

Applying Sensor-Based Irrigation for Tree Fruit Orchards

Long He

2020 Automated Irrigation Webinar

Penn State Extension

May 19th, 2020

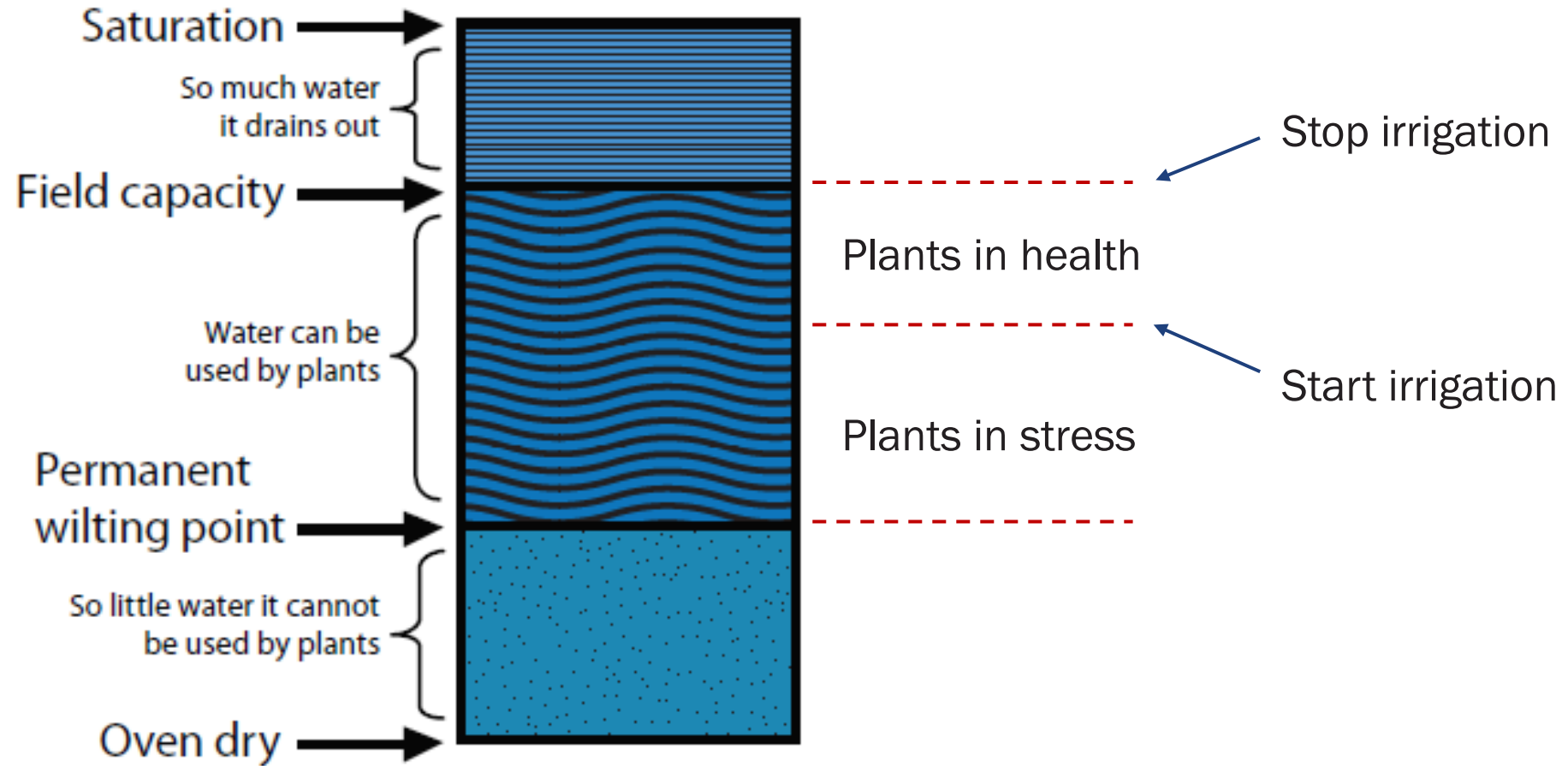


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Water Levels in Soil



FREC Research Block (2018-2019)

Soil Moisture Irrigation



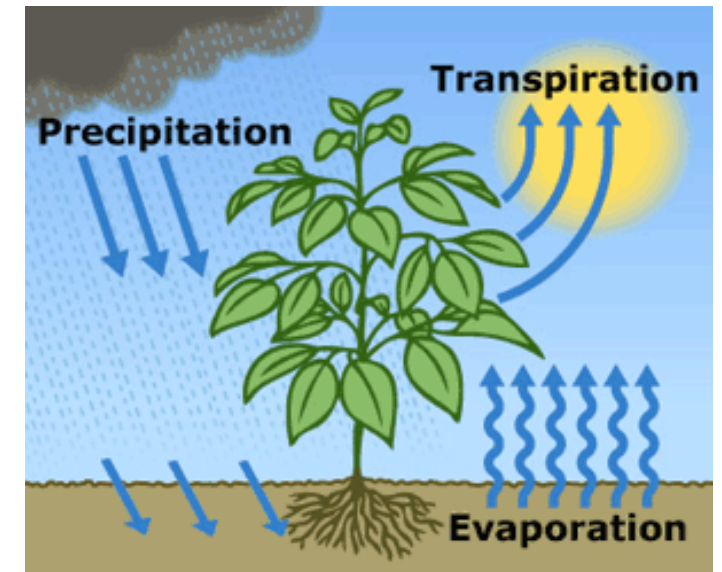
- Soil water content
- Soil water potential
- Data recording and monitoring

Canopy Stress Irrigation



- Canopy temperature vs. Air temperature
- Crop water stress index

Evapotranspiration Irrigation



- Weather station
- Daily ET
- Accumulated water deficit

Commercial Orchards –Soil Moisture Monitoring (2019)



Hollabaugh Bro. Inc
(Honey Crisp)



Mt. Ridge Farms
(Fuji)



Twin Springs Fruit Farm
(Crimson Crisp)



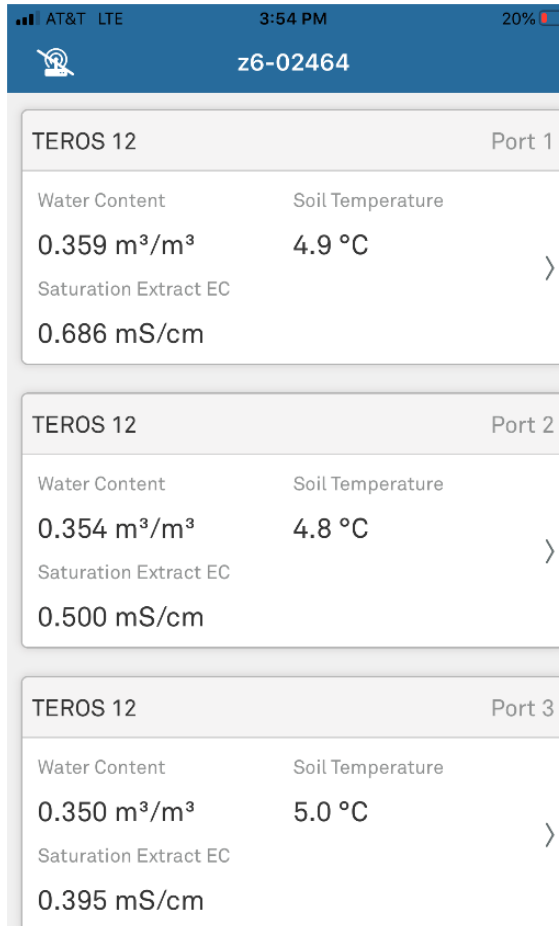
El Vista Orchards
(Gala)

Soil Moisture Sensor System Setup

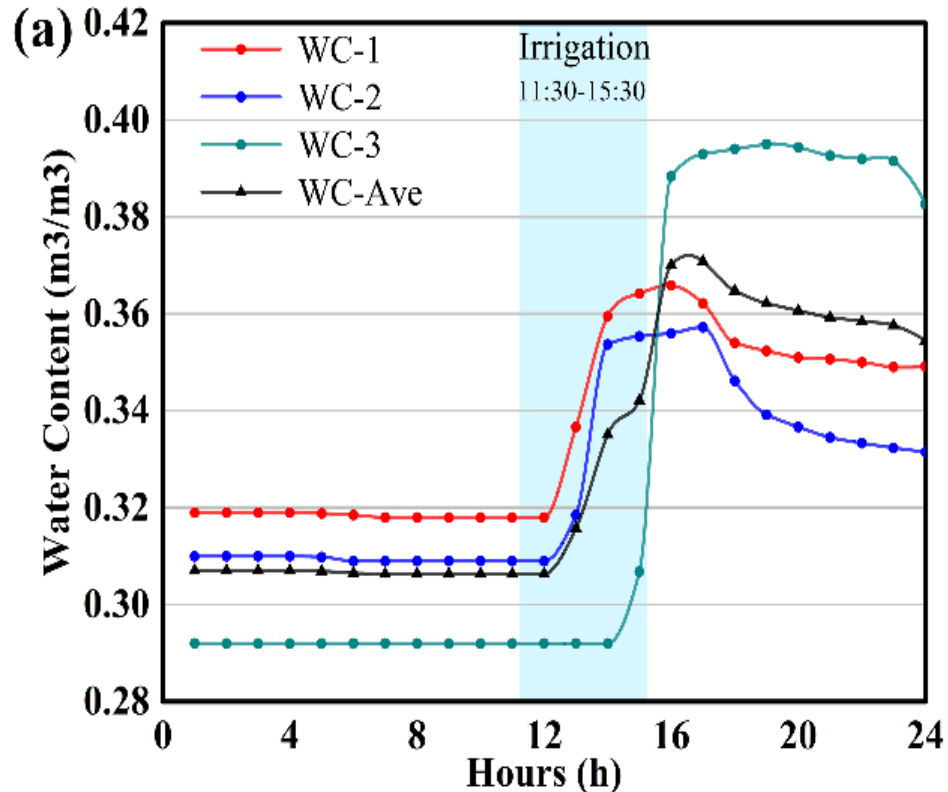


- Soil water content and Potential sensors
- Datalogger to record sensor data
- Cellular network for data communication (cloud server)

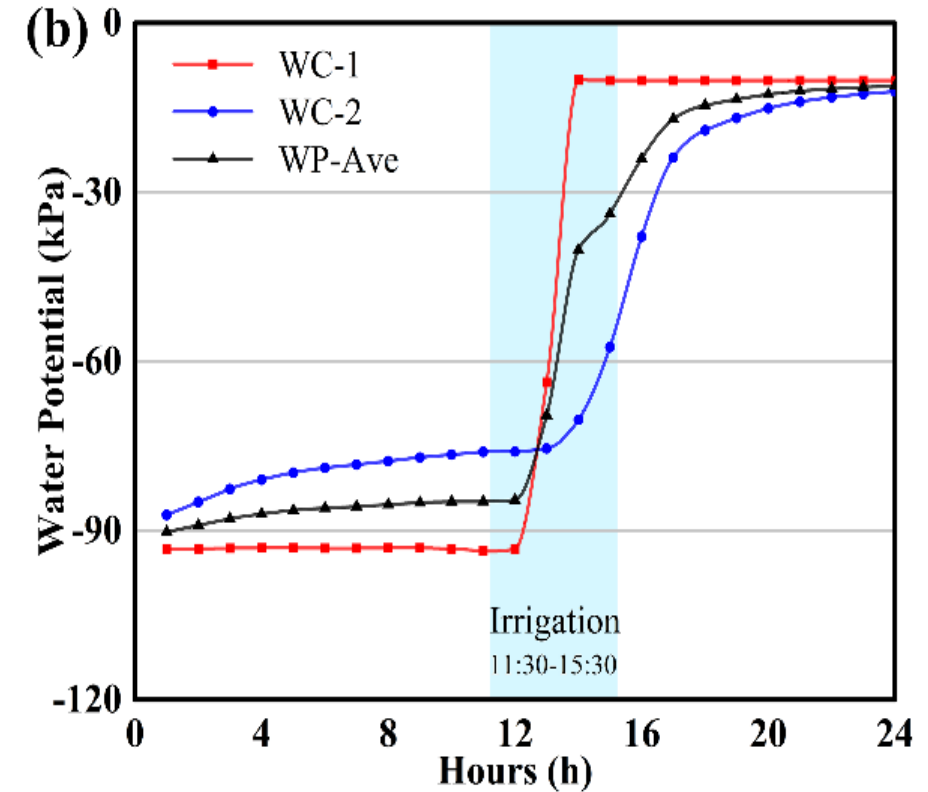
Data Monitoring and Using



Soil Moisture Change during an Irrigation Event

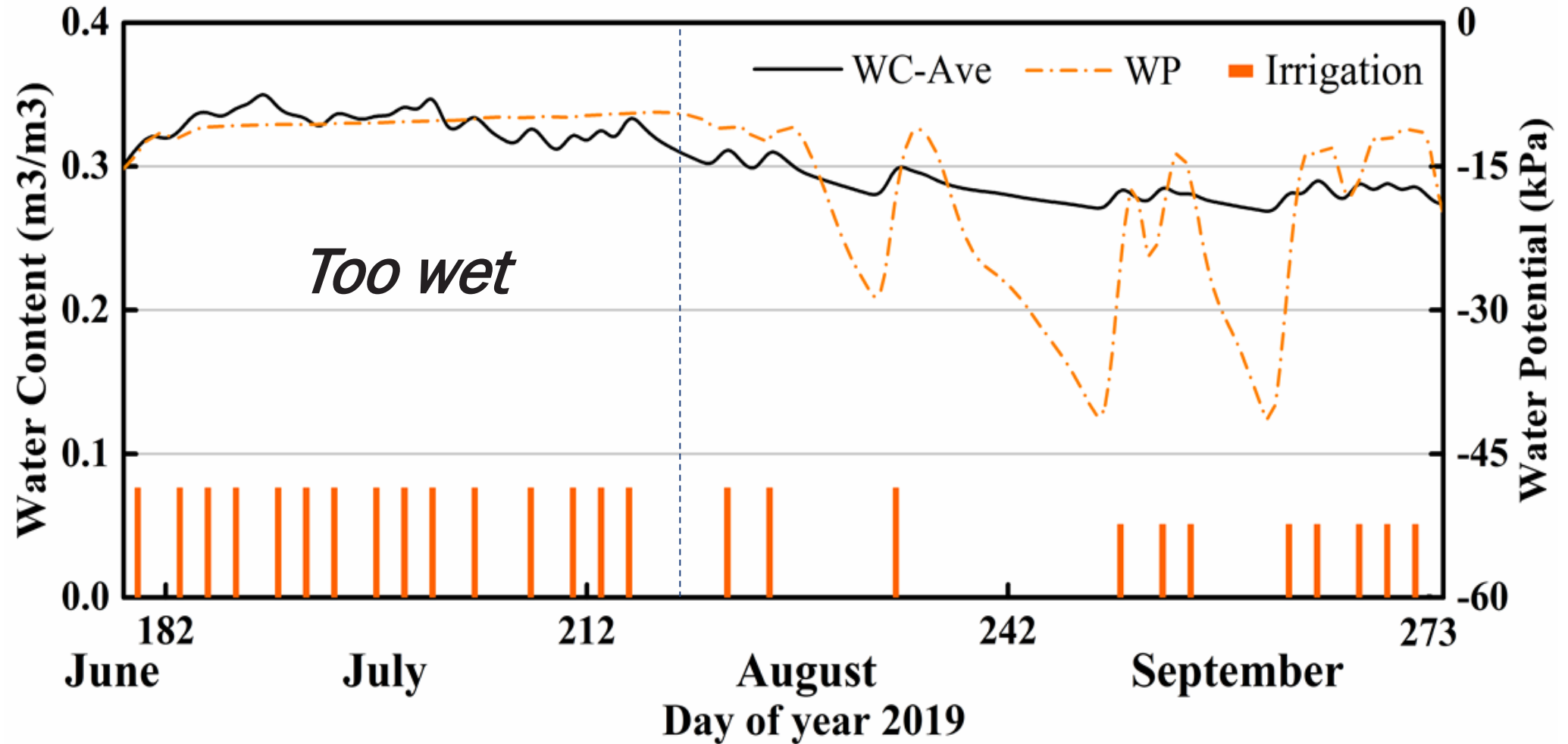


a) Soil water content at different depths

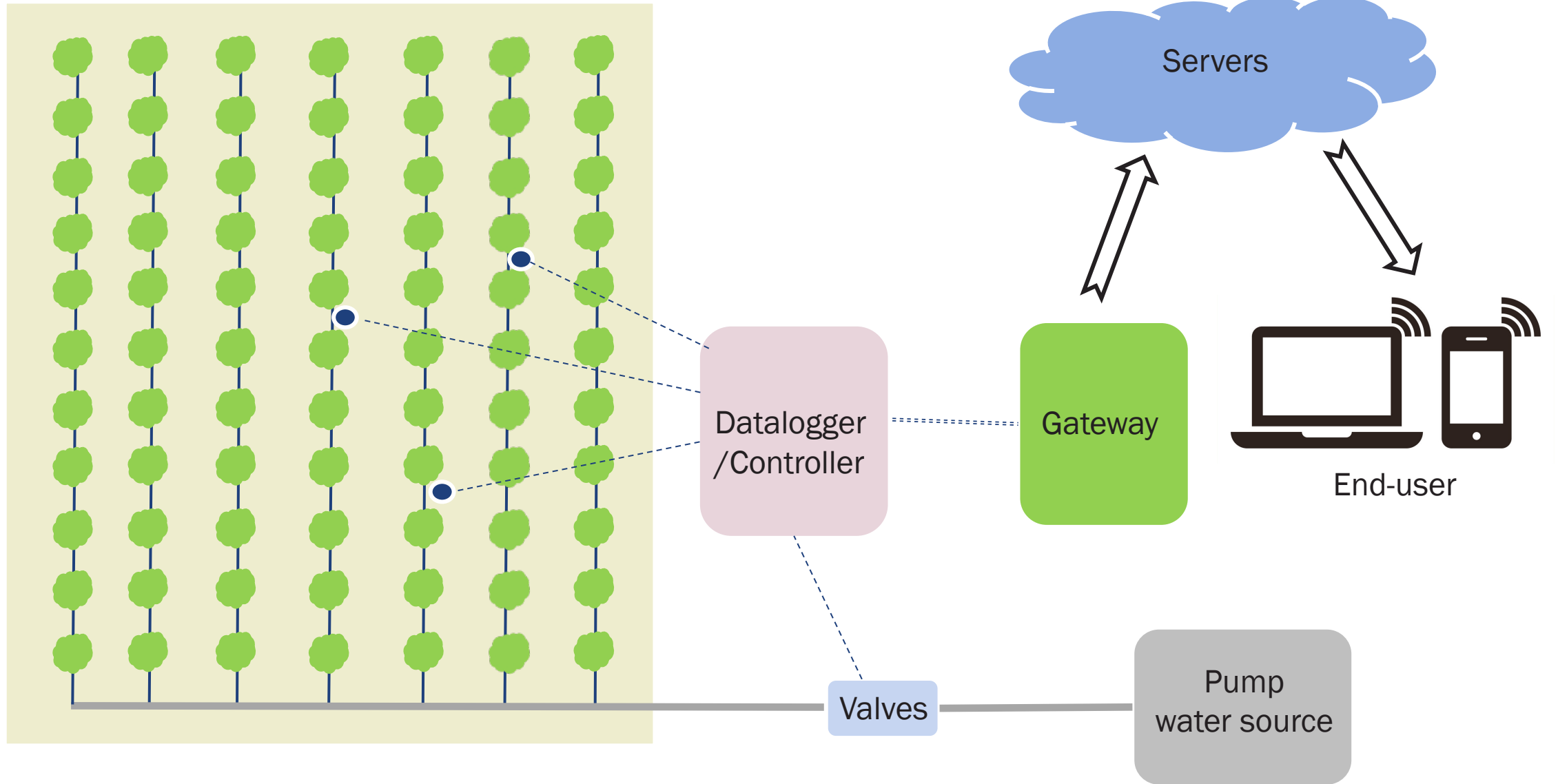


b) Soil water potential at different depths

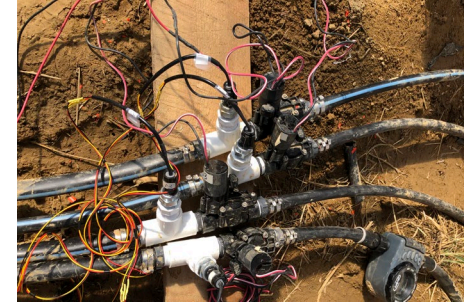
An Example from a Commercial Orchard



Automatic Irrigation System



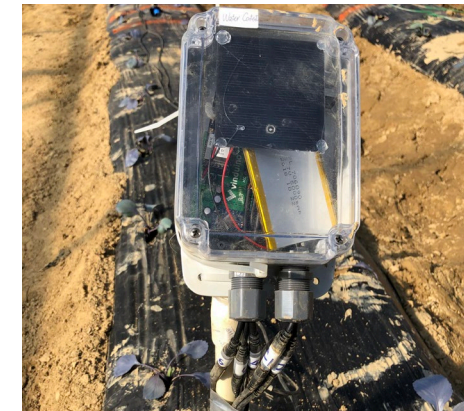
Automatic Irrigation System



← Solenoid valves



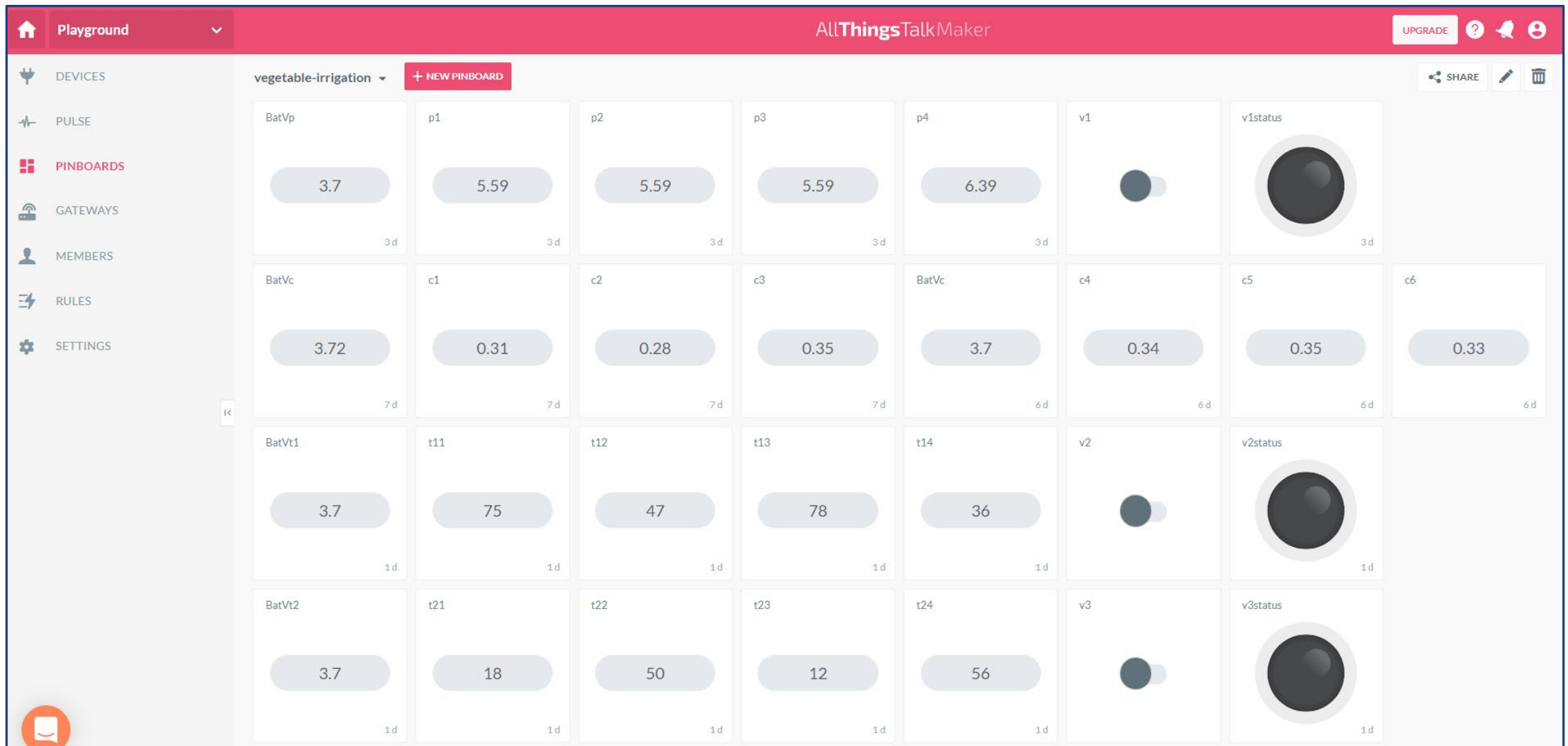
← Soil moisture sensors (Watemark)



← Sensor box (Vinduino)

LoRa Based IoT Irrigation System

Interface of IoT irrigation System



The interface displays a dashboard for an IoT irrigation system. The top navigation bar includes a home icon, 'Playground', the 'AllThingsTalkMaker' logo, and an 'UPGRADE' button. A left sidebar contains navigation options: DEVICES, PULSE, PINBOARDS (highlighted), GATEWAYS, MEMBERS, RULES, and SETTINGS. The main content area shows a 'vegetable-irrigation' pinboard with a '+ NEW PINBOARD' button and a 'SHARE' icon. The dashboard is organized into a grid of data cards:

- Row 1:** BatVp (3.7, 3d), p1 (5.59, 3d), p2 (5.59, 3d), p3 (5.59, 3d), p4 (6.39, 3d), v1 (toggle switch), v1status (circular gauge, 3d).
- Row 2:** BatVc (3.72, 7d), c1 (0.31, 7d), c2 (0.28, 7d), c3 (0.35, 7d), BatVc (3.7, 6d), c4 (0.34, 6d), c5 (0.35, 6d), c6 (0.33, 6d).
- Row 3:** BatVt1 (3.7, 1d), t11 (75, 1d), t12 (47, 1d), t13 (78, 1d), t14 (36, 1d), v2 (toggle switch), v2status (circular gauge, 1d).
- Row 4:** BatVt2 (3.7, 1d), t21 (18, 1d), t22 (50, 1d), t23 (12, 1d), t24 (56, 1d), v3 (toggle switch), v3status (circular gauge, 1d).

Each data card displays a numerical value and a refresh interval (e.g., '3d', '7d', '1d'). The interface also features a bottom-left notification icon.

❖ Commercial services



Apps for different crops, based on the ET calculation with weather data



Web-based irrigation information, based on the ET calculation with remote sensing/satellite imagery

❖ Academic resources

<http://irrigation.wsu.edu/>

<https://extension.psu.edu> (keyword: irrigation)

Thank you!

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