Ranch Systems LLC

Field Monitoring and Control

www.ranchsystems.com

# Ranch Systems

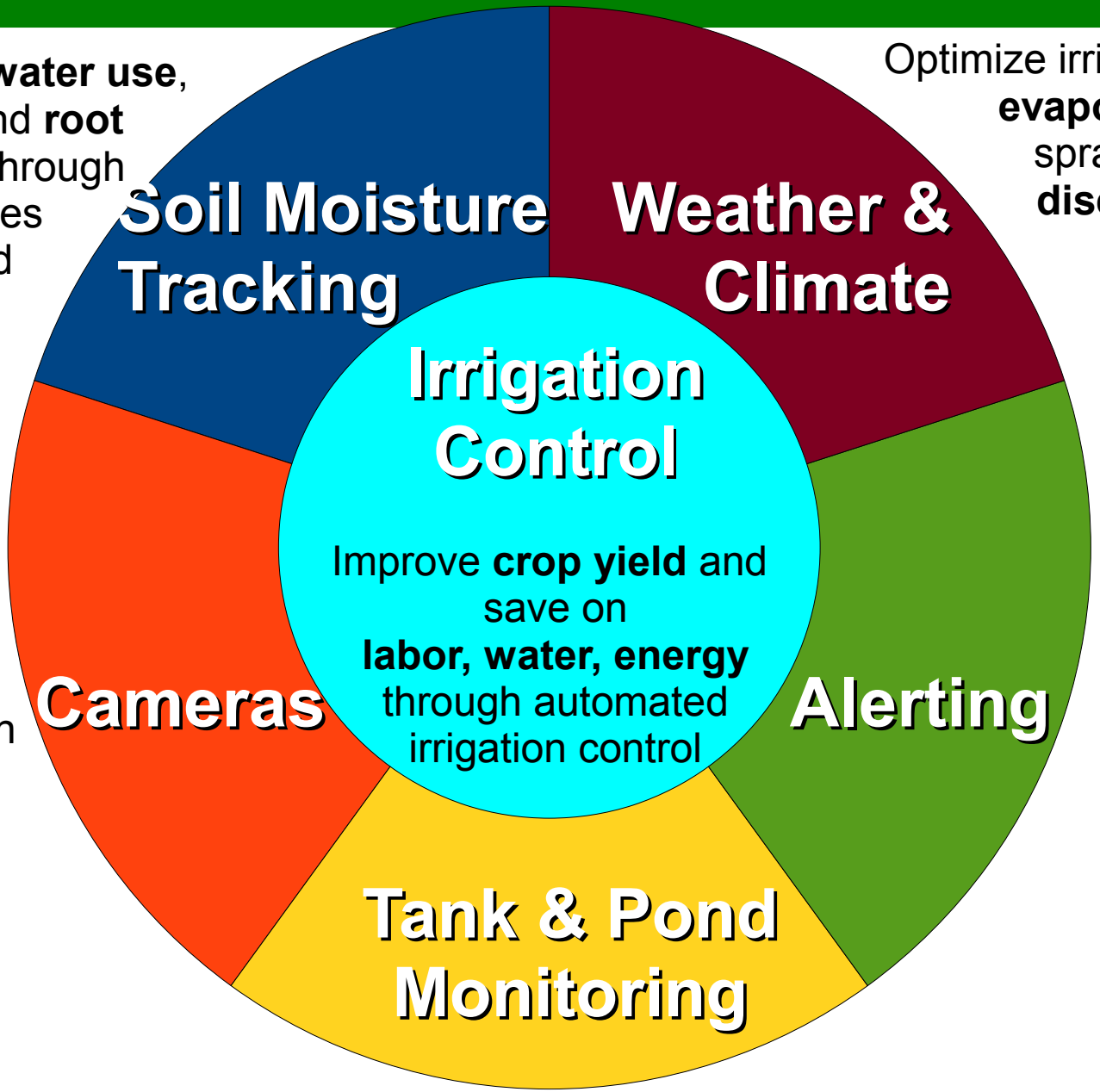
# Overview Presentation

September 2010

# Integrated Field Monitoring & Control

Optimize your **water use**, **plant stress** and **root development** through use of soil probes and color coded soil profile charts

Optimize irrigation by tracking **evapotranspiration** and spraying by calculating **disease risk indices**. Know your climate: **heating, cooing, rain, wind**.




Keep track of **crop growth,** progress of **field work,** weather **visibility (fog),** and **theft** through use of remote cameras with time-lapse video capability.

Minimize losses by timely alerting in case of: **frost, heat stress, irrigation leaks, valve misfires**.

Accurately account for **water production and use**. Optimize irrigation to match **scarce water** resources.

# Ranch Systems Background

- Founded in 2005
- Currently deployed at 200+ farms/ranches world-wide
- 400+ unique users
- 1500+ telemetry units
- Profitable
- Growing ~75% year-over-year
- Selected Top-10 New Product at World Ag Expo
- Selling and servicing through resellers world-wide

# System Design Overview

## Field Installation

Tank gauges...

Valves...

Pumps...

Flow meters...

Soil Probes...

## Internet

Internet

Cellular

Ranch Systems Data Center and Internet Software

## Users

Cable, DSL etc.

100% online application

Accessible by web browser or mobile device

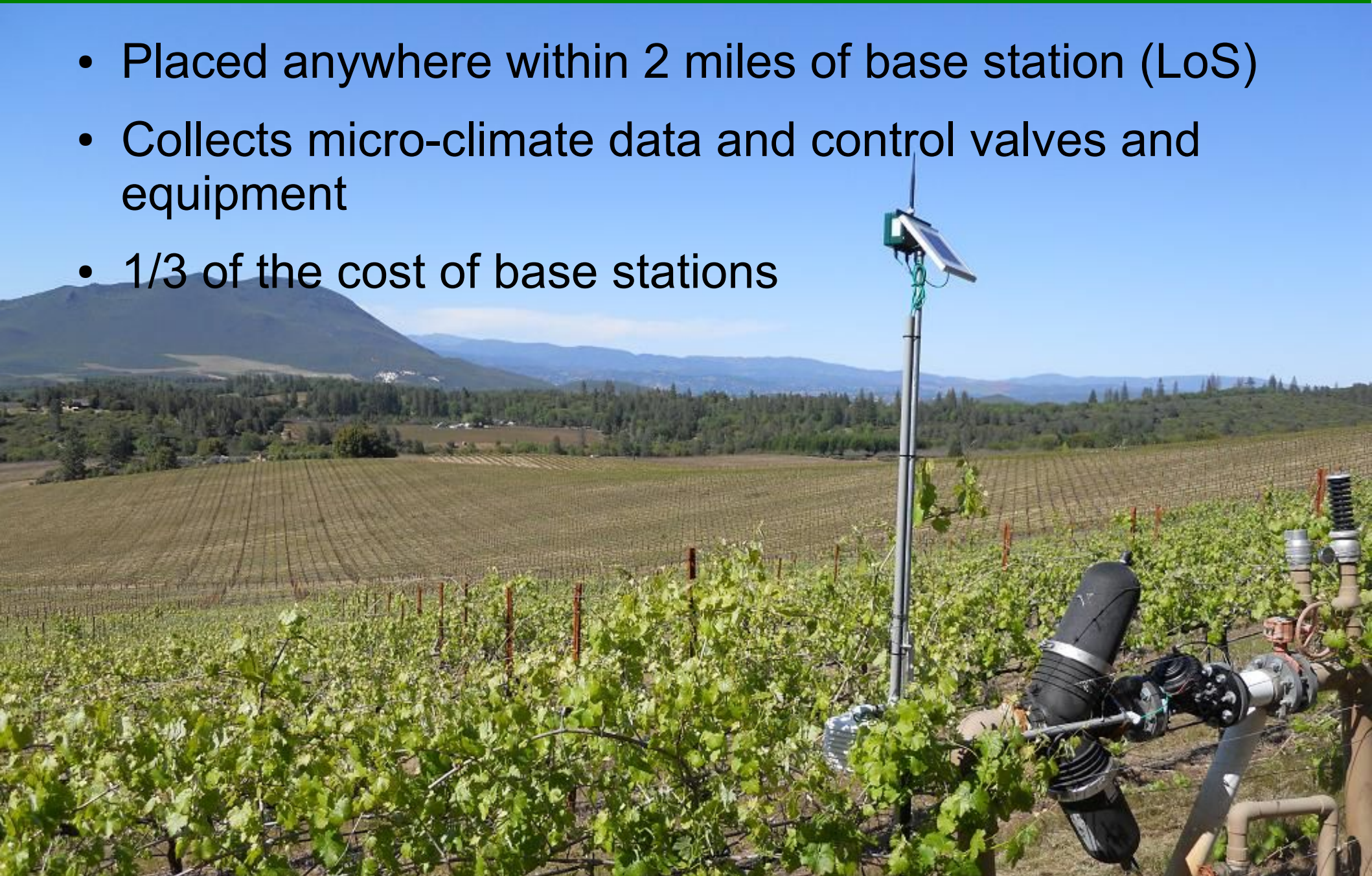
# Base Stations – The Heart of the Systems

- Maintains constant Cellular or WiFi link to server
- Coordinates traffic direct to/from all nodes on site
- “Caches” irrigation programs from server ahead of time
- Often “doubles” as weather station

# Base Station with 12-valve Hard-Wire Box

# Nodes: The Spokes of the System

- Placed anywhere within 2 miles of base station (LoS)
- Collects micro-climate data and control valves and equipment
- 1/3 of the cost of base stations

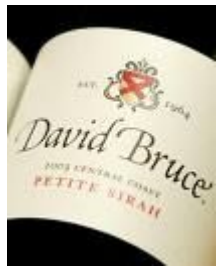


# Nodes Controlling Valves

# Nodes Monitoring Tanks and Filters

# More Nodes...

# Customer Examples

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Driscoll's
The Finest Berries in the World
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KENZO ESTATE
Hudson Vineyards
STAGLIN FAMILY VINEYARD
KENDALL-JACKSON
Pahlmeyer
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DIAGEO
Nissen Vineyard Services
WILLIAMS SELYEM
REVM
POM WONDERFUL
Rhys Vineyards
Johan VINEYARDS
Johan Vineyards
SALVESTRIN

# Economic Benefit Framework

| | Increased Revenue | Labor Savings | Water Savings | Energy Savings | Managerial Savings | Loss Prevention |
|---|---|---|---|---|---|---|
| Weather Monitoring | More accurate crop selection & rotation due to micro-climate data | | # gallons / week saved by irrigating according to ET | | # hrs saved by eliminating manual data collection / processing | # tons of crop and $ of spray saved by more accurate disease prediction |
| Irrigation Monitoring & Control | Increased crop weight from e.g. pulsed irrigation. | # hrs / week saved by eliminating manual operation | # gallons / week saved by irrigating at night (less evaporation) | # kWhrs / week saved from less pumping and $ saved from off-hours pricing | # hrs / week saved by fewer on-site visits and by automated water reporting | # gallons saved from leak detect. # ton crop saved by avoiding missed irrigations |
| Soil Moisture Monitoring | Increased fruit quality from optimized plant stress | # hrs / week saved by eliminating manual sampling | # gallons / week saved by eliminating over-irrigation | # kWhrs / week saved from less pumping | # hrs saved by eliminating manual data processing | # tons of crop saved by prevention of plant stress or rot (average/year) |
| Alerting | | # hrs / week saved by avoiding on-site checks | # gals/week saved by avoiding needless frost protection | # kWhrs / week saved by avoiding needless frost protection | # hrs saved from avoiding redundant checks | # tons of crop saved by more timely alerting (average/year) |
| Tank Monitoring | | # hrs / week saved by eliminating manual checks | | | | Avg. $ saved annually from detected spills/leaks |
| Visual Monitoring (Cameras) | Increased retail traffic from live image feed to web site | # hrs saved / week from better monitoring of field work progress | | | # hrs / week saved by fewer on-site visits | Avg. $ saved annually from detected thefts/fraud |

# Customer: Obsidian Ridge Vineyards

- Profile:
  - 100 acres premium grapes, Lake County
- Challenges:
  - Soil: low soil water holding capacity
  - Well: limited production – can't irrigate long sets
  - Management: remote location
- Solution:
  - 1 cellular base station, 9 wireless valve control nodes, 1 pump control node
  - Cost (installed): ~$16K

    Ongoing: $184/month

- Results:
  - Annual labor/mgmt costs down from $18.5K to $4.8K ($13.7K savings)
  - 15% increase in water use efficiency
  - Energy cost down from $8K to $6.5K ($1.5K savings)
  - On average 1 spray cycle saved per year: ~$10K savings

Estimated payback period:
**9 months**

# Customer: NorCal Tree Farm

- Profile:
  - Former reclamation site, ~30,000 trees
- Challenges:
  - Need to develop deep root system quickly
  - Well: insufficient capacity – large holding tank
  - Management: remote location
- Solution:
  - 1 cellular base station with valve control box, 1 wireless pump, 1 tank node. 4 soil probes + nodes.
  - Cost (installed): ~$20K

    Ongoing: $114/month

- Results:
  - Annual labor savings: 3 hrs, 4 days/week, 6 months at $20/hr (fully loaded) = $5760
  - 20-30% reduction in water use: 300K gallons/year. No hard cost, but significant environmental benefit.
  - Energy savings from reduced pumping (per PG&E bills): $1090.
  - Annual savings from elimination of flooding related washouts and repairs: $5K-$10K
  - Savings from reduced management visits to site for inspection and tensiometer readings: $7200+

Estimated payback period:
**12 months**

# Customer: Sonatera Vineyards

- Profile:
  - 11 acres premium grapes and olives, Sonoma County
- Challenges:
  - Owner operated, but not living on site
  - Previous system malfunctions led to frequent water loss or missed irrigation
- Solution:
  - 1 cellular base station, 3 wireless valve control nodes
  - Cost (installed): ~$8K

    Ongoing: $84/month
- Results:
  - Annual labor/mgmt savings of 40-60 hrs / season, equivalent to ~$2-3K
  - Avoided water/energy waste: Average of 30 hrs/season = 60,000 gallons = ~$1K
  - Un-quantifiable improvement in fruit quality
  - Significant, un-quantifiable improvement in owner's “life-style” and peace of mind!

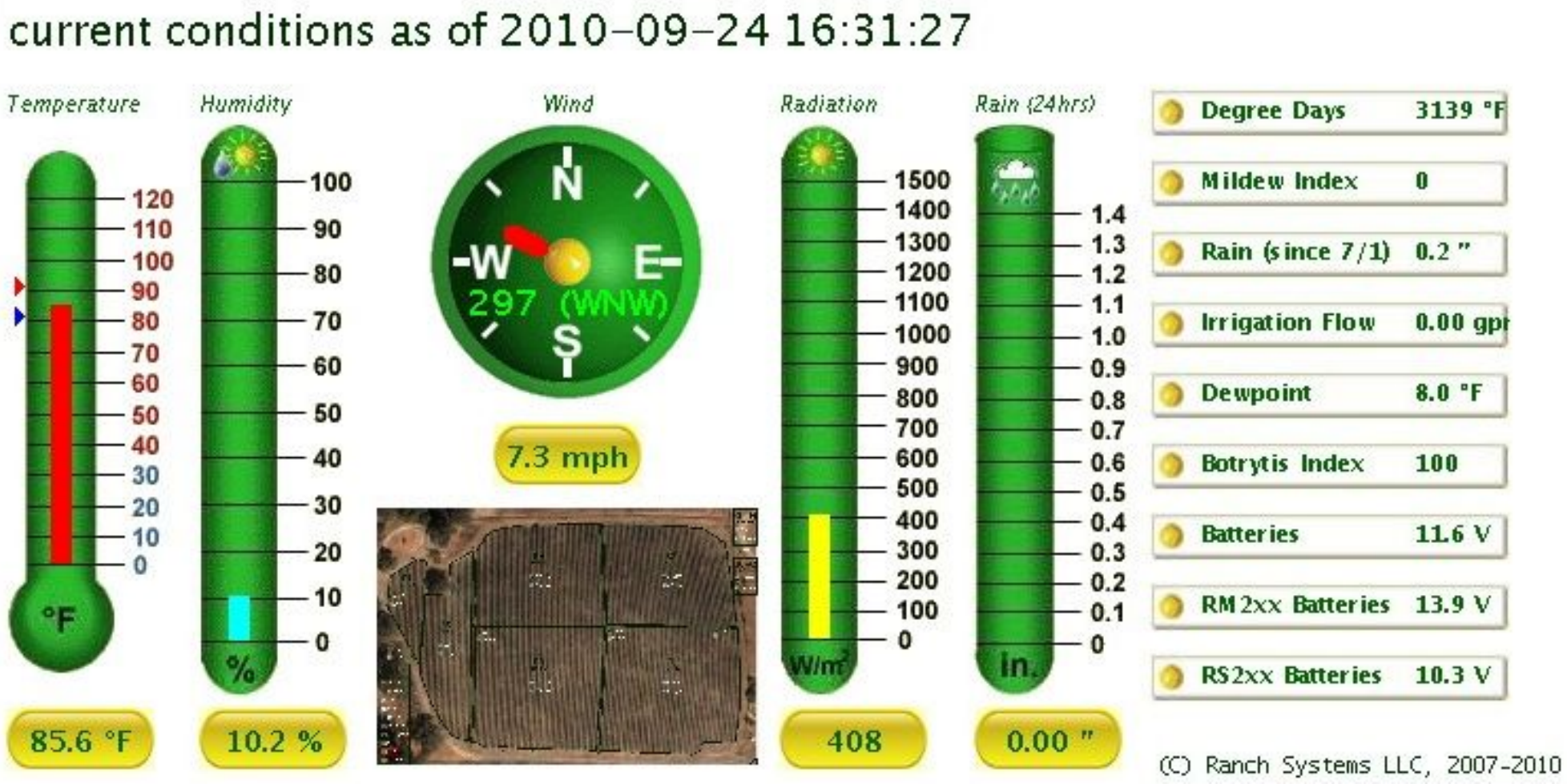
Estimated payback period:
**30 months**

# System Design Considerations

- Plan for solid wireless connectivity
  - to avoid missed irrigations
  - both for the base link and the nodes
- Plan for “feedback sensors”
  - for every control action, must have a feedback to confirm
  - typically flow sensor(s), but pressure sensors also work
  - system alert engine uses these sensors to “keep tabs”
- Some tips:
  - Pick a good “commanding” base location (even if no sensors/valves at that location)
  - Soil probes may only be needed per soil type, not necessarily each block
  - A main head flow sensor typically works out cheaper and simpler than sensors in each block

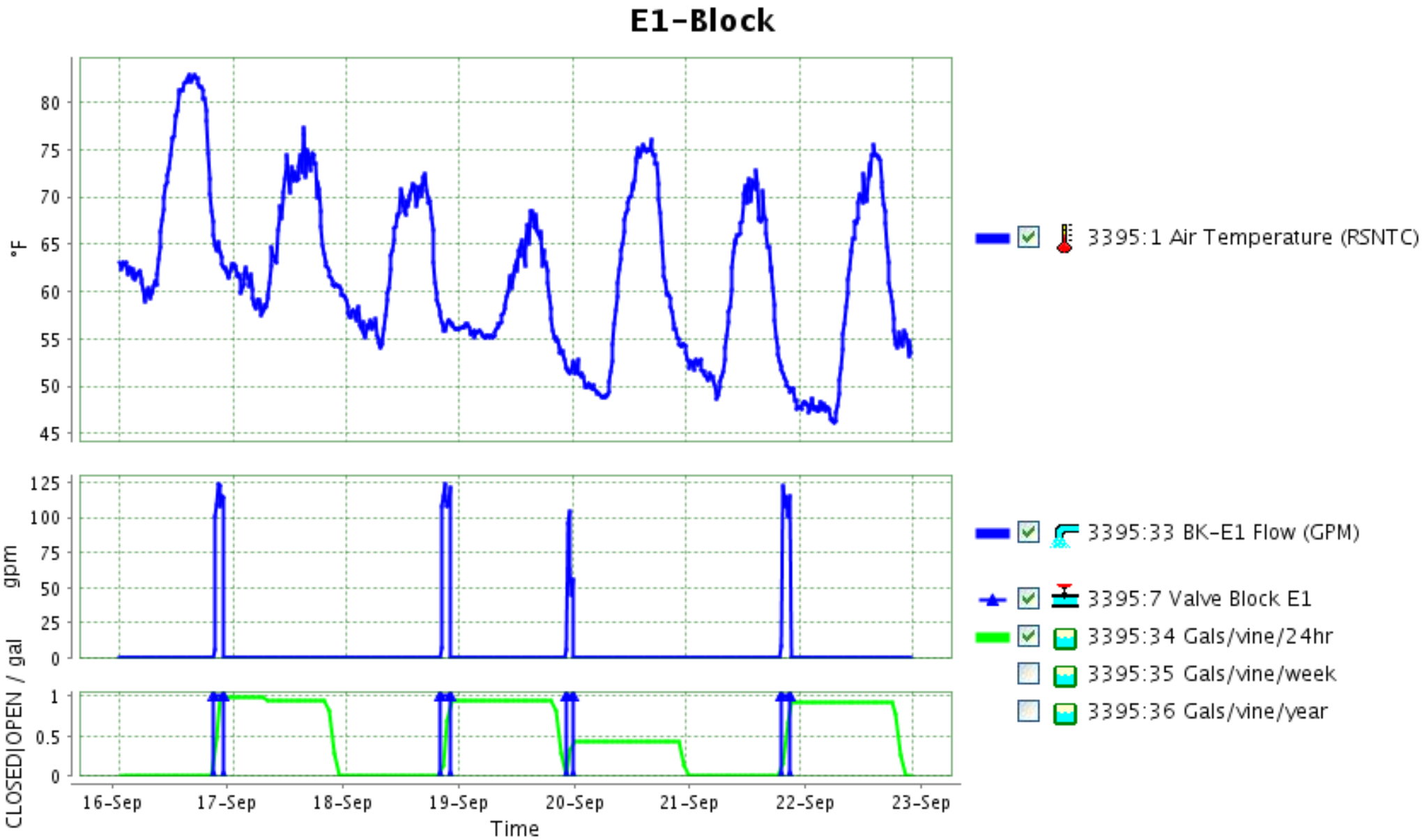
# Software Screenshots

# The Dashboard: 1-click Access!

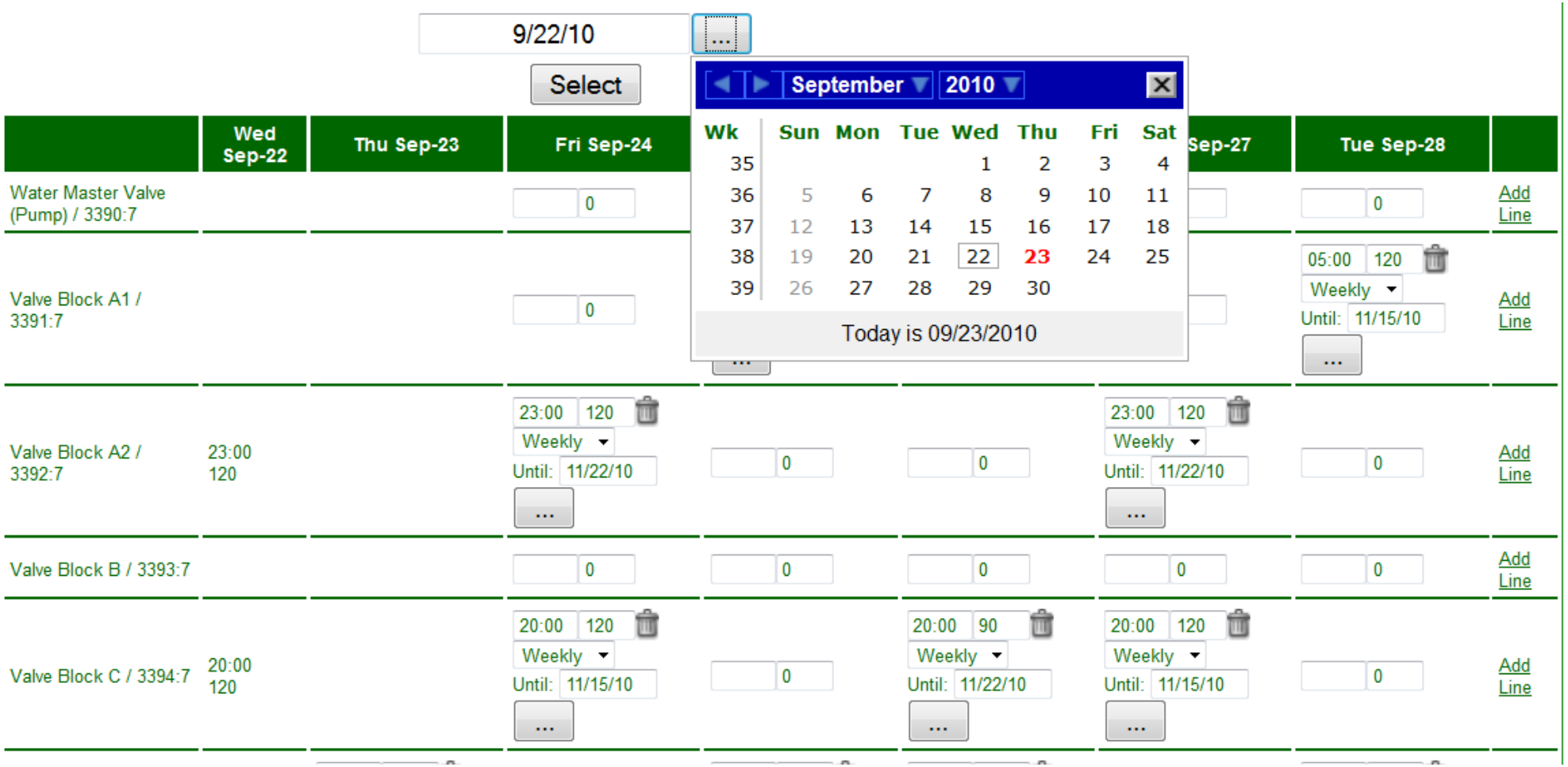


# Map Overview

# Irrigation Block Execution Overview



# Irrigation Schedule



# Irrigation Control Configuration

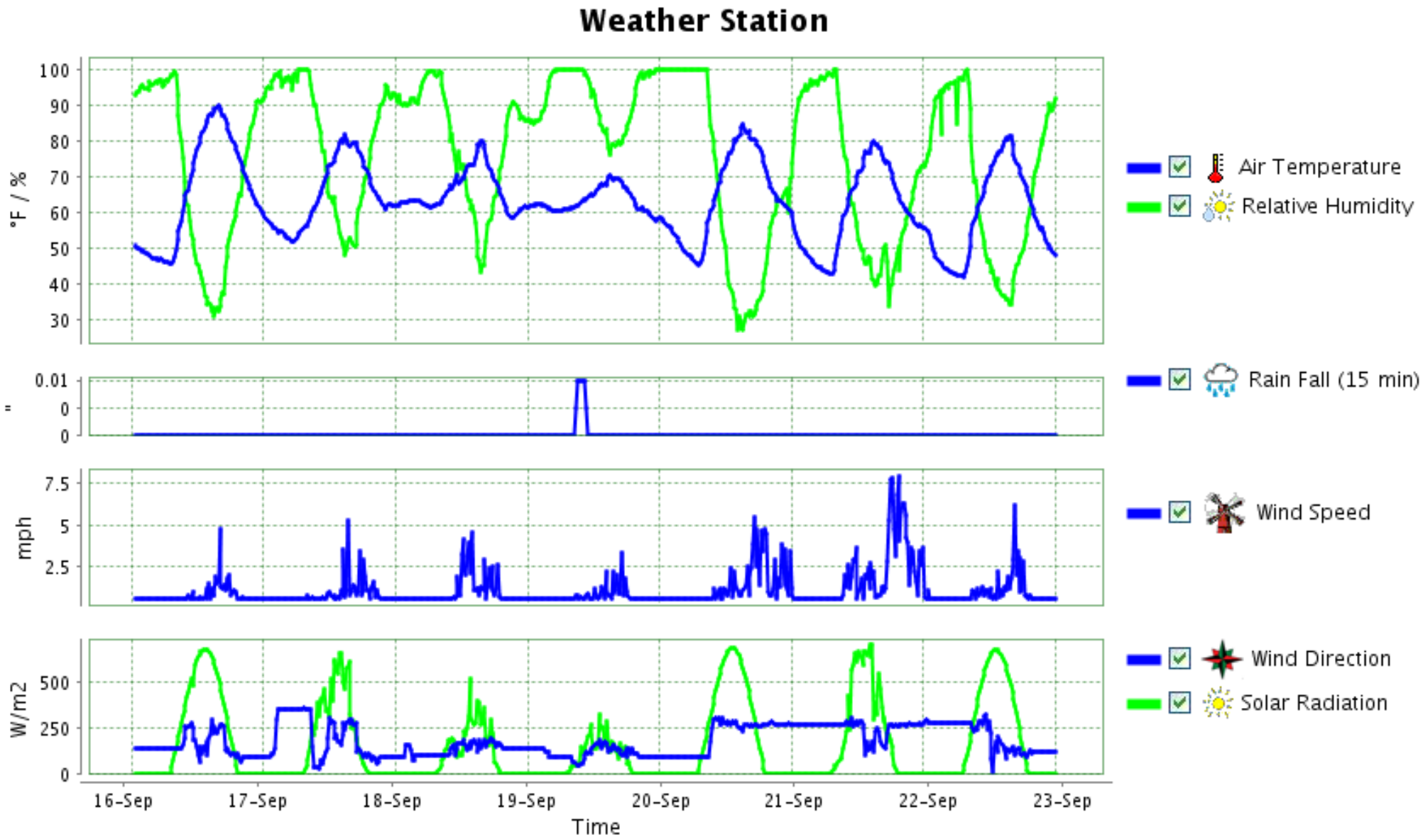
## Master and Injection Configuration

| | Master Valve | Master Warm-Up (mins) | Injection Valve | Injection Time (mins) |
|---|---|---|---|---|
| Water Master Valve (Pump) / 3390:7 | | 0 | | 0 |
| Valve Block A1 / 3391:7 | 3390:7 : Water Master Valve (Pump)(19091) | 0 | | 0 |
| Valve Block A2 / 3392:7 | 3390:7 : Water Master Valve (Pump)(19091) | 0 | | 0 |
| Valve Block B / 3393:7 | 3390:7 : Water Master Valve (Pump)(19091) | 0 | | 0 |
| Valve Block C / 3394:7 | 3390:7 : Water Master Valve (Pump)(19091) | 0 | | 0 |

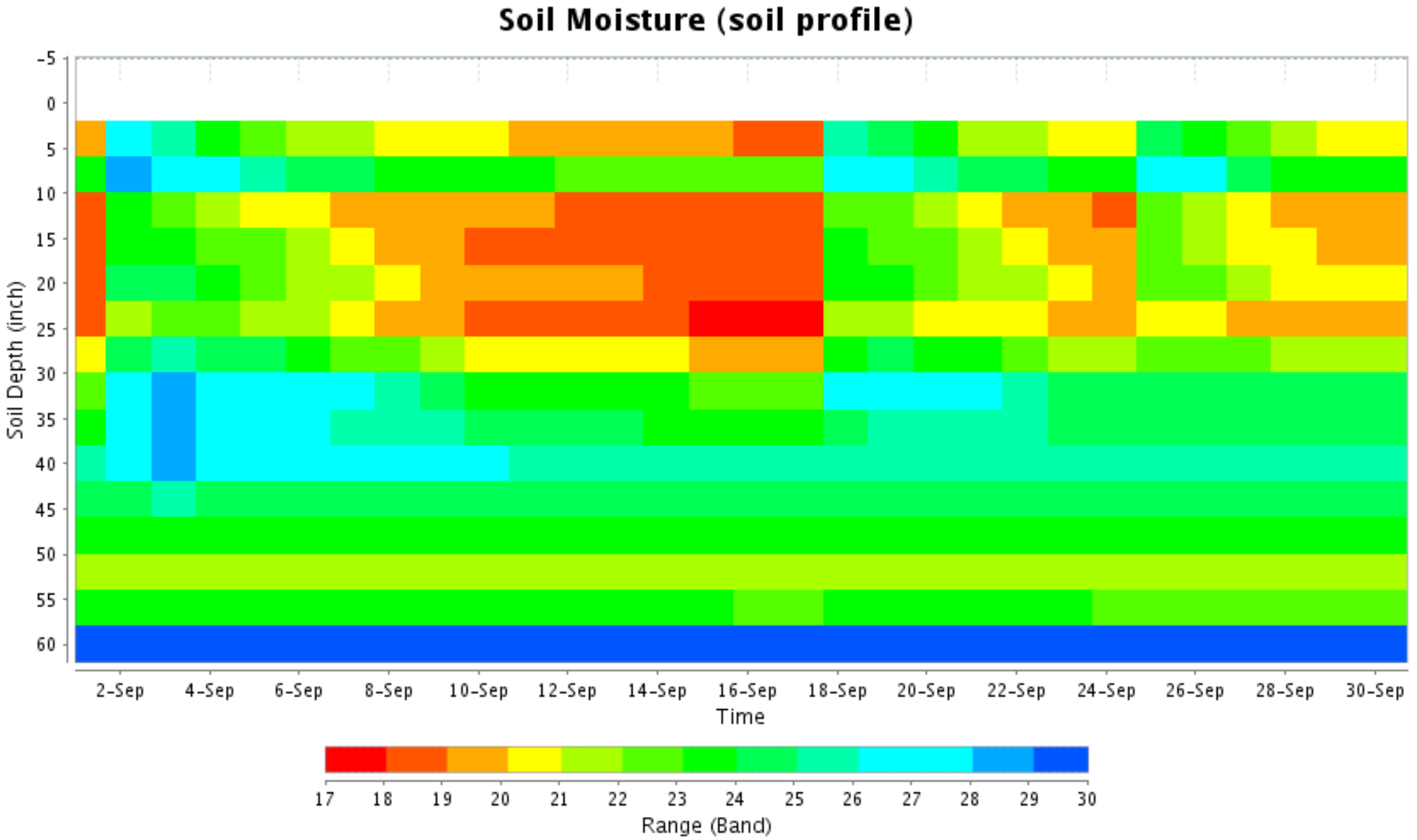
## Feedback Monitoring and Alert Configuration

| | Main Feedback sensor | Injection Feedback sensor | Max schedule deviation (mins) | Max feedback delay (mins) | Users to alert | Last alert issued |
|---|---|---|---|---|---|---|
| Water Master Valve (Pump) / 3390:7 | | | 0 | 0 | | 2010-07-08 07:02:48 |
| Valve Block A1 / 3391:7 | 3390:5 : Frequency Counter (ms)(21408) | | 20 | 30 | dhowe | 2010-09-21 07:20:06 |
| Valve Block A2 / 3392:7 | 3390:5 : Frequency Counter (ms)(21408) | | 20 | 30 | dhowe | 2010-09-09 01:20:06 |
| Valve Block B / 3393:7 | 3390:5 : Frequency Counter (ms)(21408) | | 20 | 30 | dhowe | 2010-09-02 04:20:00 |

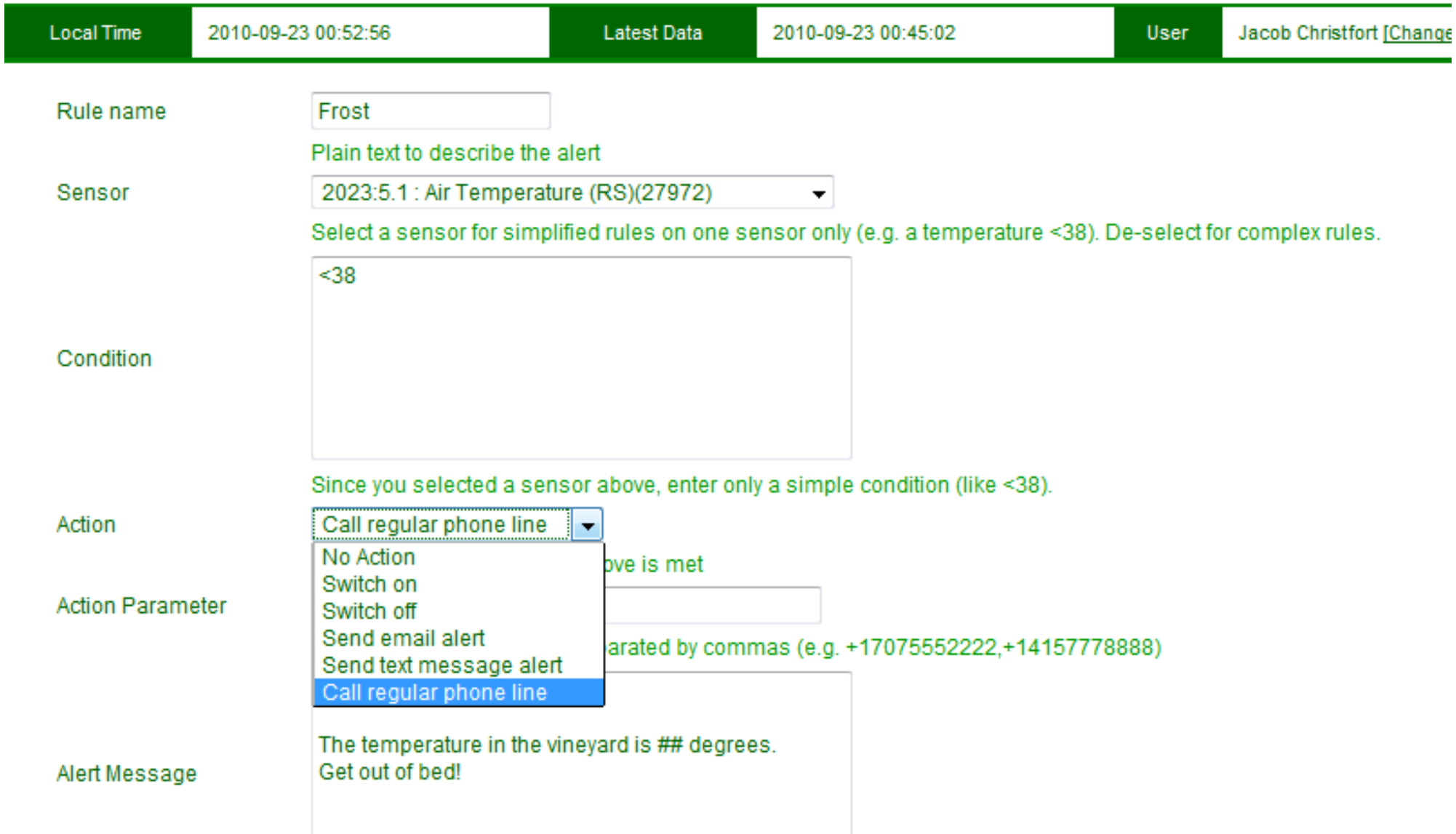
# Weather Tracking



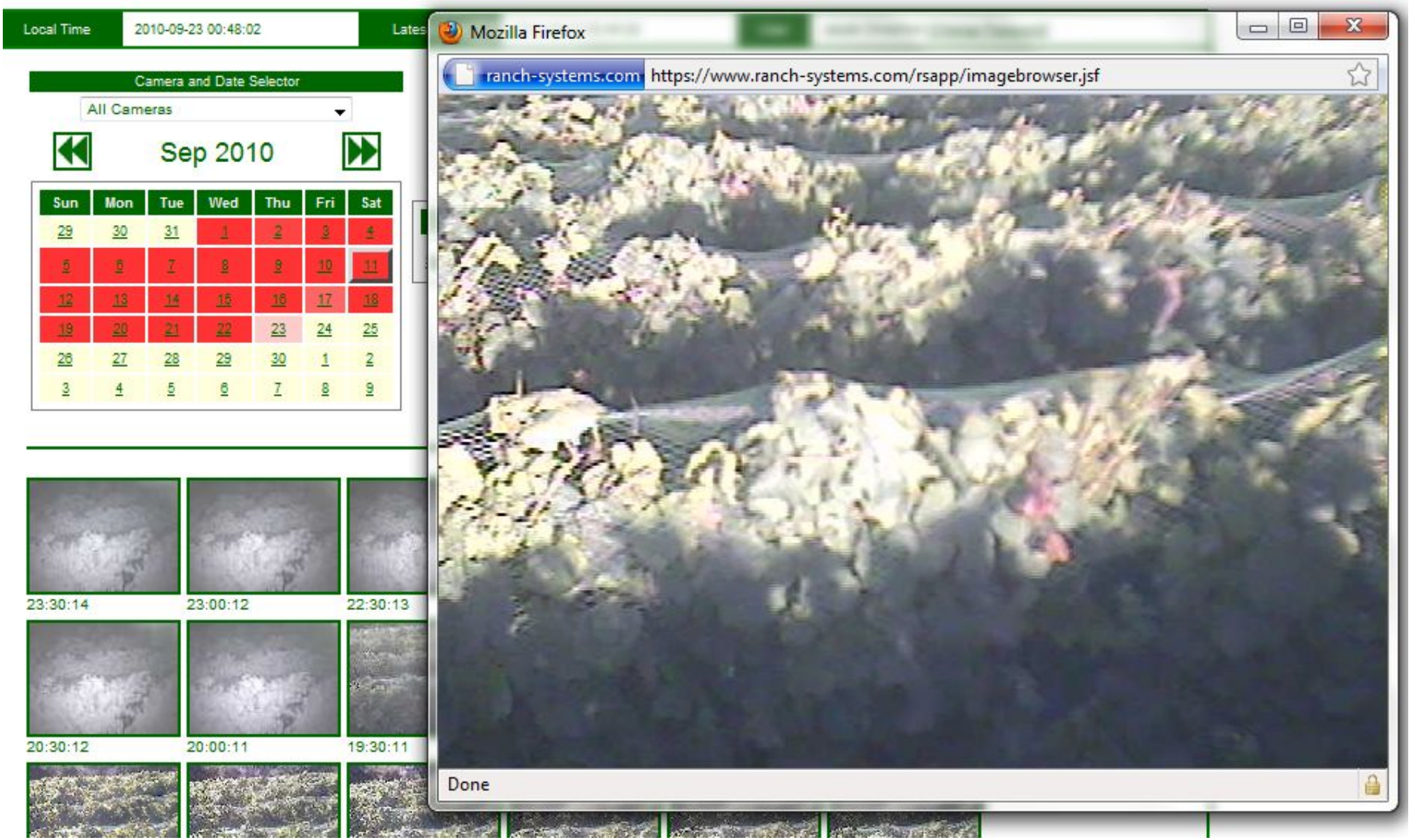
# Soil Moisture Tracking



# Alert Configuration



# Visual Monitoring



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