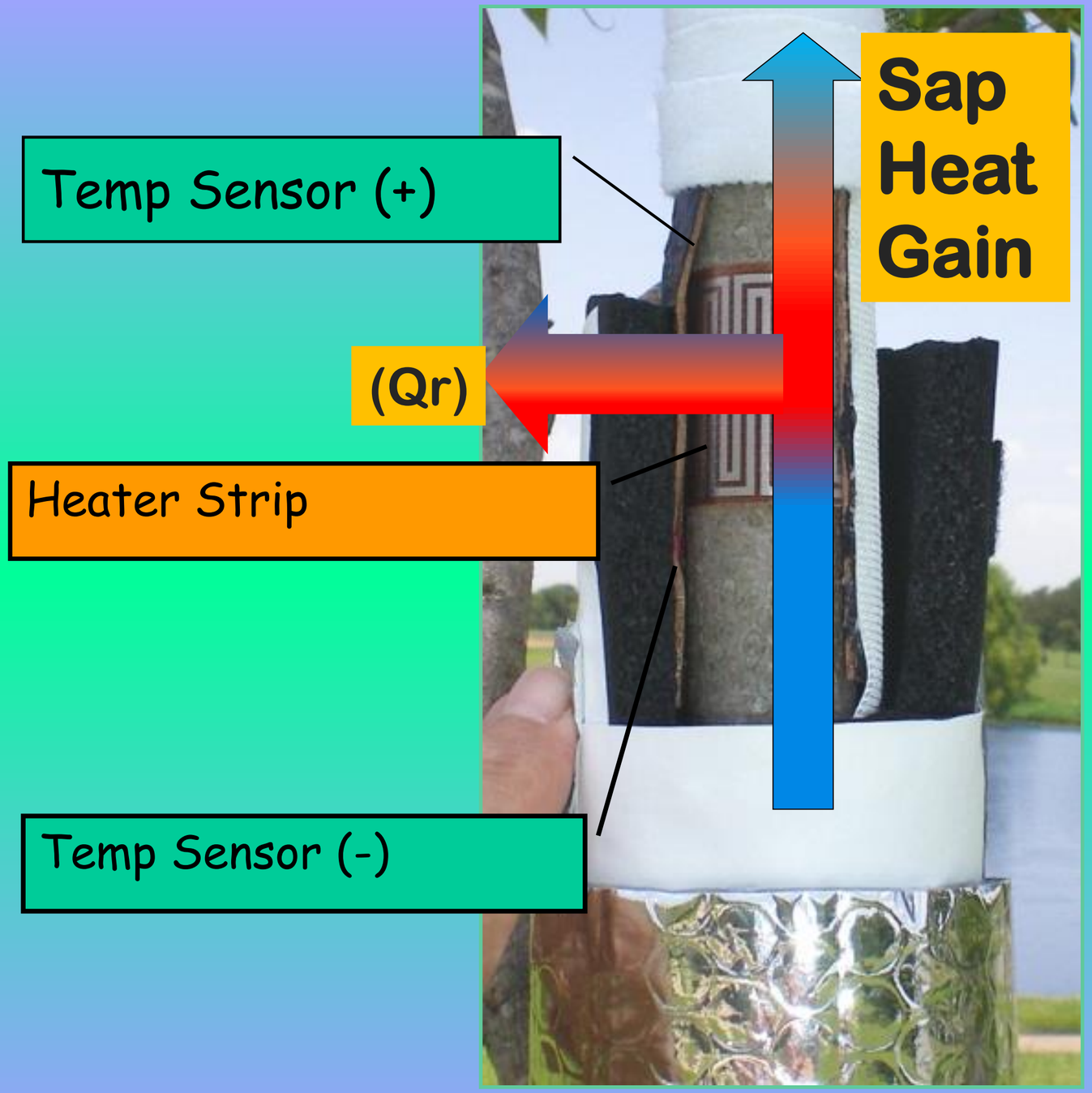


- Weather
- Plant Water
- Soil Status
- Root Health
- Water Balance

Sap Flow Sensor

Exo-Skin Sensor

Plant Transpiration - Energy Balance



Sap Flow

Technology
Four Patents
& 25 Years
Science
References

✓ Requirements

Shielding and insulation to prevent heat from the sun and irregular temp swings.

Solar Power required to maintain constant heat (about 10 W per sensor)

Measure stems, input heater and plant properties into the logger / web site computations.

Real-time computations and communication to grower, and technical support.

Maintenance to observe stem, adjust for growth, check condensate and keep stem healthy.

Sap Flow Applications –

- **Commercial Irrigation – New Sensors and Systems for**
- Orchards – Nuts, Fruit Trees – Almonds - Citrus
- Crops – Corn, cotton, soybean
- Viticulture – Wine grapes (8 years operations)
- High value – fruits and plants
  - Kiwi Raspberry Cherry

SapIP Radio Transmitter / Logger

To WEB ACCESS

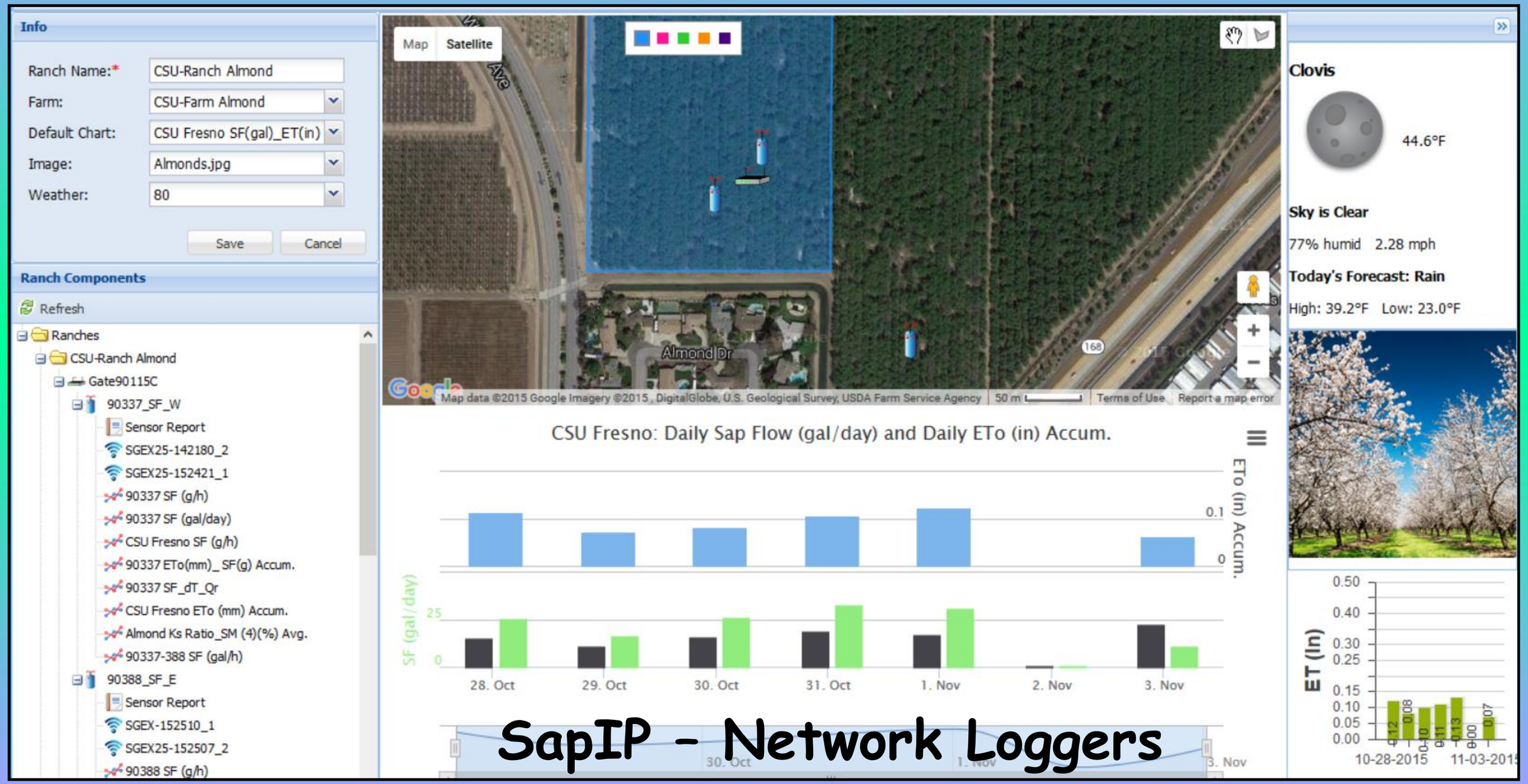
From Remote Fields:

✓Plant Stress

✓Water Needs

✓Plant – Soil – Water

Data Retrieved **Agrisensors.net** Remote Network



SapIP - Network Loggers

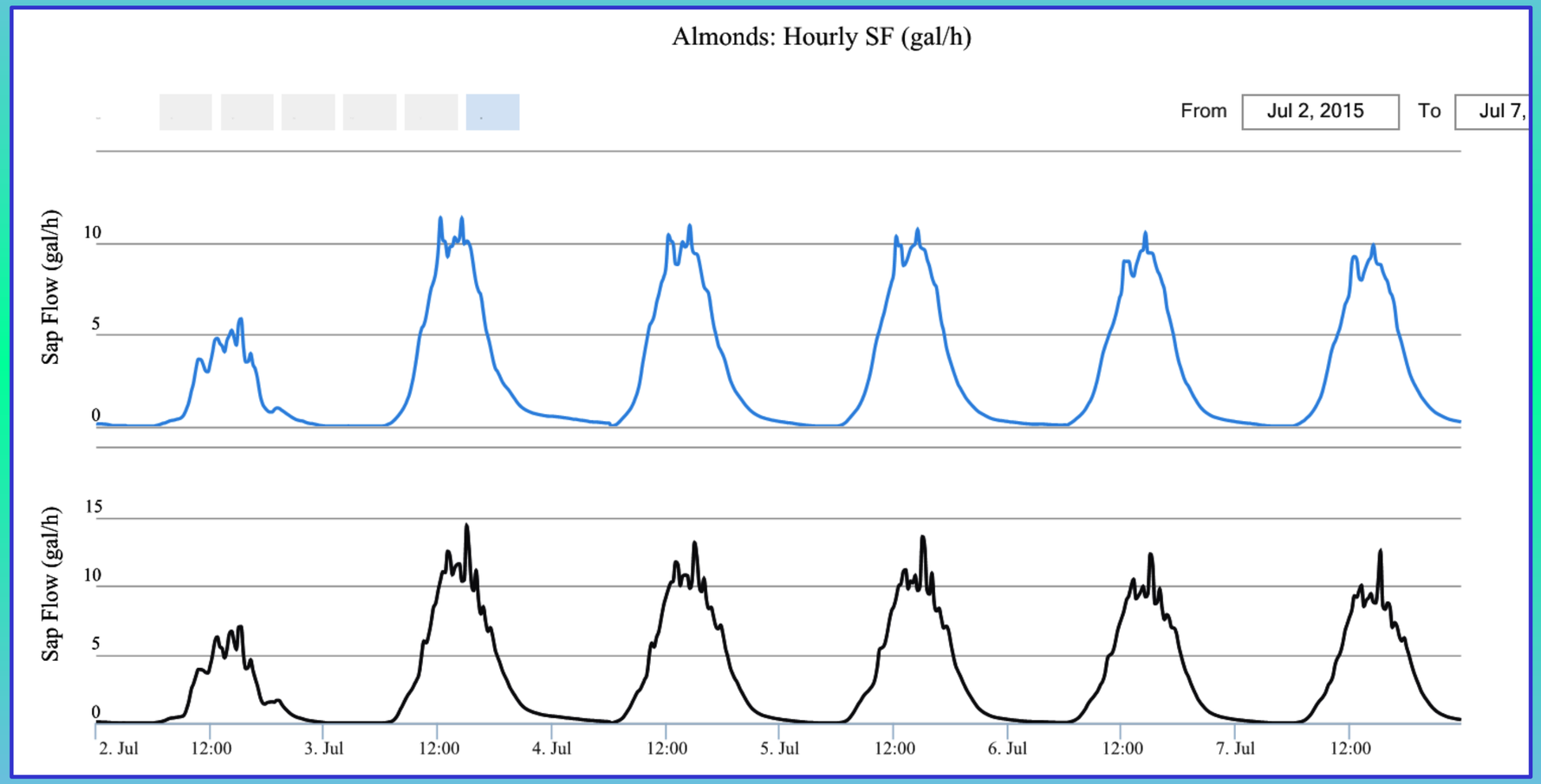
Installation and Results

- Starting June 1 2015 - Nonpareil – 2 Zones
- Previous work to validate methods in 2014 July - Sept
- Selection of healthy trees is important
- Representative of Field (not outliers)
- Measure branches and select dominant
- Index branch dimensions to canopy as installations vary.

BASIC Data Collection

- ✓Sap Flow data
- ✓CIMIS Data - ETo for comparison
- ✓Soil Moisture Data to Validate Irrigation
- ✓Accumulate daily total and check with weekly irrigation schedule
- ✓Correlated with Pressure Chamber –
  - ✓Stem Water Potential

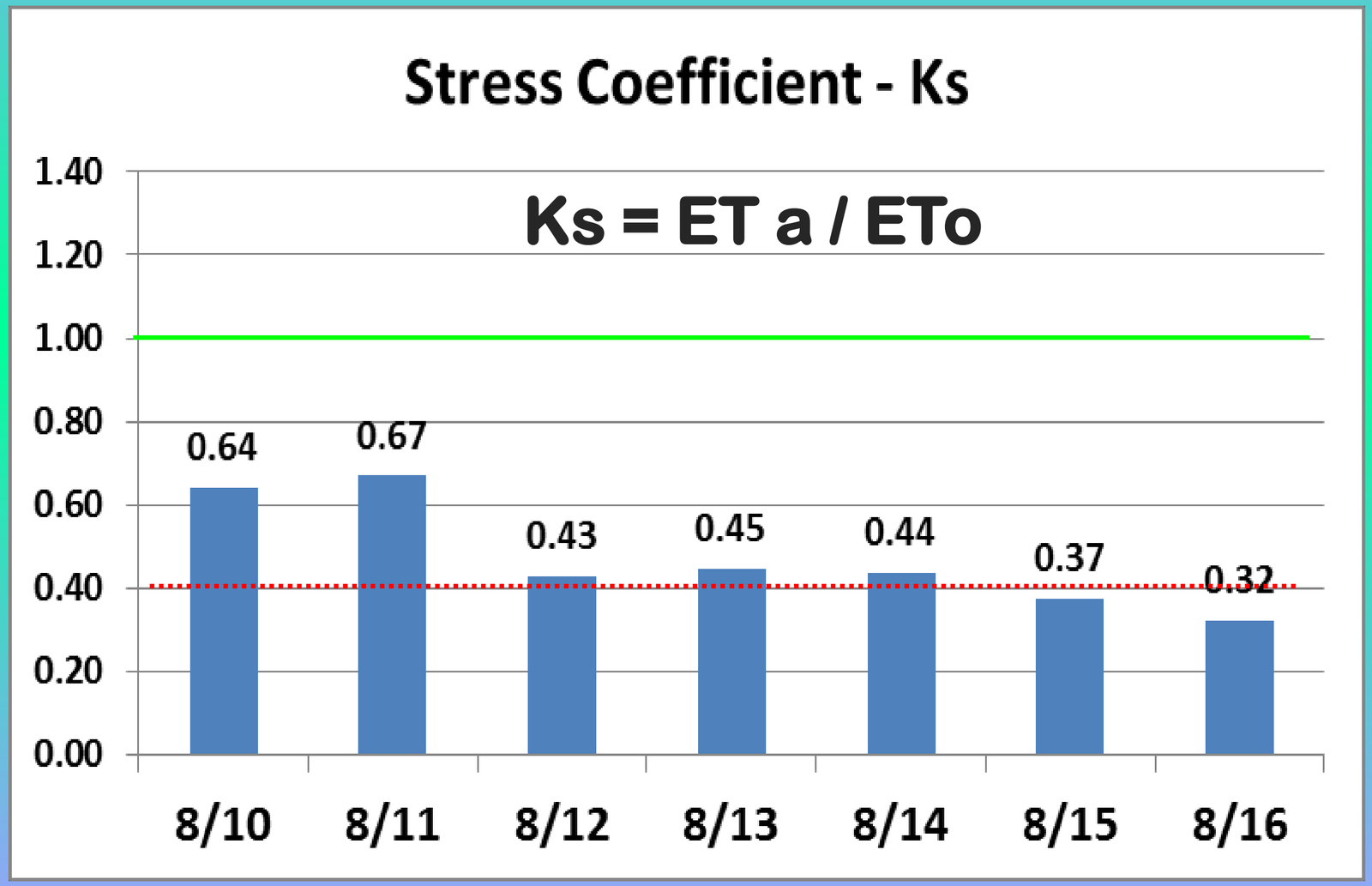
Live Plant Water Usage
WWW access and data storage



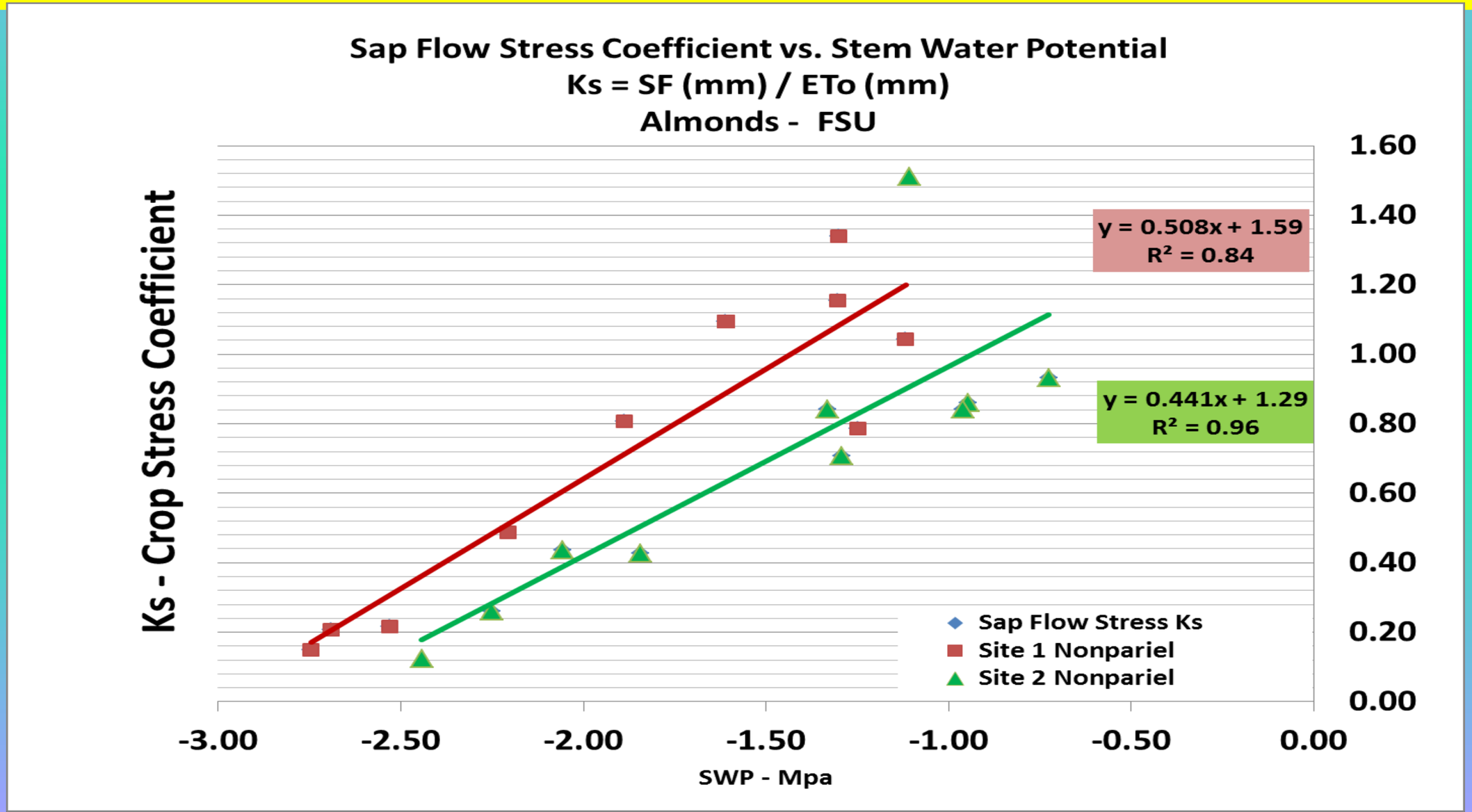
Hour by hour, tree transpiration

Response to weather, irrigation, stress.

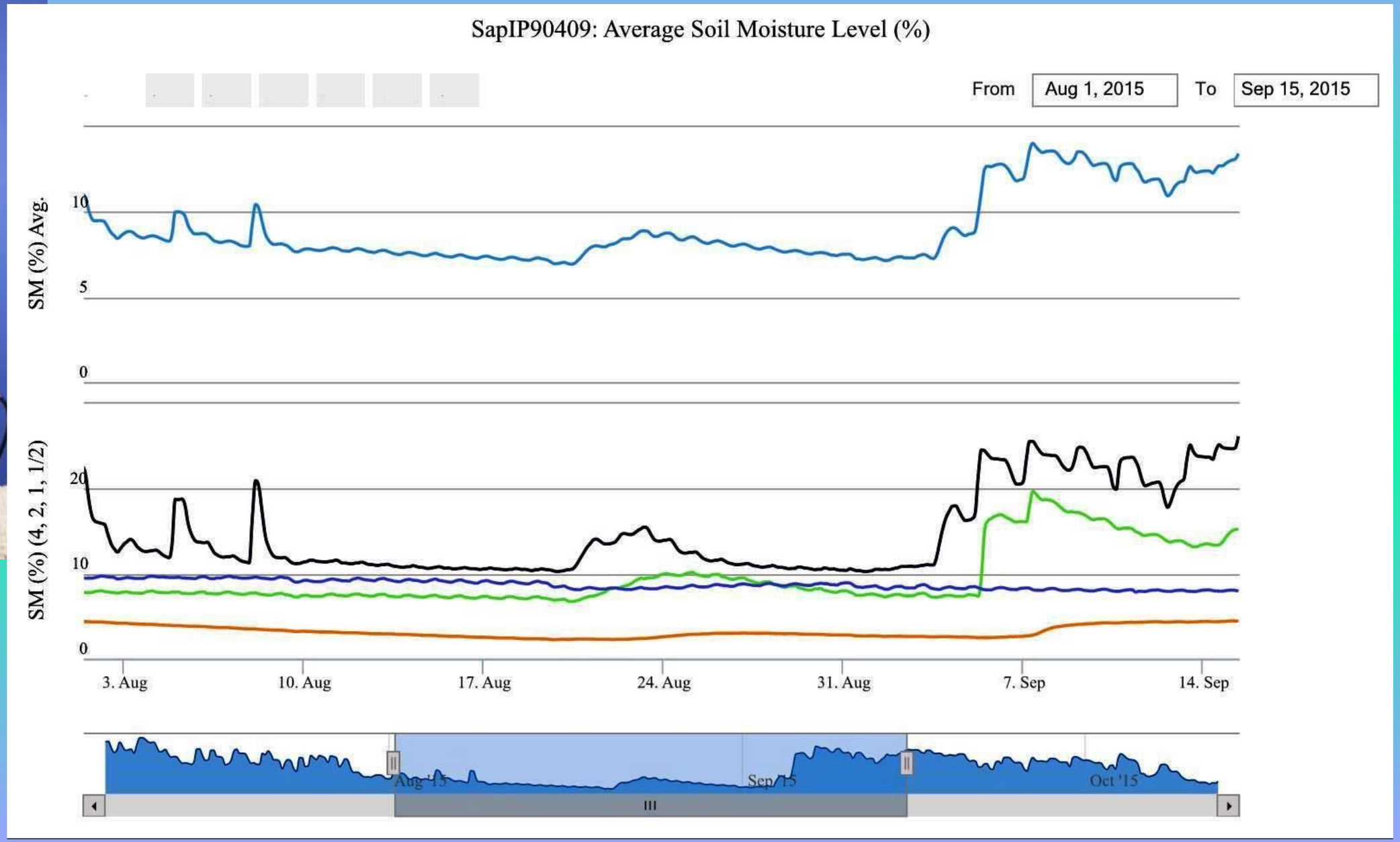
Irrigation Stopped - Almonds Severe Stress after 7 Days



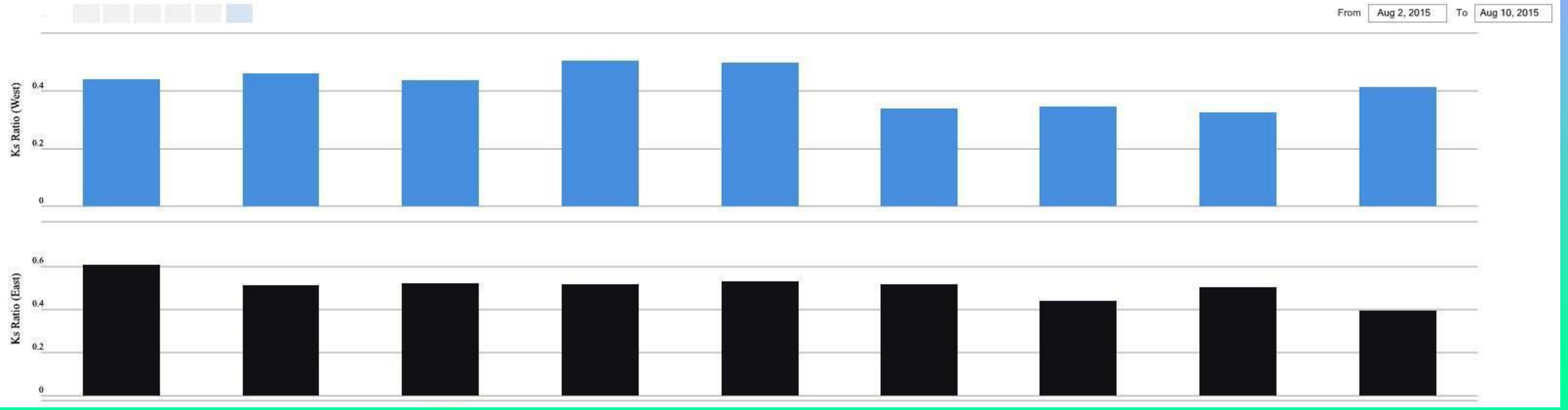
Stem Water Potential / Sap Flow Ks is highly correlated. Characterize the plant – varietal response vs. Soil, or vs. Grower irrigation for deeper water and root development. (2014 data).



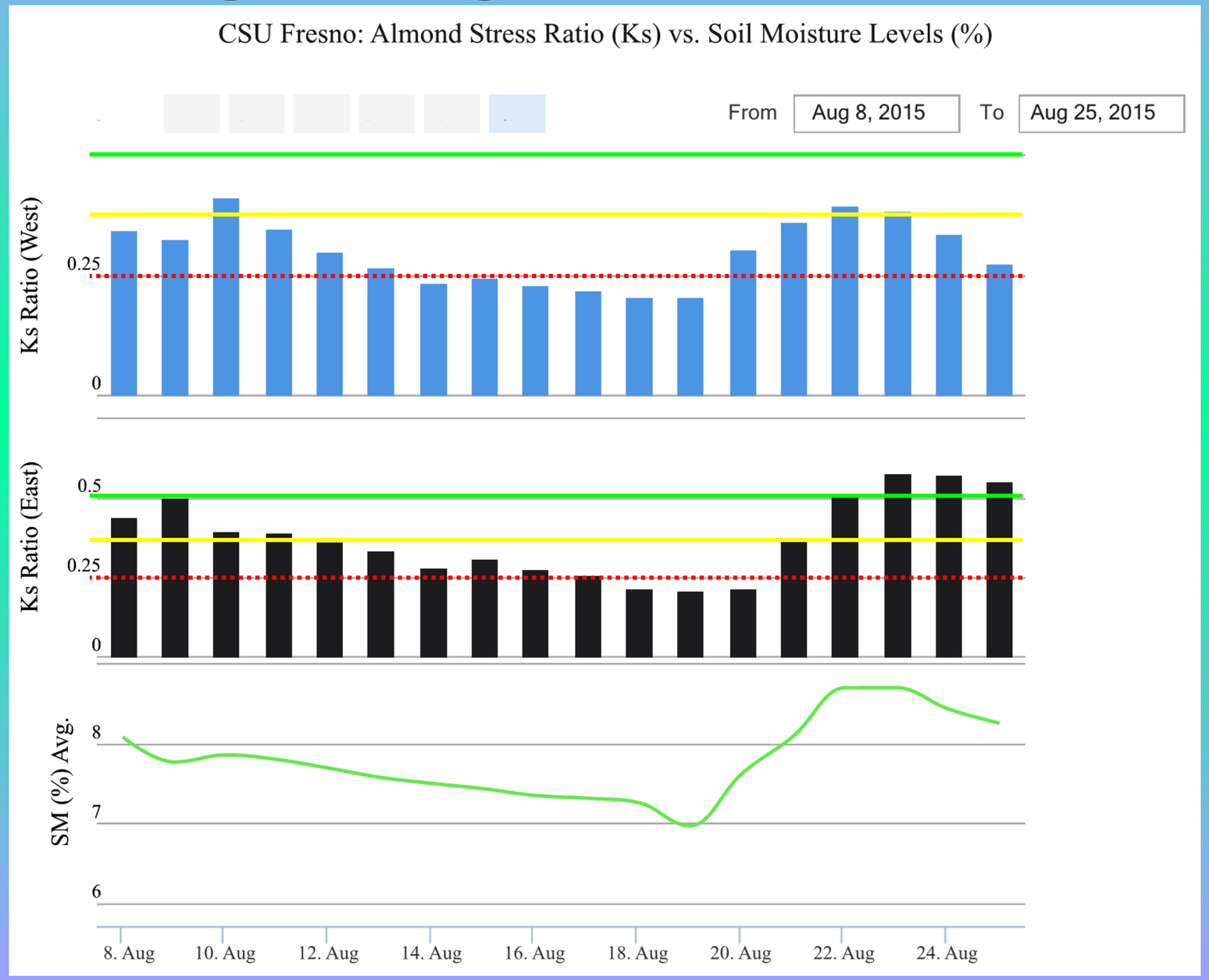
SM150 soil moisture-Bury at 6", 1 ft, 2 ft, & 4 ft



CSU Fresno: Almond Stress Ratio (Ks) vs. Soil Moisture Levels (%)



Long Irrigation – 380 Gal tree 4 days



Limited Recovery -W

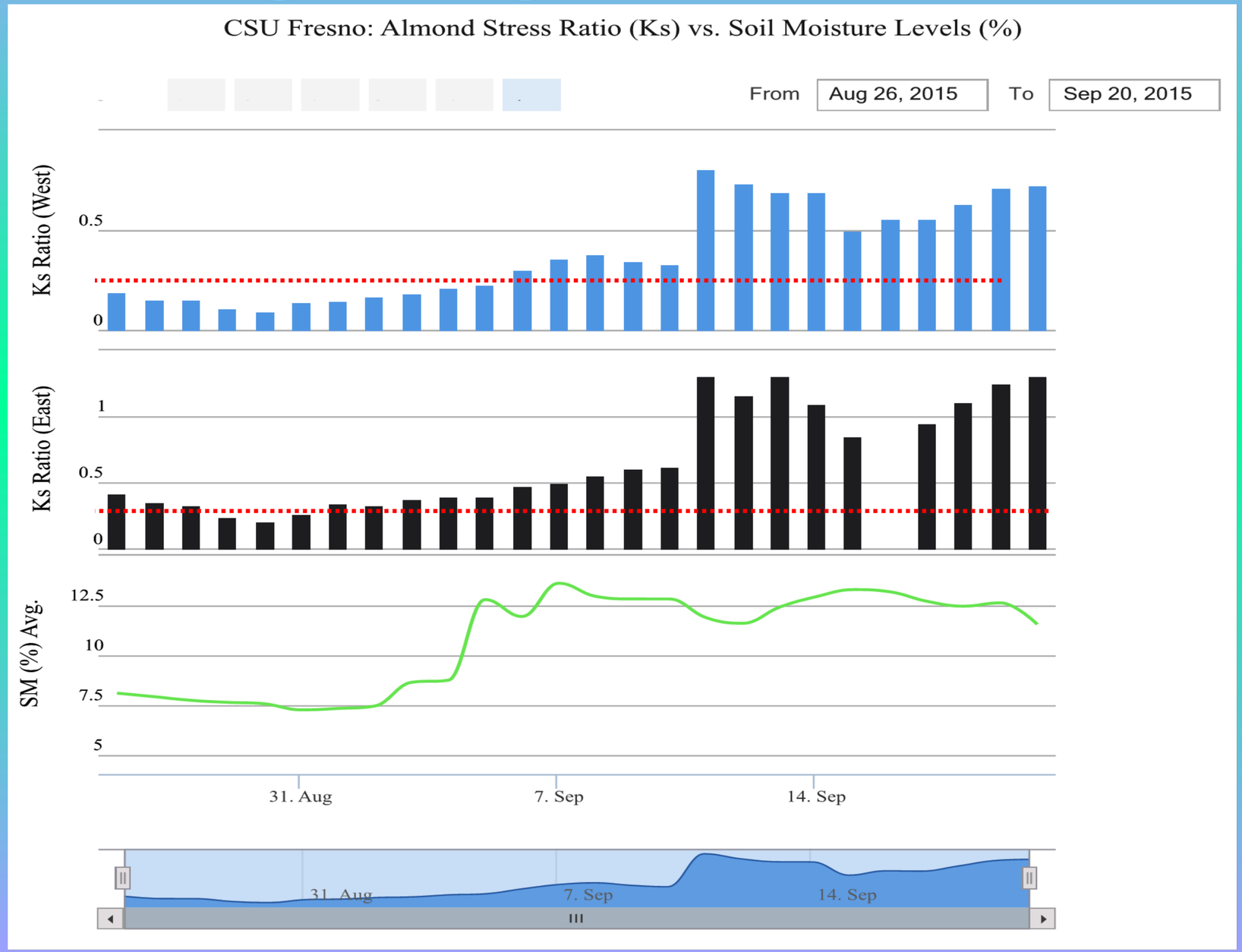
Sap flow increases

100% over 3 days -E.

Trees are still Stressed to 52% of Normal Well Watered Almond

(Kc = Eta/ETo)

Long Irrigation - 380 Gal tree 4 days



Recovery -As Sap flow increases

To over .5 Ks factor

Irrigation started Sept 3, 5, 7 th after harvest and shells picked up on Sept 2.

Plants Tell You Stress Level by Sap Flow Rate per Hour

Dynamax monitors plant stress:

- **Plant bio-feedback with Actionable Intelligence**
- **Plant activity – When to Irrigate & how Much**
- **Improve Recover Time – Avoid significant losses**
- **Plant health – When to apply Nutrients**
  - **Stop Wasting Fertigation**
- **Analyzes Stress by Soil and Varietal**

Dynamax Fresno, CA

- Serving Central CA, San Joaquin Valley

- WET Center – FSU Almond trial site on campus

- Central CA - Service and support
- On-site install, maintain, and warranty equipment.

- Call us for your needs at – 800 – 896 –7108

www.dynamax.com

- **Questions**

How long does it take to install sensors?
Can we sense sap flow in the winter, start of the season?
Can Stress be measured from Nutrients – lack of growth?
Can heat cause stress, and even with high soil moisture?
Why use soil moisture, will it work as a status tool?
Do we need to measure Pressure Bomb water status?
Do I need an accurate Eto from a local weather station?