

Madera County Water and Natural Resources

Madera County GSAs Chowchilla, Delta-Mendota and Madera Subbasins

IrriWatch Set Up and Use

10:00 a.m. to 12:00 p.m., January 20, 2021

Zoom, Madera County

Madera, CA



Introductions

- Dr. Bryan Thoreson
Dauids Engineering (USA)
<https://dauidsengineering.com/>



- Dr. Wim Bastiaanssen
IrrriWatch (The Netherlands)
<https://www.irriwatch.com/>



Presentation Outline

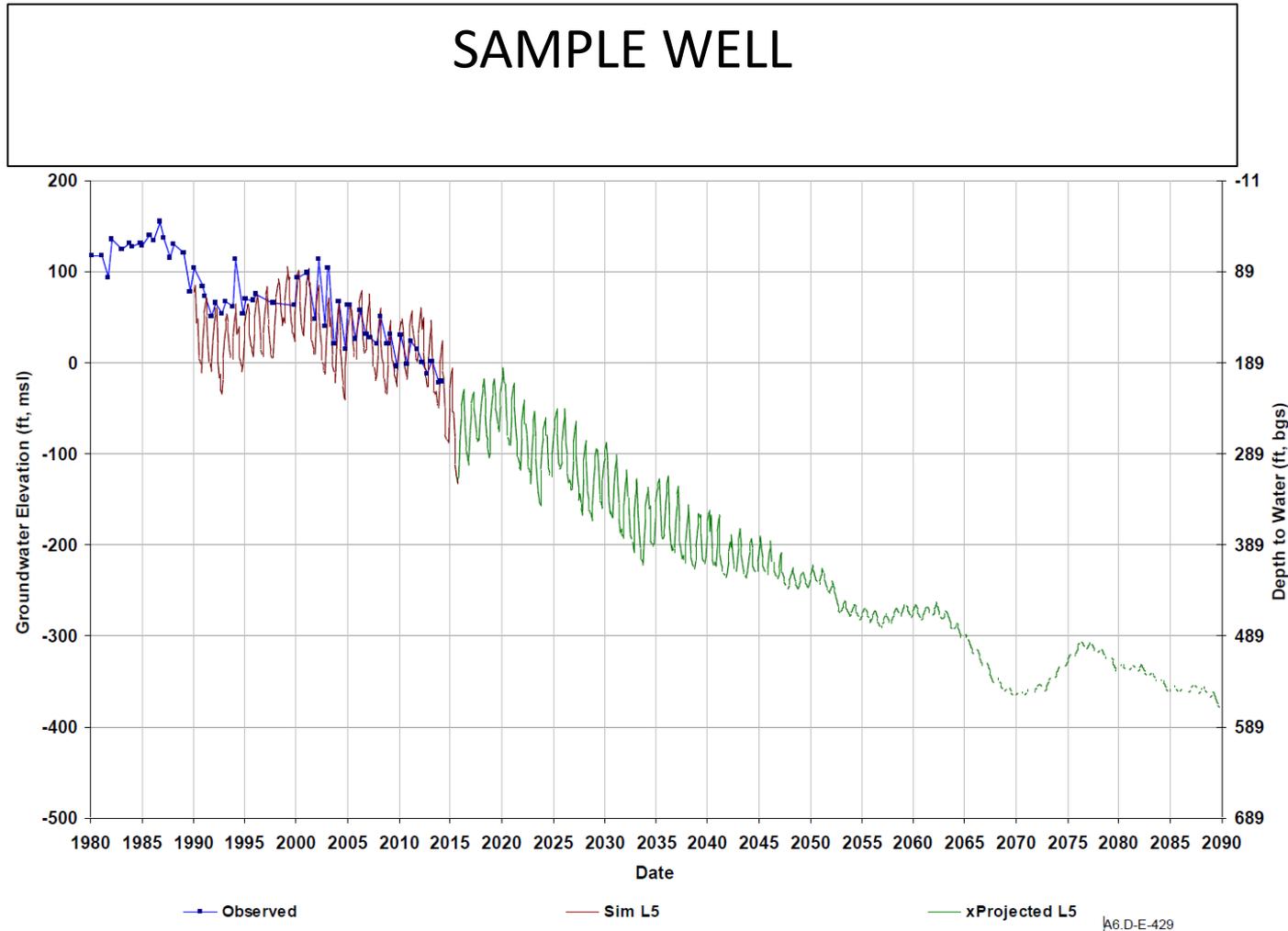
- IrriWatch as the GSA measurement system
- IrriWatch as a farmer's irrigation management tool
- Steps to Enroll
- How to log in, define parcels, assemble farm units.
- How to read and interpret available data
- How IrriWatch determines field irrigation status
- Describe how to view ET_{aw} versus allocation

Q&A/Discussion Following Each Topic
Questions Welcome Any Time

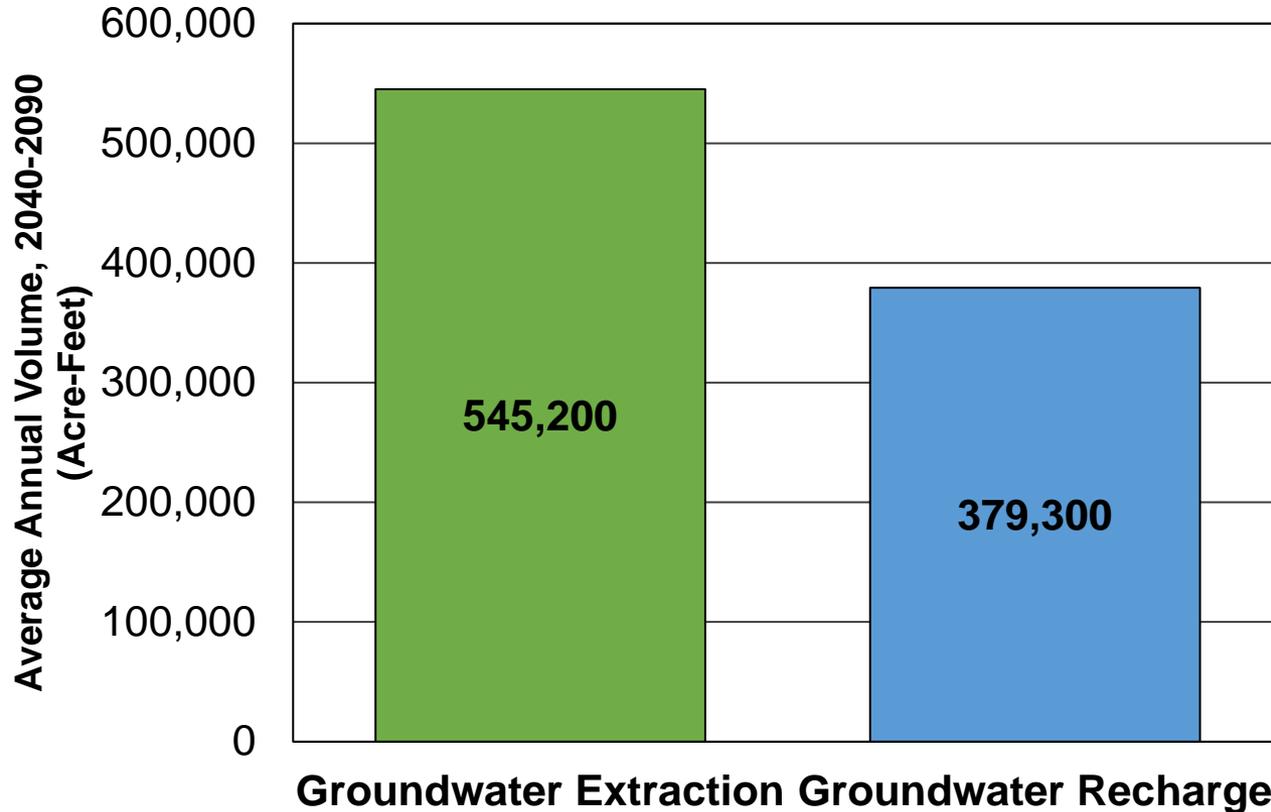
Groundwater Condition Without Projects (2040-2090)

MCSim - Projected

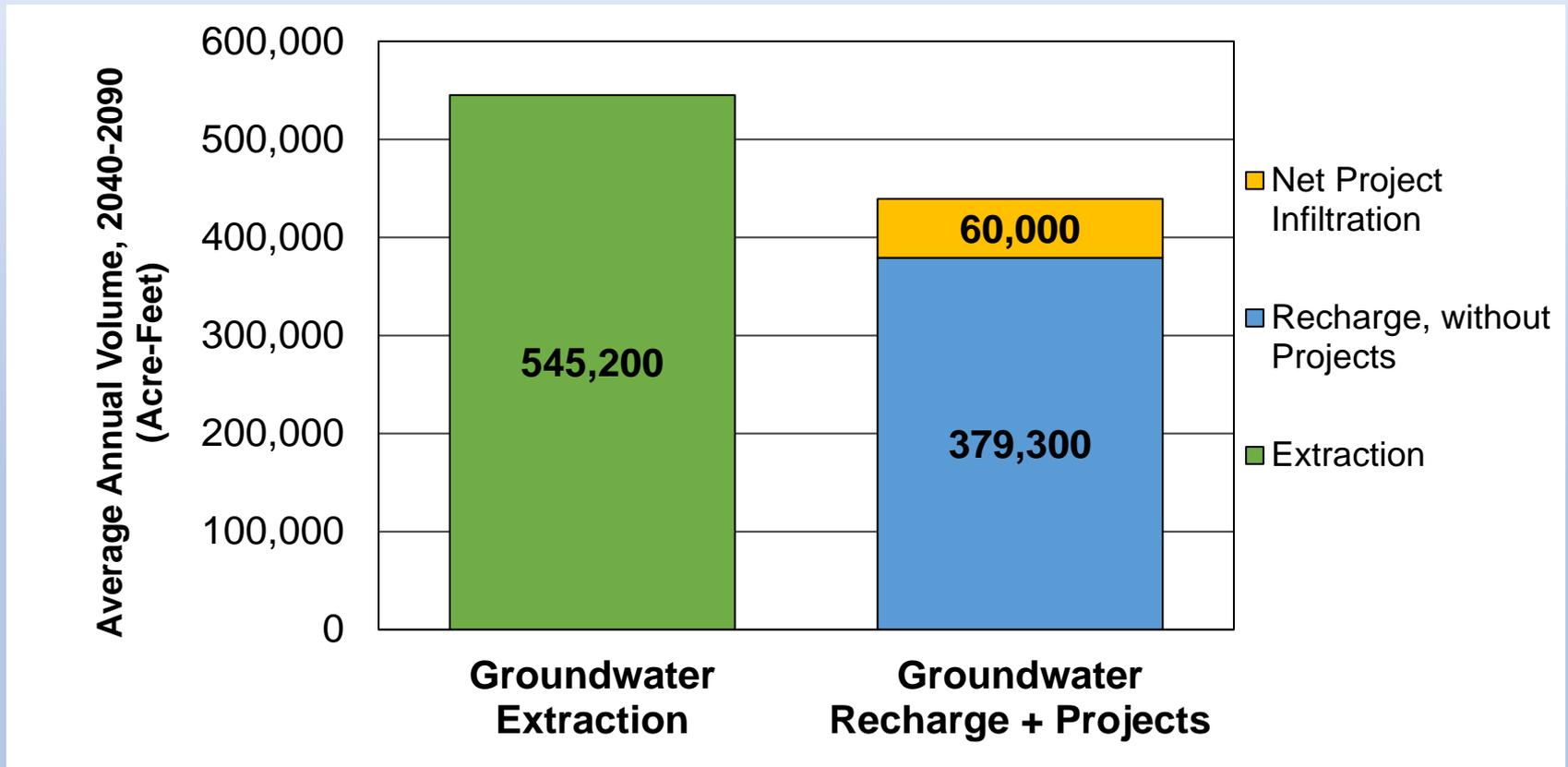
Appendix E.3.



Groundwater Condition Without Projects (2040-2090)

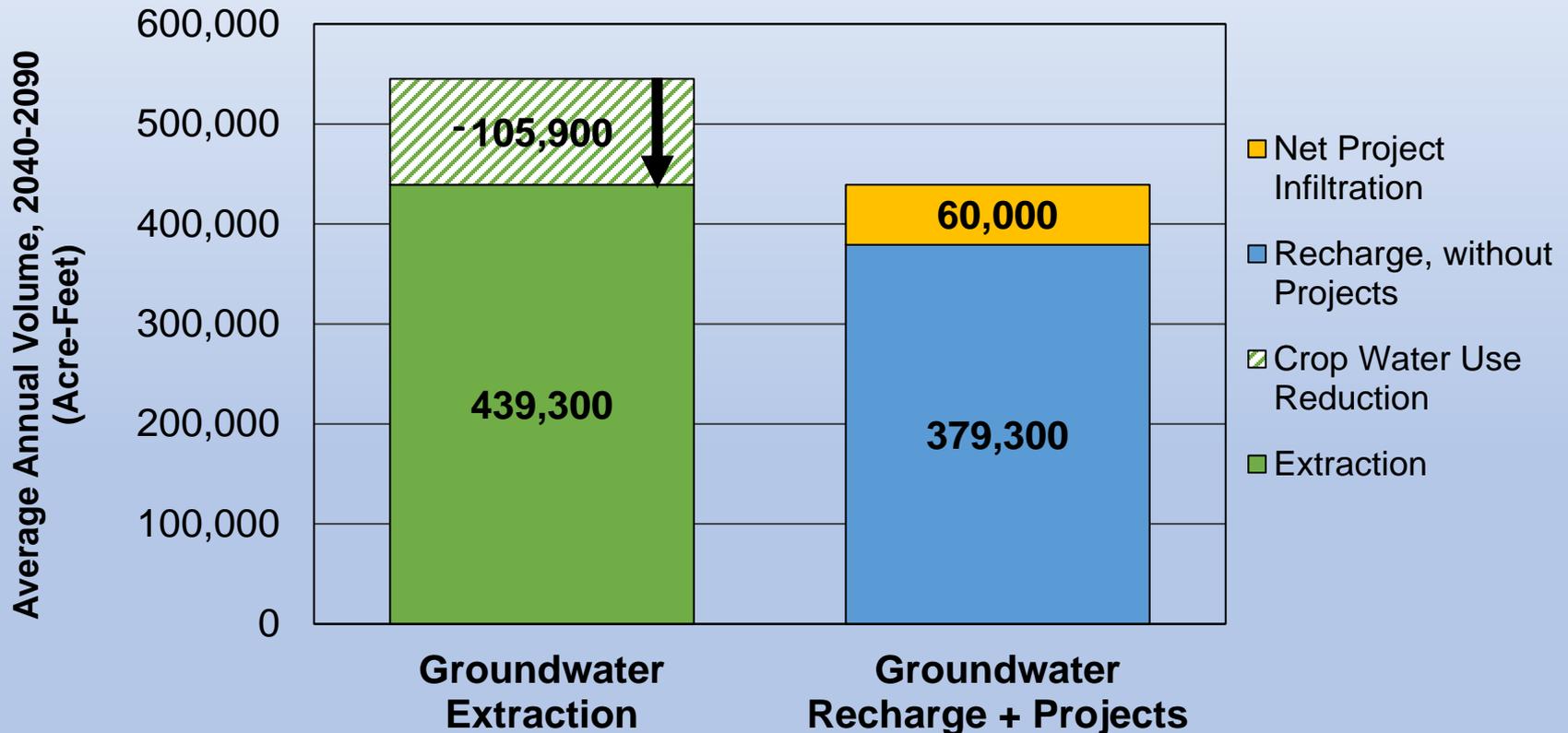


Groundwater Condition With Projects (2040-2090)—Step 1: Recharge



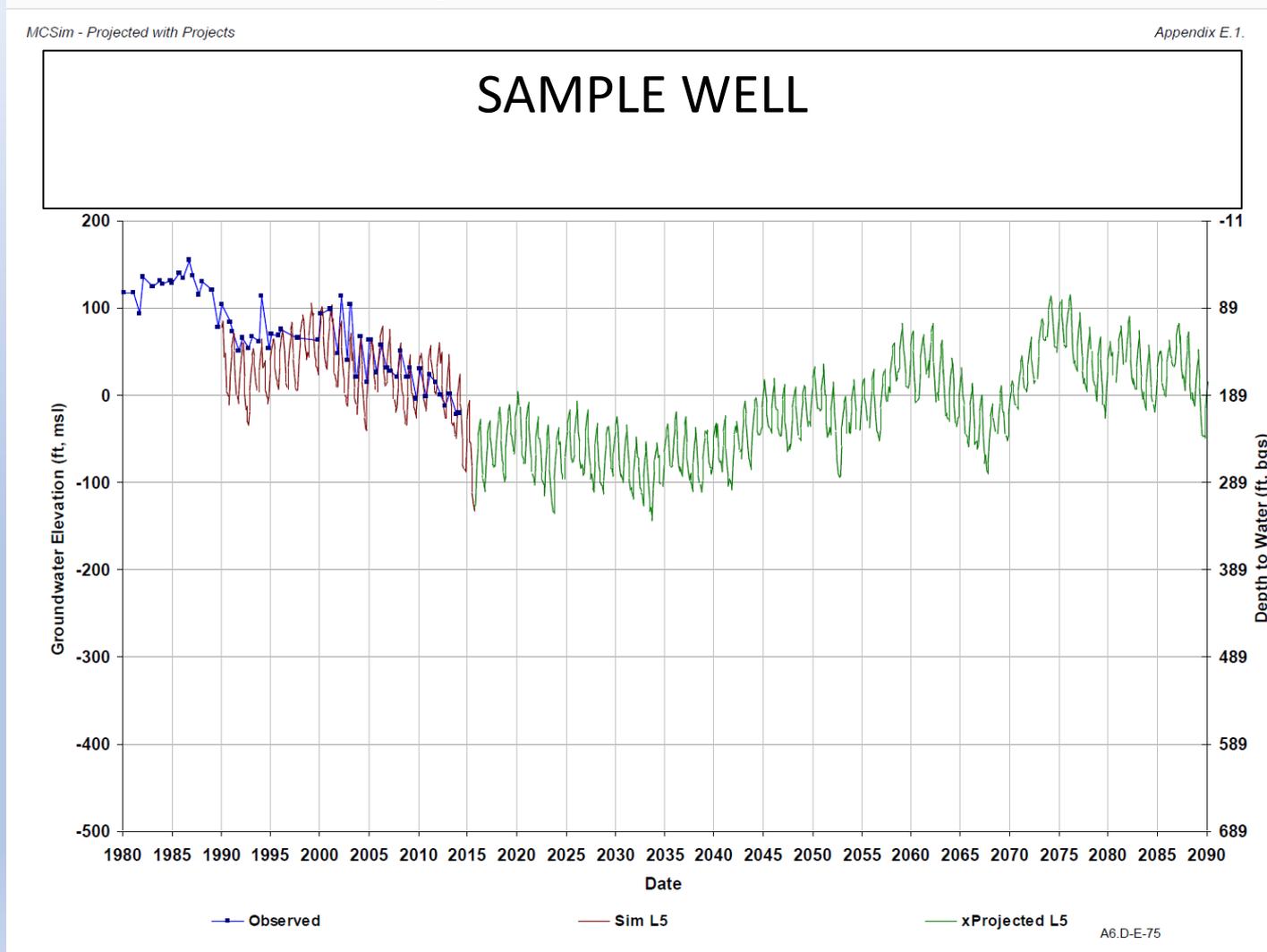
Madera County Recharge Program: Divert all available flood waters (when available) to increase recharge.

Groundwater Condition With Projects (2040-2090)-Step 2: Demand Management



Crop Water Use Reduction Program: Madera County GSA 90,000 acre-feet (AF). Remaining crop water use reduction due to permanent recharge basins replacing irrigated area.

Groundwater Condition With Projects (2040-2090)



GSP Requires Increased Recharge and Consumptive Use Reduction

- Increased recharge in the Madera County GSAs
 - Recharge (basins, flood-MAR, in-lieu)
 - Other supplies and transfers
- Consumptive use reduction (Demand management) program
 - Allocation–IrriWatch 
 - Allocation + Water Market
 - Land Resting/Retirement and Easements
 - Fee structures

IrriWatch Tracks ET for GSA

- SGMA requires groundwater basin to be sustainable (water inflows = water outflows over 50 years of average hydrology)
- Currently water outflows are greater than water inflows
- Solution
 - Increase inflows—Recharge program
 - Decrease outflows (ET), *IrriWatch tracks ET*
 - Sustainable Ag Land Conservation (SALC) program
 - Demand Management

IrriWatch ET Calculations

- **Surface Energy Balance Algorithm for Land (SEBAL)**
- **Daily calculation based on data**
 - Remotely sensed
 - Ground-based
- **Calculated for each approximately 33-foot by 33-foot square area of the field**

GSA ET Tracking Program (Under Development)

- Water year or calendar year tracking
- GSA staff review IrriWatch reports on
 - ET
 - ET of applied water
- Late July/early August GSA alerts growers that are on pace to exceed allocation.
- GSA sends ETaw report to all growers after end of year
- What basis do you prefer for tracking water year or calendar year?

IrriWatch Tracks ET and Provides Irrigation Scheduling Support for Farmers

- Uniform ET equals good production
- Information on ET supports irrigation scheduling
- Additional parameters in IrriWatch support on-farm management, e.g. Leaf Nitrogen and daily Actual Crop Production
- Allows farmer to assemble farm units

IrriWatch Training Schedule

- November 6, 2020 – SEBAL and root zone water budget
- December 16, 2020 – Enrollment workshop with MAWA
- January 20, 2021 – IrriWatch set up and use
 - Explain the data portal, including how to register, log in, define parcels, assemble farm units
 - Explain how to read and interpret available data
 - Describe how IrriWatch determines the irrigation status of a field
 - Describe how to view ET_{aw} versus allocation
- Mid/late summer 2021 – IrriWatch feedback and comparison to field measurements
 - Listen to feedback
 - Respond to questions
 - Discuss comparisons with field measurements.
 - Discuss relationships between AW, ET and ET_{aw} for selected fields

Meet the Davids Engineering team



Grant Davids

Sr. Principal Engineer



Bryan Thoreson

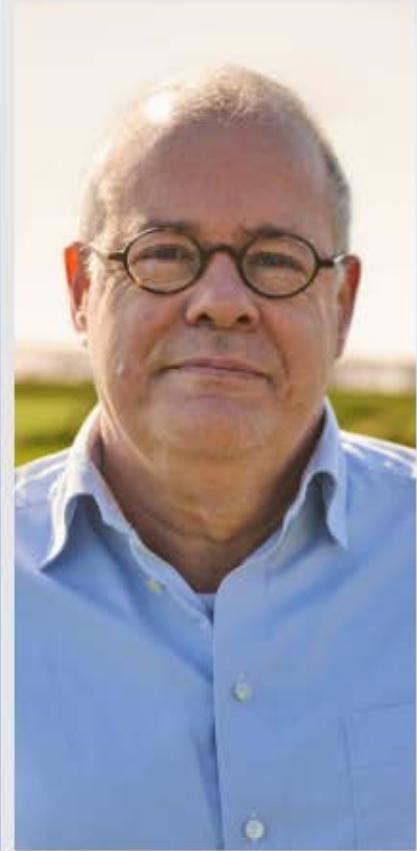
Supervising Engineer/Scientist



Ryan Fulton

Associate Engineer/Scientist I

Meet the team



Prof. Wim Bastiaanssen

Founder & CEO



Ir. Tim Hessels

Geo-Irrigation Specialist & Ph.D. student



Ir. Harald Tijink

IT Developer



Ing. Sam Bastiaanssen

GIS Expert & Operational Manager

IrriWatch data is taken up in California



Steps to Enroll

- Email to Etmeasurement@maderacounty.com
 - Your Email address
 - Your APNs
 - Optionally provide
 - Crops
 - irrigation method
- OR
- Submit form on maderacountywater.com

Steps After Enrolling

- IrriWatch will send you an email with the request to create a password
- One email address for each company account for getting started
- Except for Madera County, nobody else has access to your fields
- You have to validate fields, crops, soils and irrigation methods
- Comments can be sent to support@irriwatch.com, preferably with a sketch or a map
- IrriWatch data is live since 1st of January 2021

Check email with following message

Dear Madera GSA grower,

Thank you for registering for the IrriWatch irrigation advisory service that is offered free of charge through the Madera County GSA. Please login to portal.irriwatch.com with your email as your username and create a password. Review your field boundaries, crop types, irrigation types and soil types. If corrections are needed, please send written or visual corrections to support@irriwatch.com. If one or more of your fields is not found, it might be located outside the Madera County GSA, in another nearby GSA.

If requested, IrriWatch will adjust your field boundaries before the January 1, 2021 IrriWatch start date. IrriWatch cannot adjust field boundaries during the growing season, but will adjust field boundaries between November 1 and December 15th each year for the upcoming year. If one crop is harvested and you plant a second crop, please inform IrriWatch of the plant date of the next crop and the crop type will be updated. You can view the graphs and download spreadsheets with the data, but you cannot edit the field boundaries, crop, soil or irrigation type information. Your fields will also be visible on the IrriWatch App that is freely downloadable from the PlayStore or AppStore. Also, you can add more members with their email addresses to your company account.

Thank you,

IrriWatch

Registrations as per 18 January 2021

Subbasin	Irrigated area (2015, Source: GSP)	Total number of companies/ growers signed up	Total irrigated area signed up	% of total irrigated area signed up
<i>Unit →</i>	<i>acre</i>	<i>n.a.</i>	<i>acre</i>	<i>%</i>
Chowchilla	37,100	16	14,850	40%
Delta Mendota	2,700	0	0	0%
Madera	84,900	41	34,468	41%
TOTAL	124,700	49	49,318	40%

Number of portal visits

- 20 growers have visited the portal
- 181 total portal visits since Jan. 1, 2021
- 8.6 average visits per grower
- One grower has visited 20 times



How to Log In

portal.irriwatch.com/login

Apps Sci-Hub: removing... IHE Hennes Automobi... Occasions kopen? T... Mascon Visualizatio... New Script - Earth...

IrriWatch Home

Sign In

Email

Wim.Bastiaanssen@gmail.com

Password

.....

Remember me

SIGN IN

[Forgot password?](#)

You can add colleagues

Agri-World Cooperative

Orders Company **Users** Address

Users [Add](#)

Name	Email	Profile	Status	Mails
		Expert	Enabled Not banned	Pwd lost mail New usr mail
		Expert	Enabled Not banned	Pwd lost mail New usr mail
		Expert	Enabled Not banned	Pwd lost mail New usr mail
		Local manager	Enabled Not banned	Pwd lost mail New usr mail

You can change your own settings

User details

Email	<input type="text"/>
Name	<input type="text"/>
Preferred language	English
Profile	Expert

[Change profile](#) [Change language](#) [Logout](#)

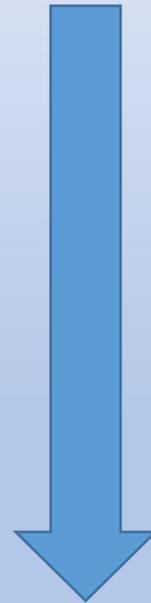
Change your password

Current password	<input type="password"/>
New password	<input type="password"/>
	<small>The password must be 8-20 characters</small>
Repeat password	<input type="password"/>
	<small>To confirm, type the new password again.</small>

[Update](#)

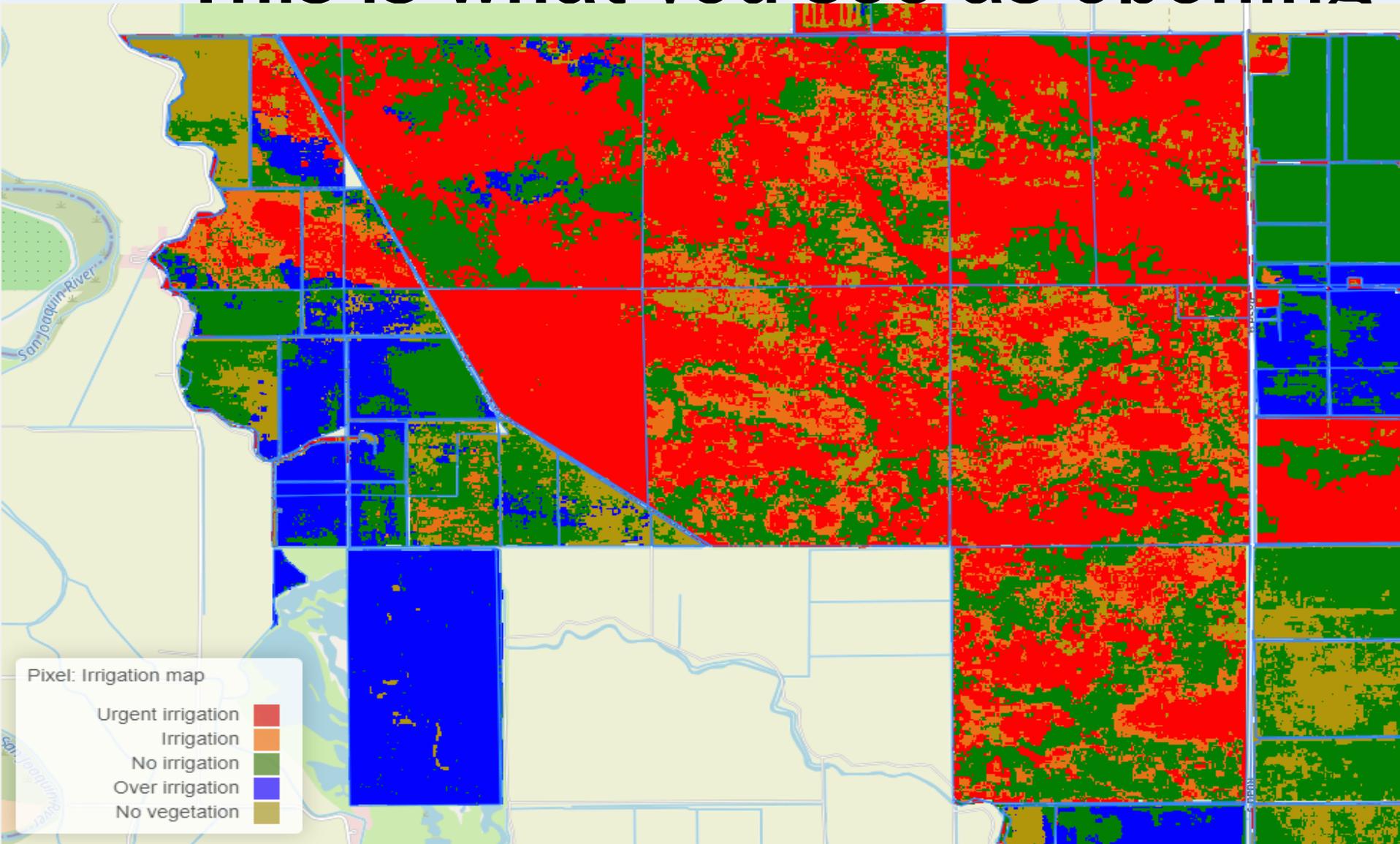
3 types of user profiles

Field Irrigator
Local Manager
Expert



More detailed information

This is what you see as opening



YouTube instruction movie How the viewer works (3 min)

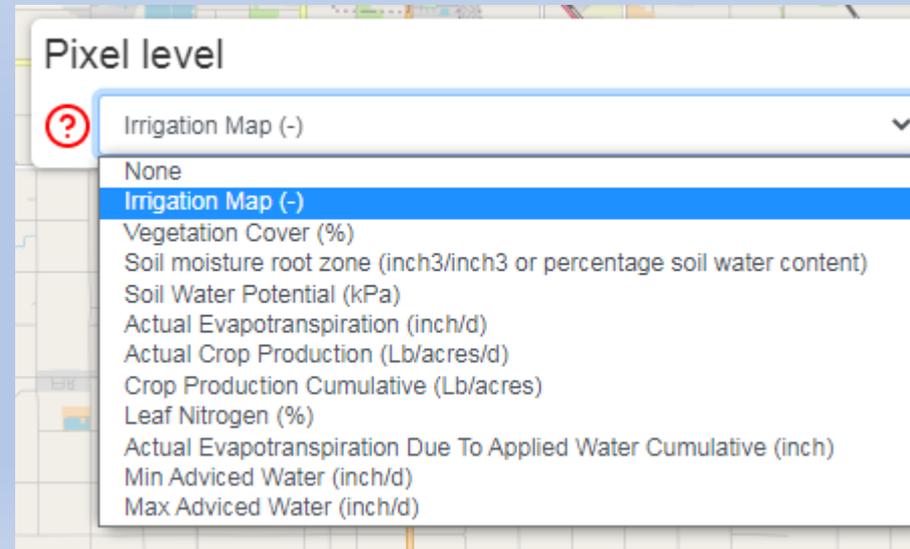
<https://www.youtube.com/watch?v=qki07xrBQys>

Summary

- **Set Imperial (Inches/feet) units**
- **Set language**
- **Select your date for viewing results**
- **Field level data provides the average value of a given field**
- **Pixel level data provides the data for every individual pixel (33 feet x 33 feet)**

Pixel level data layers

- Soil moisture root zone
- Soil water potential
- ET
- Crop production
- Leaf Nitrogen
- more



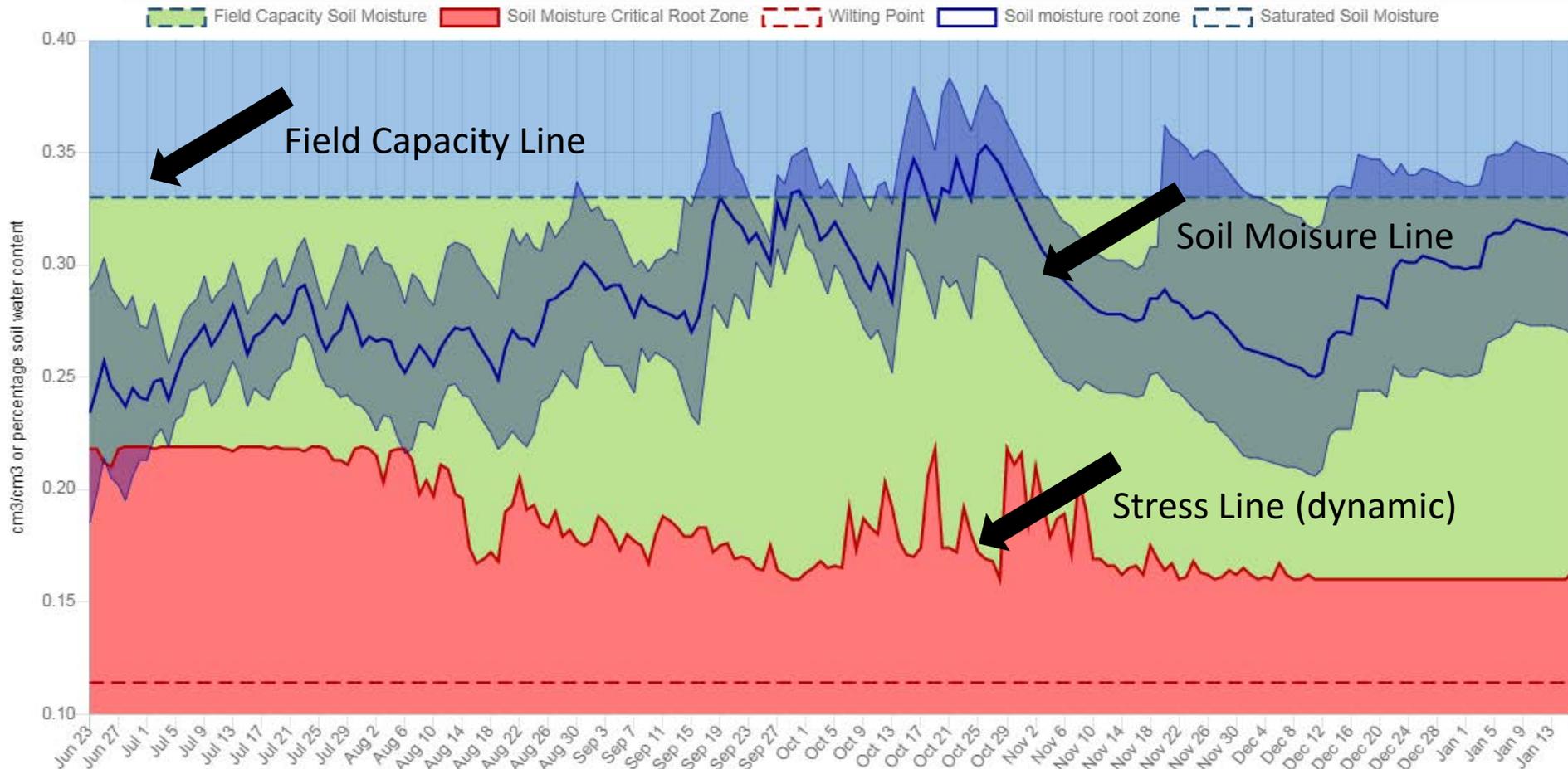
Time series of soil moisture

Graphs - C230_Almonds_field



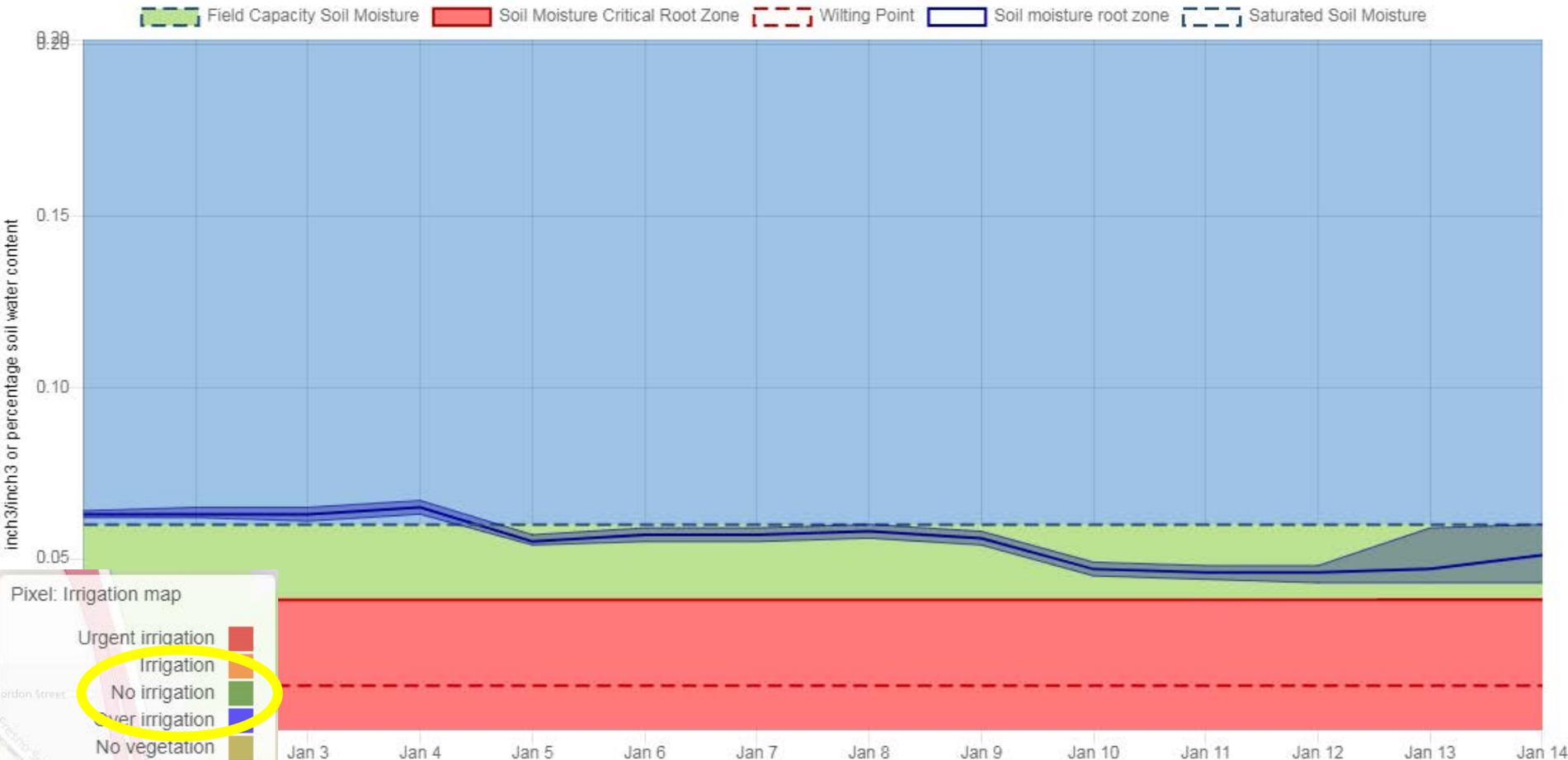
Graphs

Table data



No irrigation today

Graphs [Table data](#)

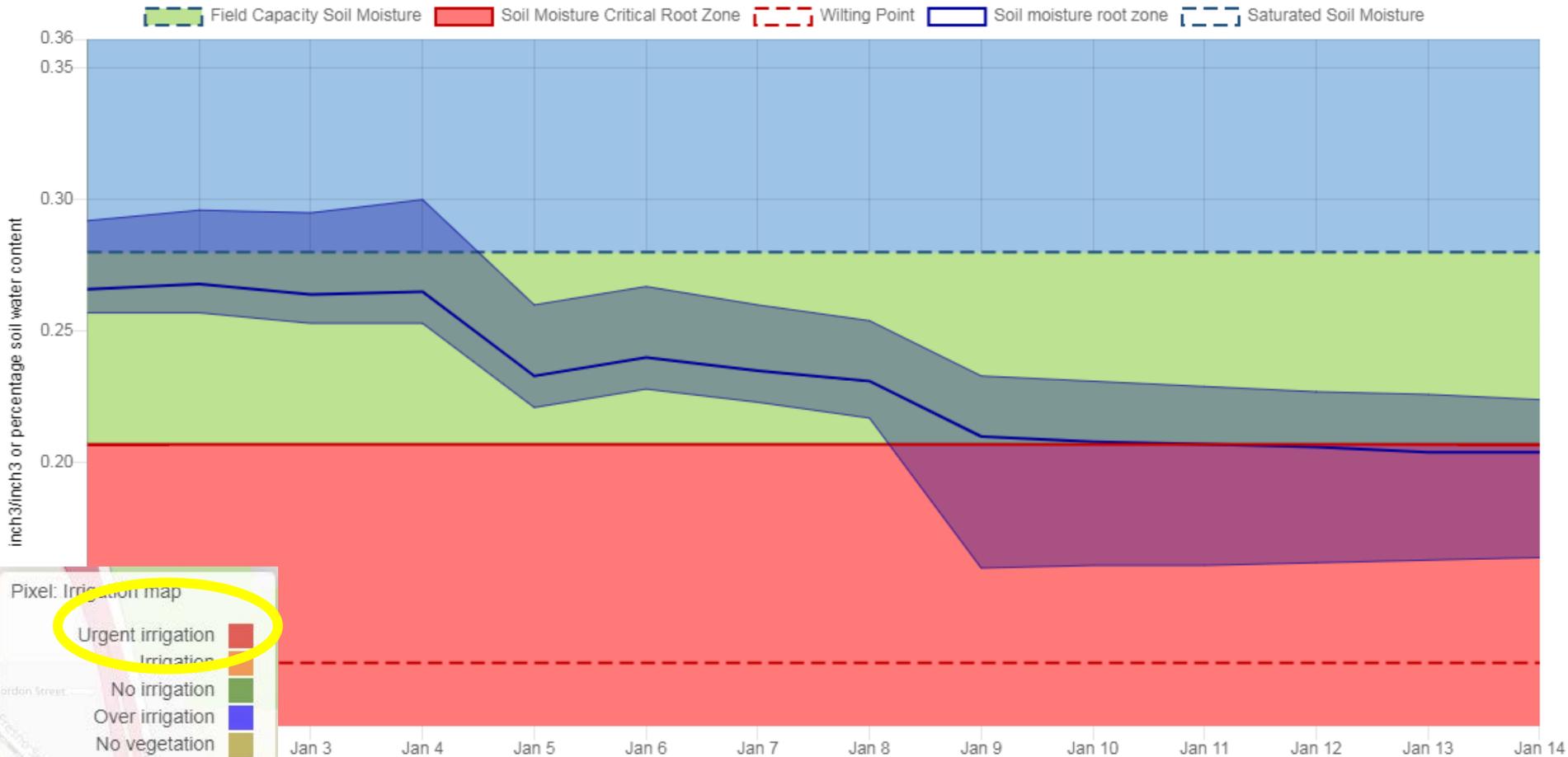


Irrigate today

Graphs - 041221003_184154



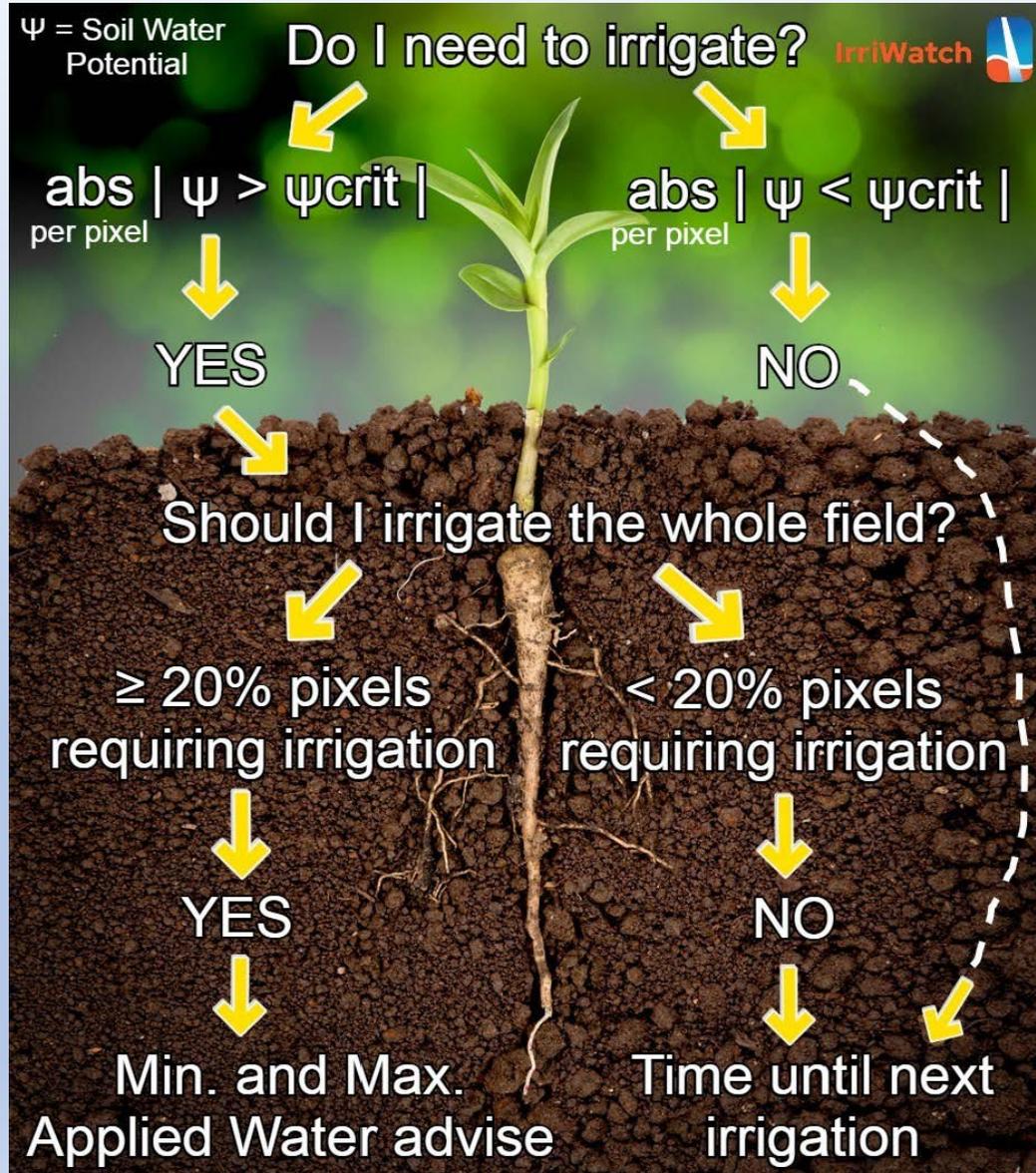
Graphs [Table data](#)



What kind of irrigation scheduling information do I get ?

- Yes / No
- Min Adviced Water for today
- Max Adviced Water for today
- Number of days until next irrigation

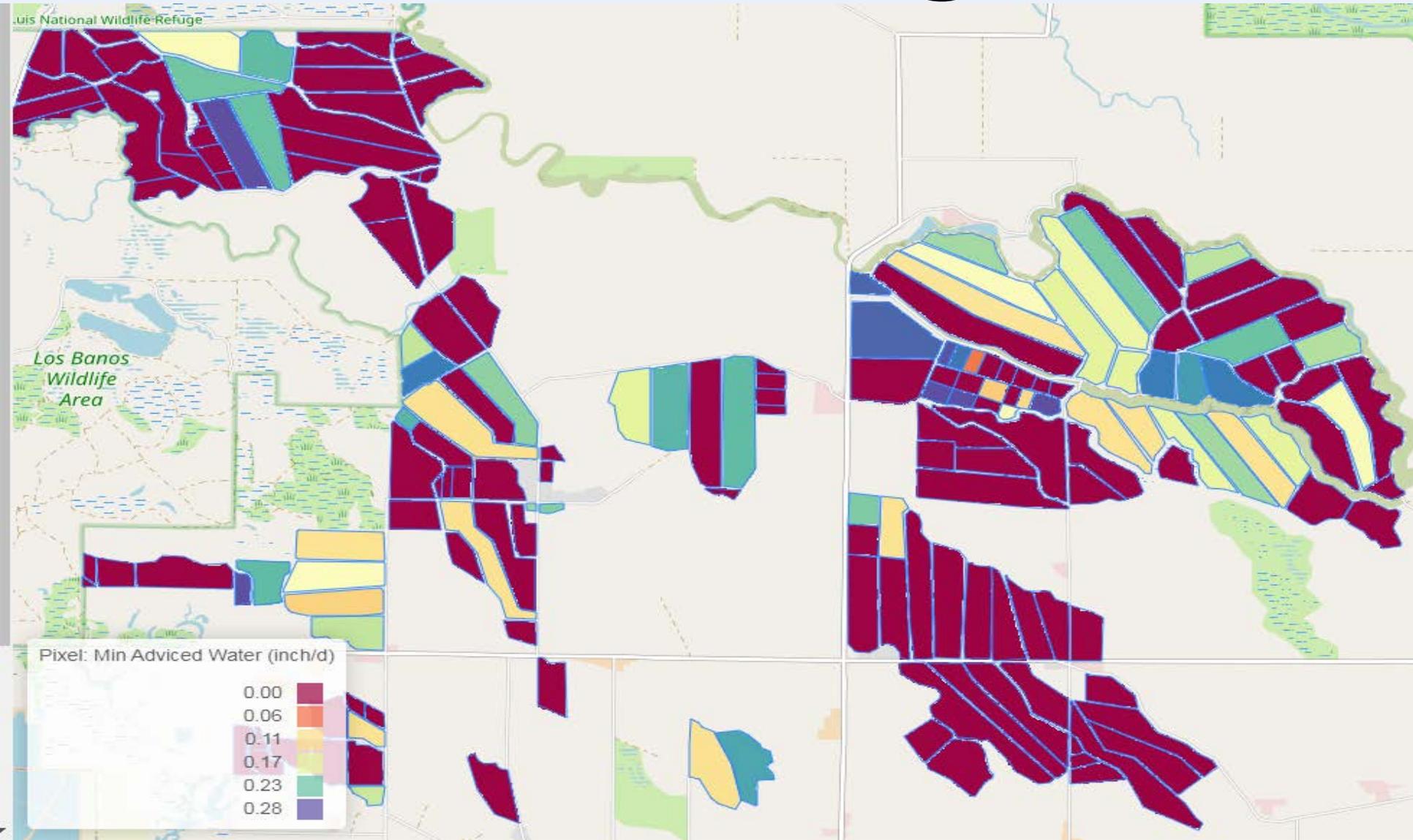
Daily Decision Model



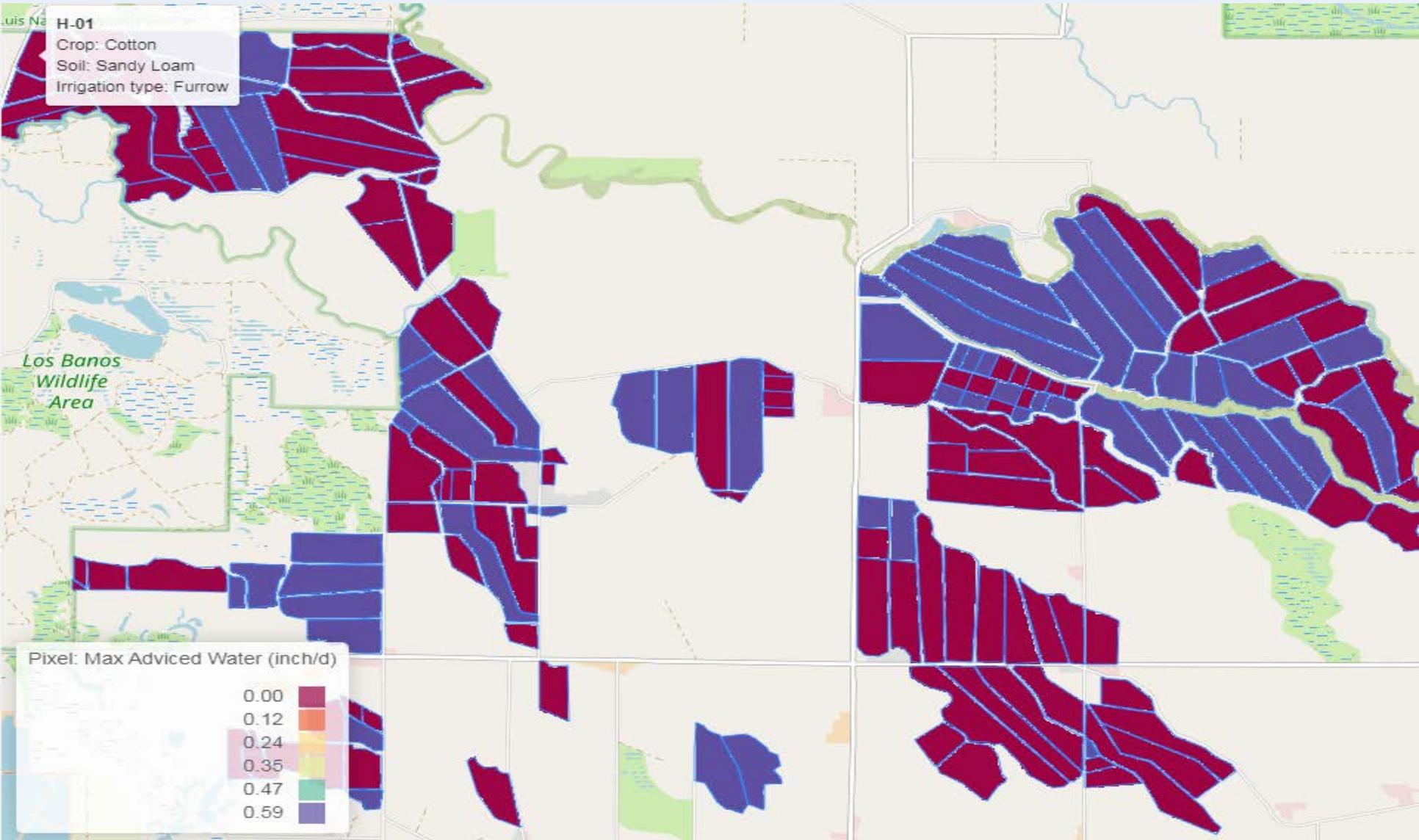
Principles of Advised Irrigation

- Minimally recover expected ET on the basis of weather forecasts
- Bring back moisture to the critical moisture level at which crop water stress emerges
- Never surpass soil moisture at field capacity
- Consider the type of irrigation system in place; micro-irrigation systems have certain capacity limits that needs to be considered

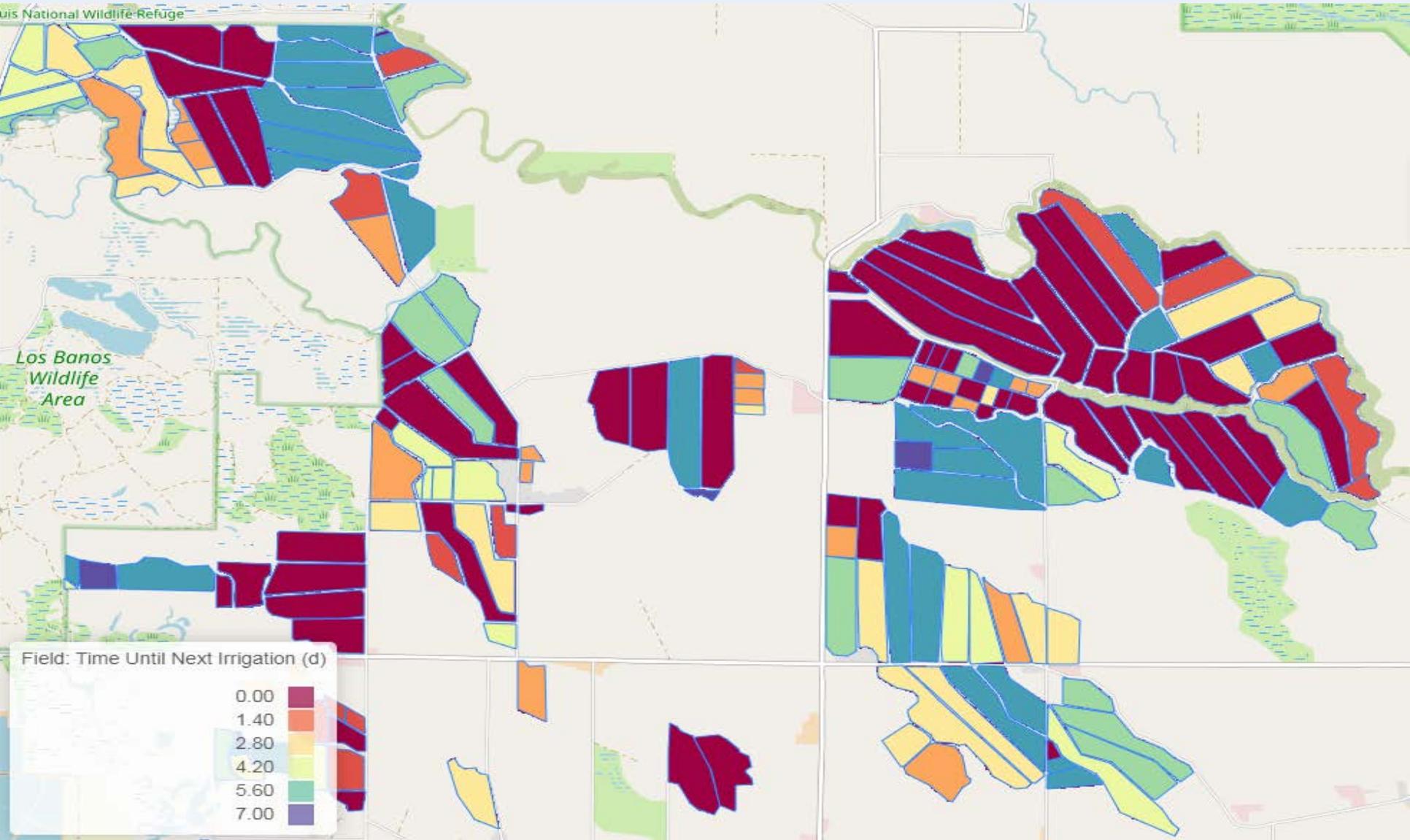
Min Advised Irrigation



Max Advised Irrigation



Time until next irrigation



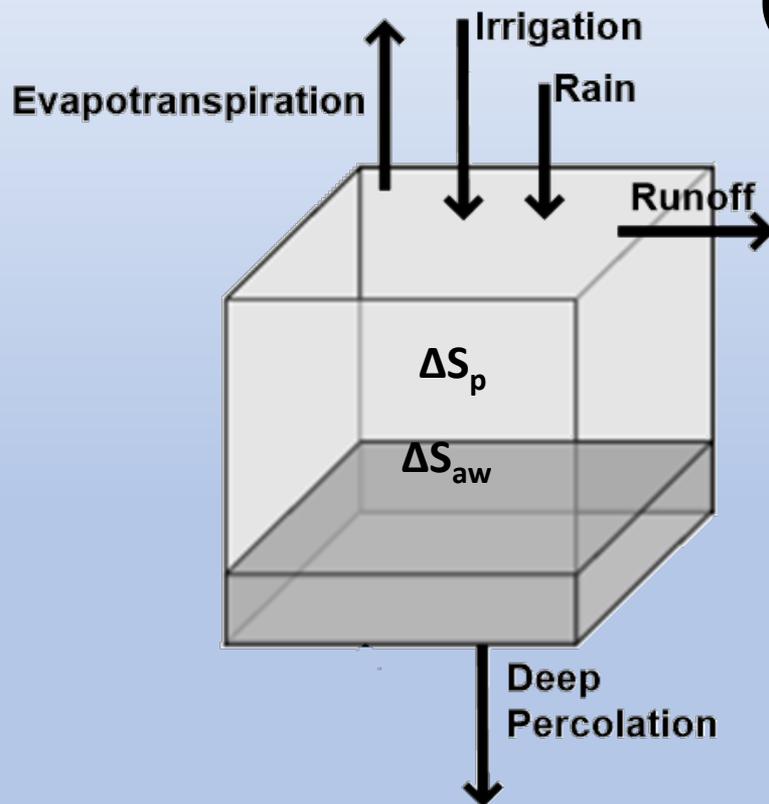
ET Terms

- Reference ET - ET of grass (CIMIS used in IrriWatch), calculated from weather station measurements of:
 - Temperature
 - Net radiation
 - Wind
 - Relative humidity
- Actual ET - calculated by SEBAL
- ET of precipitation (ET_p) is ET from water supplied by precipitation
- ET of applied water (ET_{aw}) is ET from water supplied by irrigation
- Actual ET equals $ET_p + ET_{aw}$



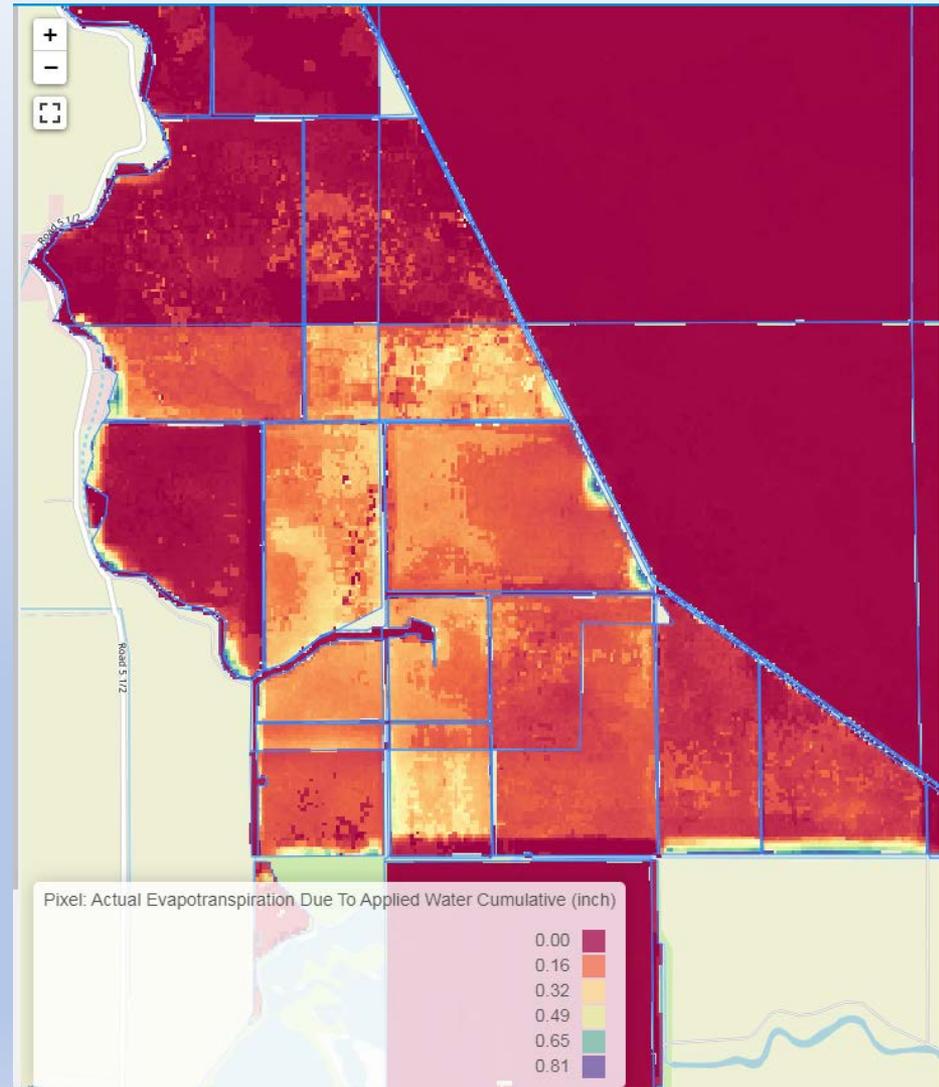
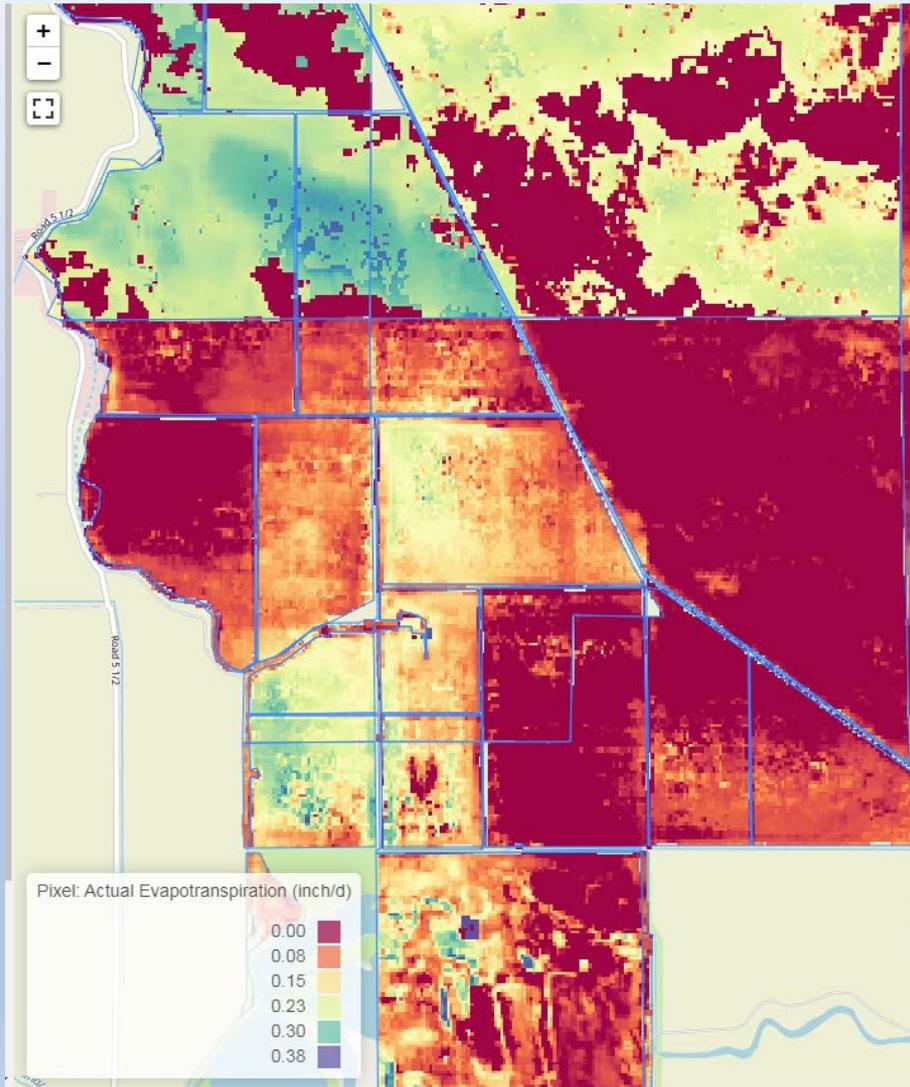
Daily Root Zone Water Balance for Every 33-foot by 33-foot Area

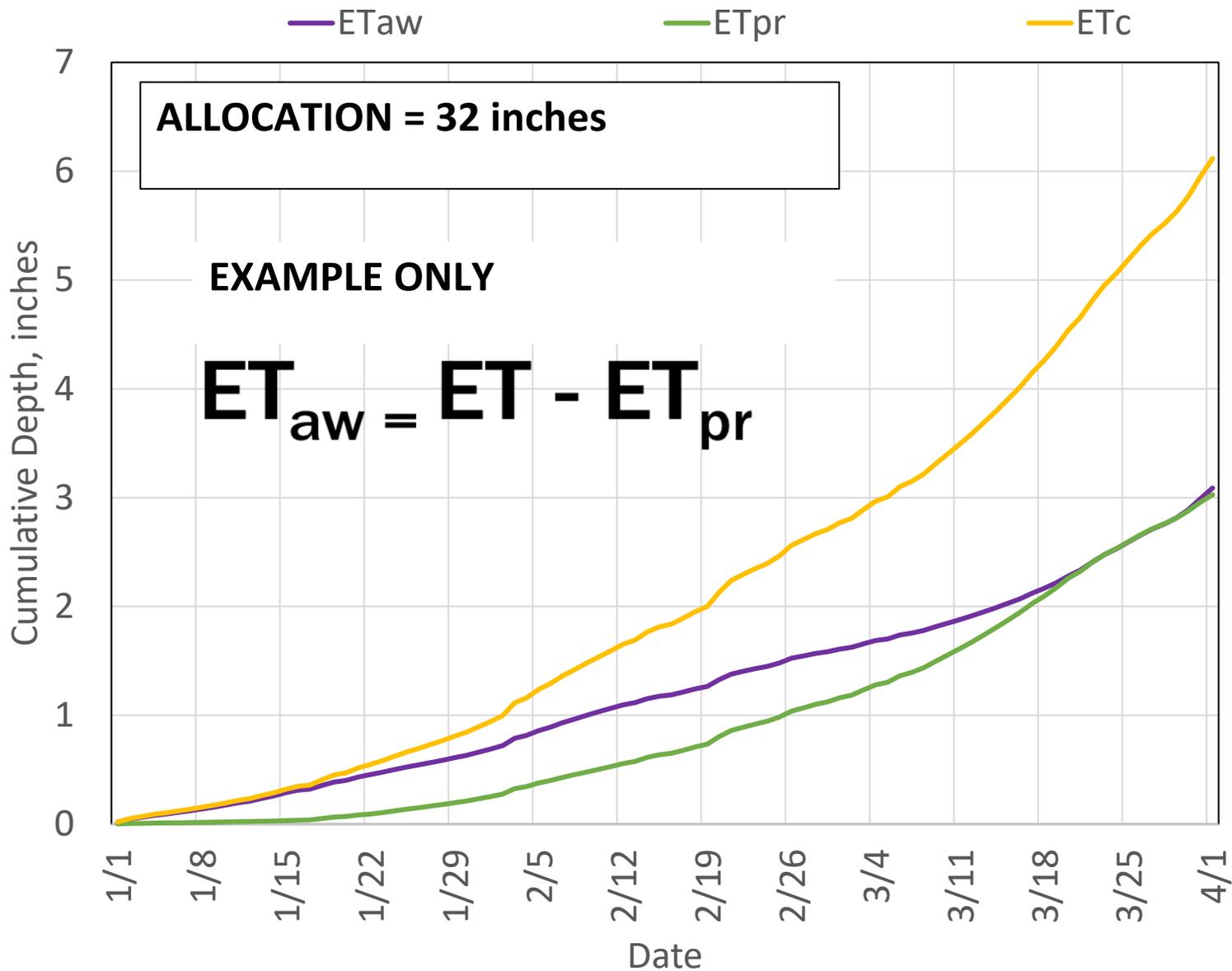
Example for Typical Summer Day
(Between Irrigations)

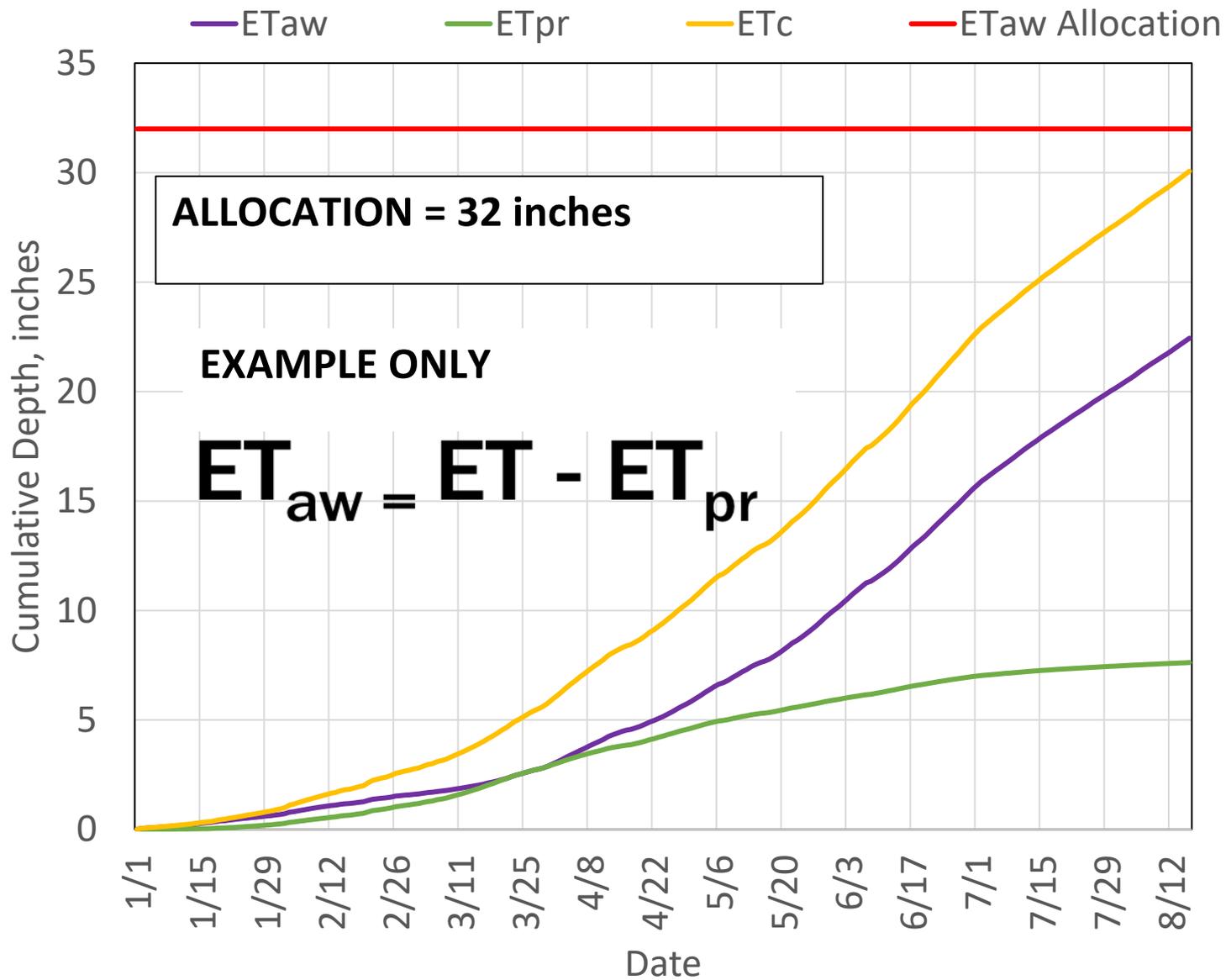


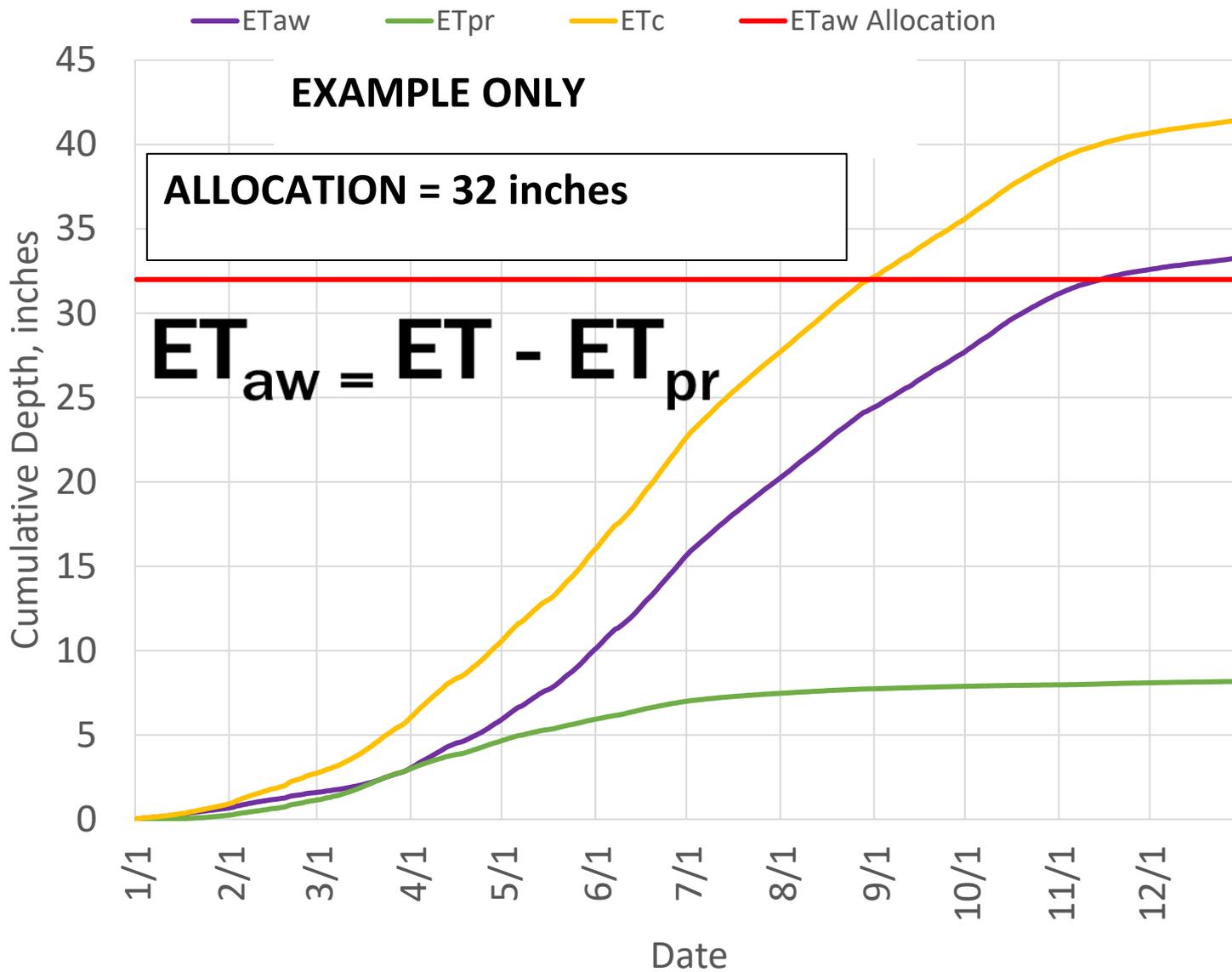
- ET = 0.18 inches
- Irrigation (applied water) = 0
- Rain = 0
- Runoff = 0
- Deep Percolation = 0
- $\Delta S_p = -0.02$
- $\Delta S_{aw} = -0.16$

ET & ETaw









Example from IrriWatch

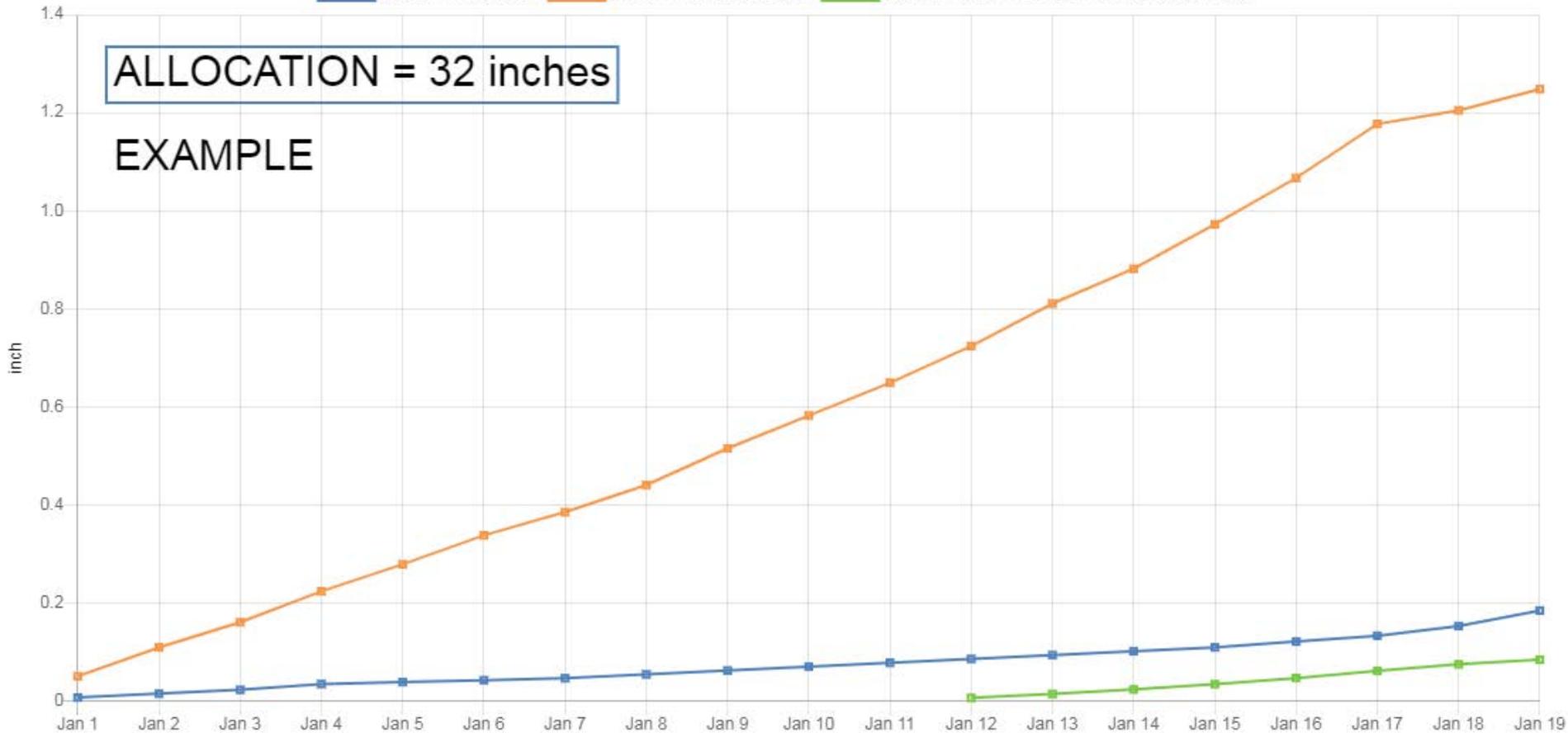
Graphs - 041081005_133848



Graphs

Table data

Actual Transpiration Actual Evapotranspiration Actual Evapotranspiration Due To Applied Water

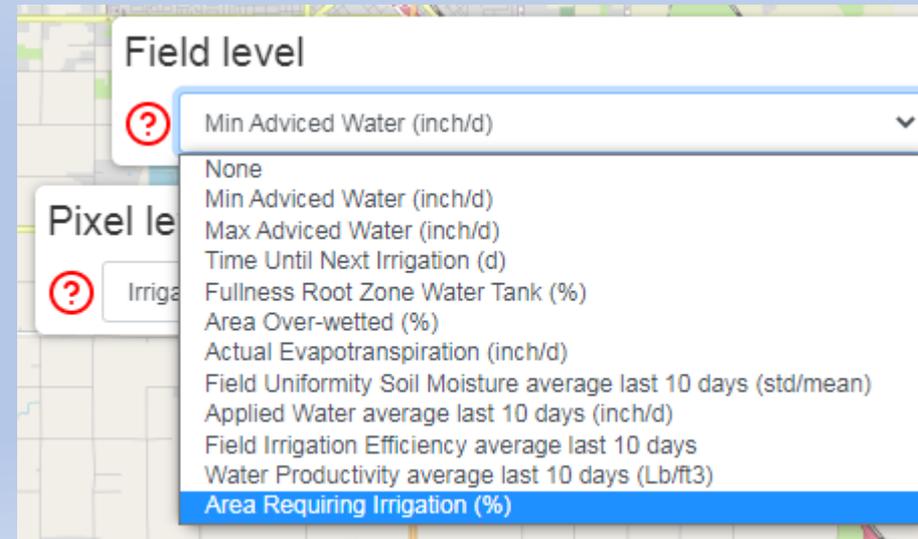


Feedback on format of ET_{aw} Allocation Graph

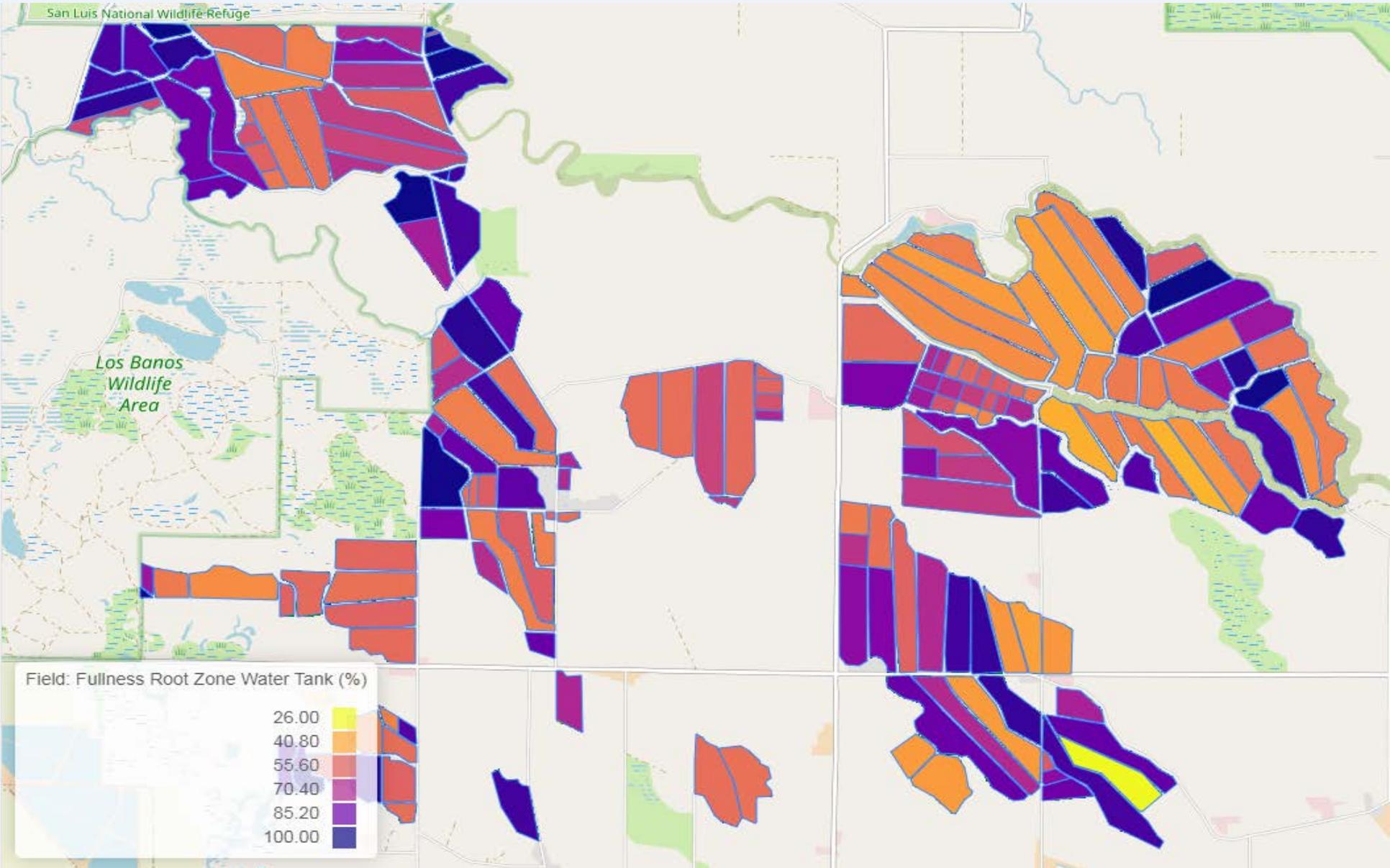
- What suggestions do you have on the format for the ET_{aw} graph?
- How can we make the graph more understandable and useful?

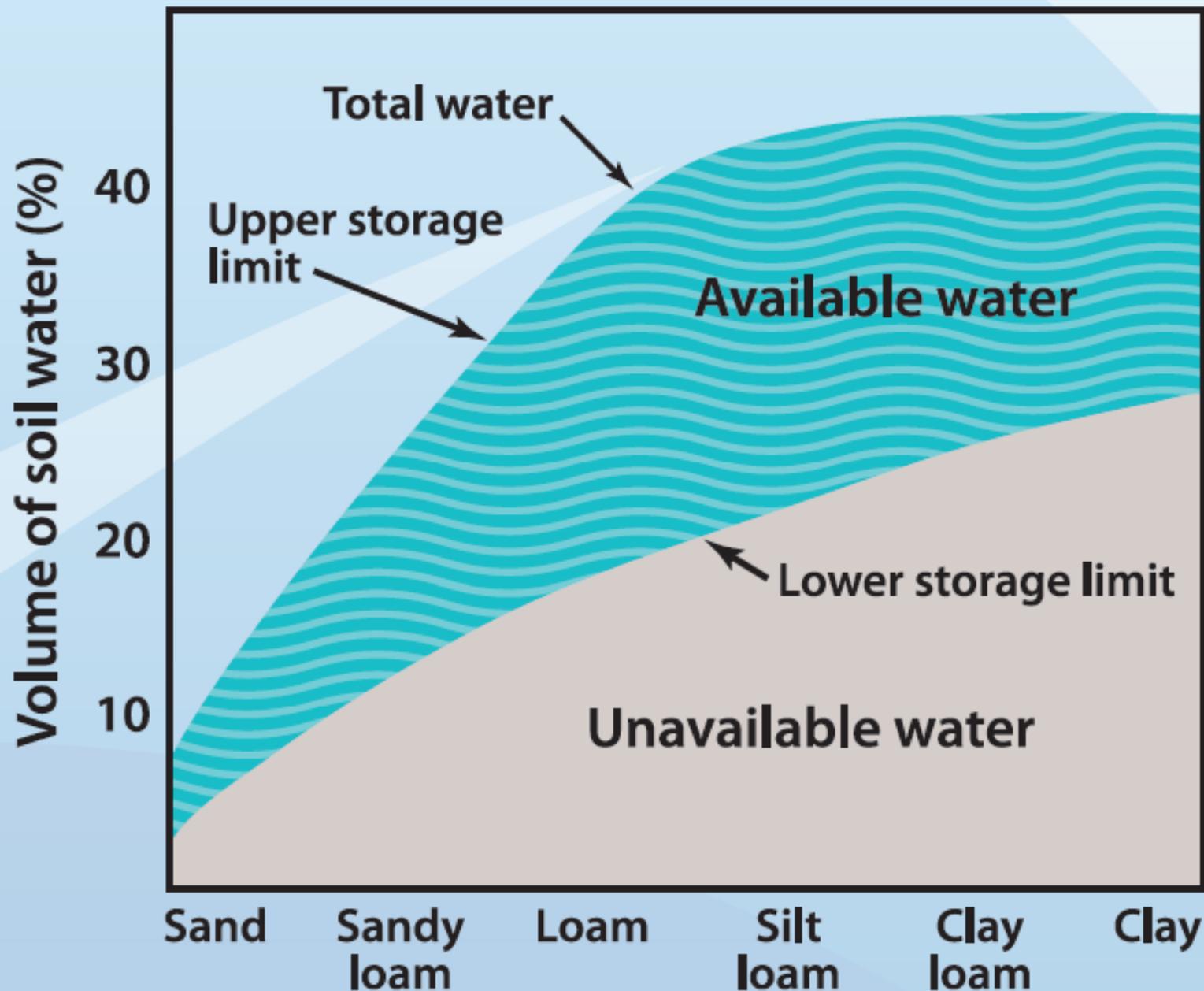
Field level data layers

- Irrigation advice
- Fullness Root Zone Water Tank
- Applied Water
- more

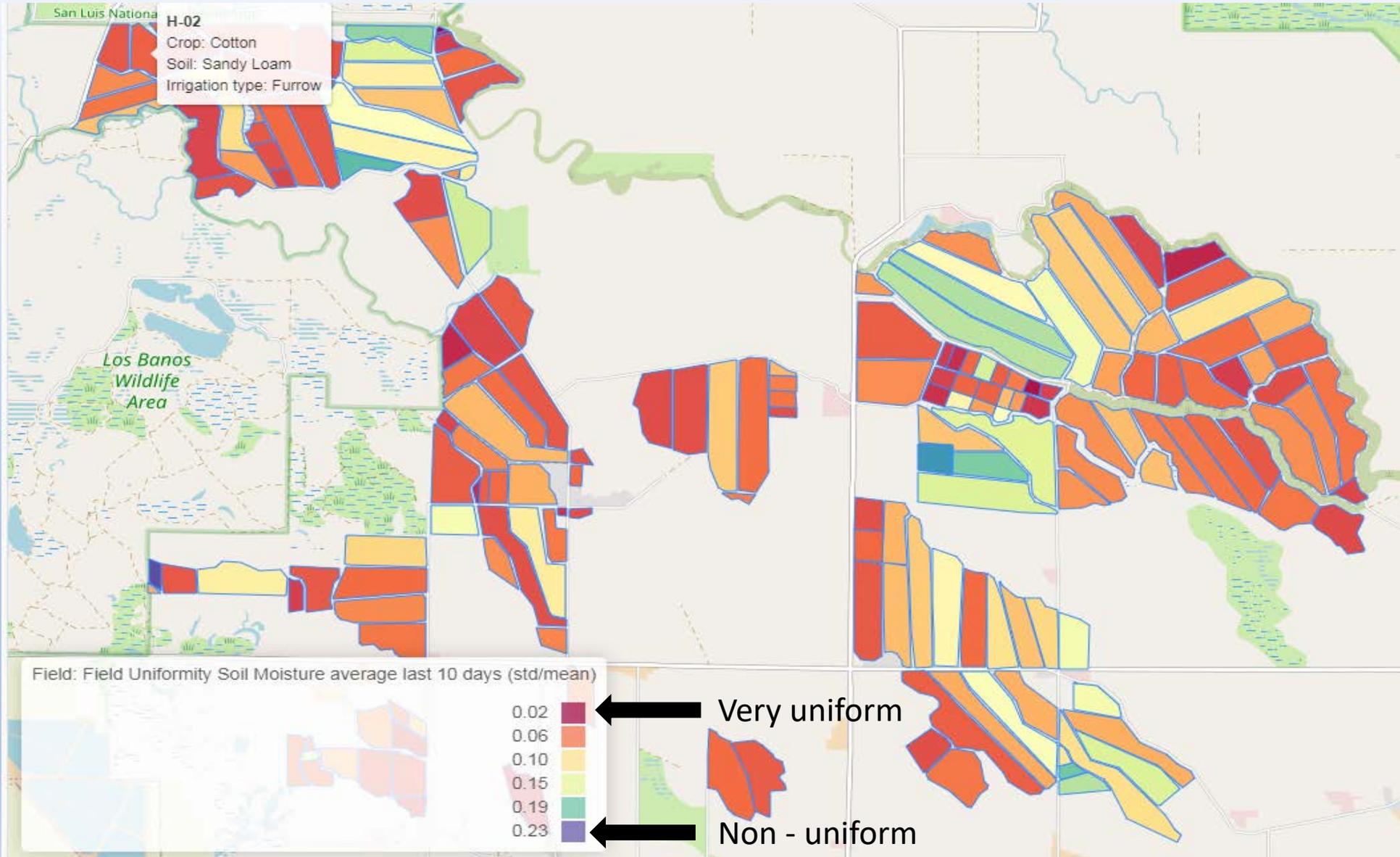


Fullness Root Zone



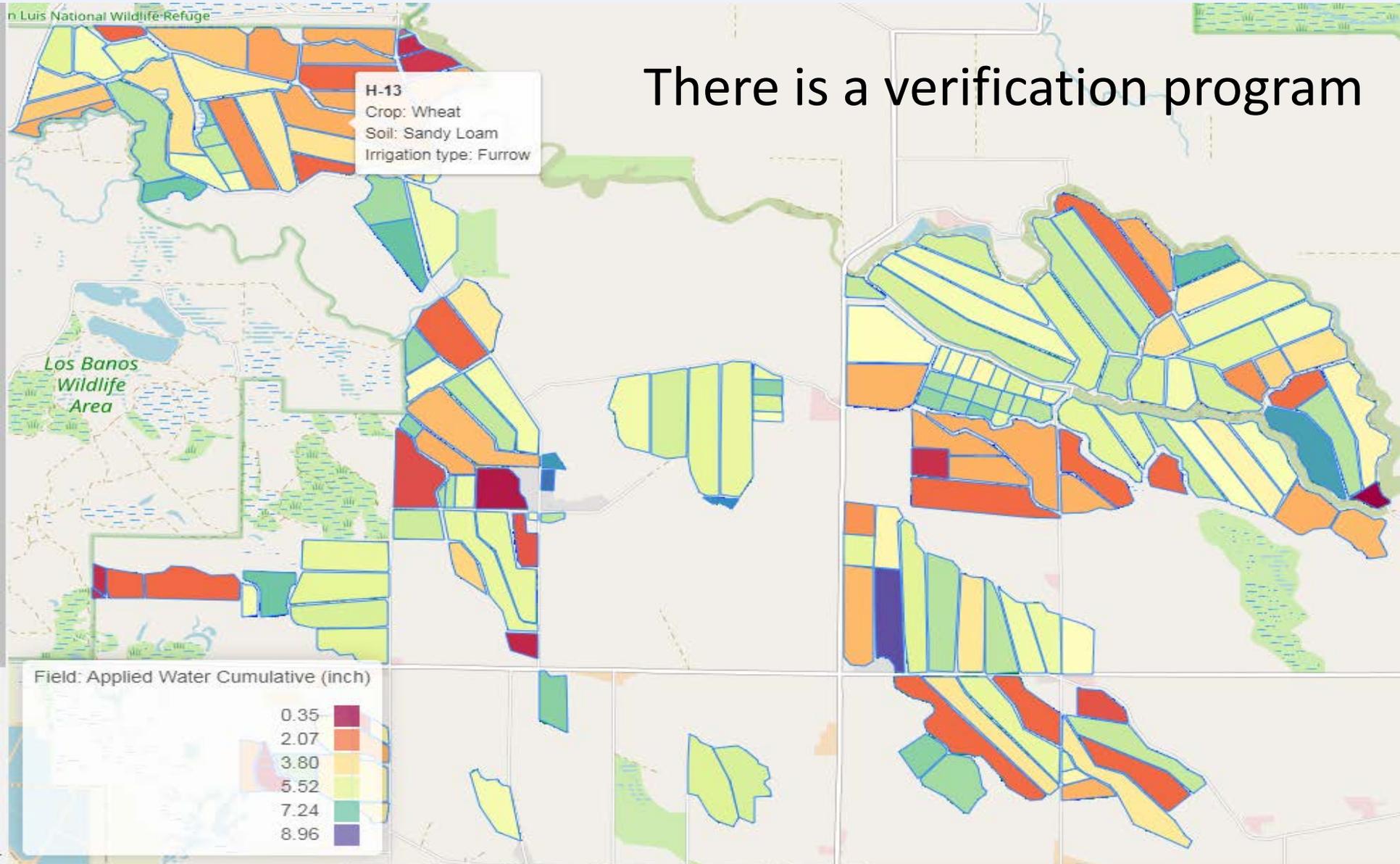


Irrigation distribution uniformity



Accumulated Applied Water

There is a verification program



Opportunity to Validate Applied Water Estimates

Describe the opportunity

- Use IrriWatch to estimate and validate irrigation efficiency

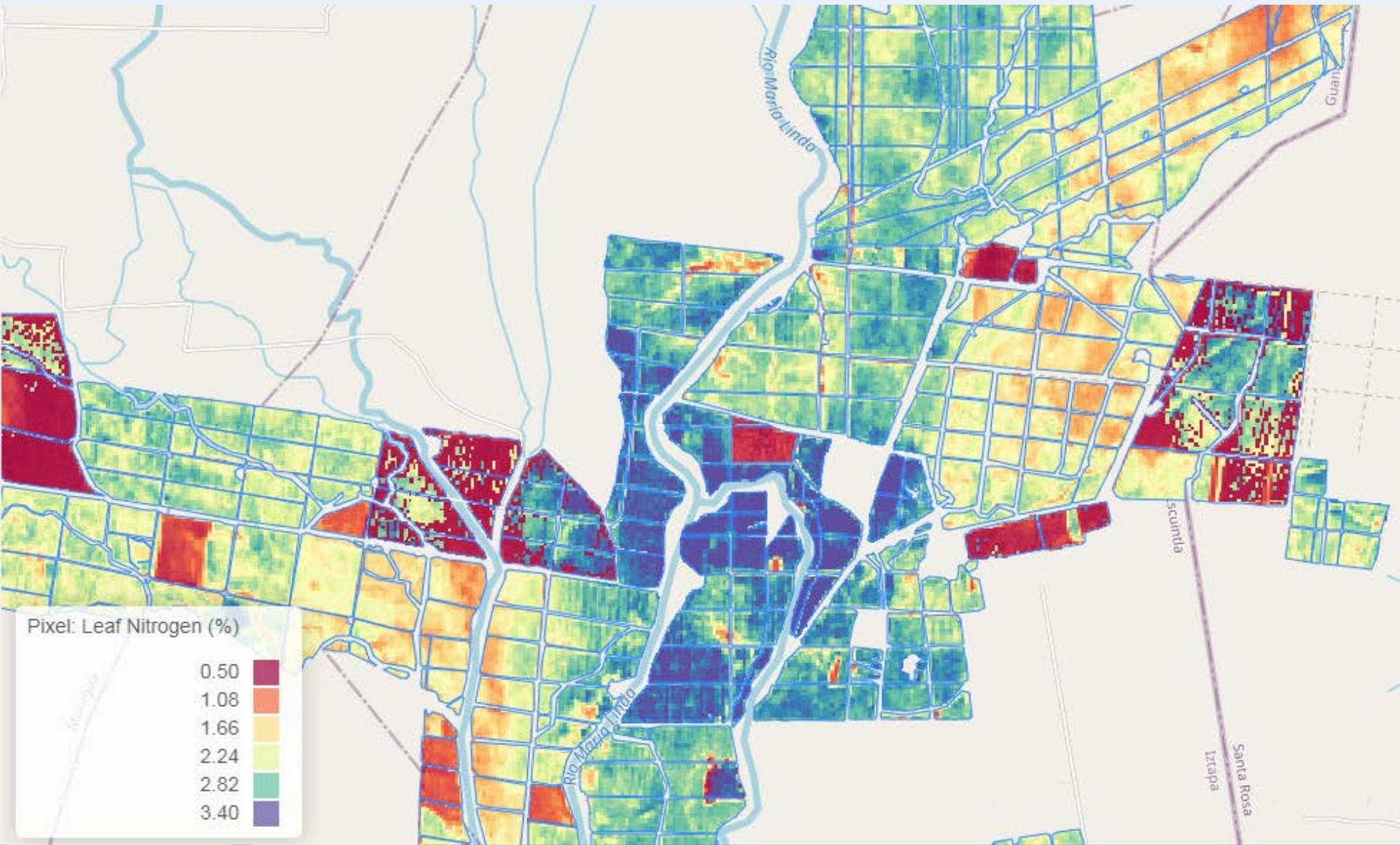
What are we asking participating growers to do?

- Enroll as a user of IrriWatch
- Help us identify well locations and field boundaries corresponding to areas served by each well
- Provide applied water estimates collected using a flow meter installed and maintained according to manufacturer specifications
- Meet with staff from Davids Engineering to collect field information (i.e., sprinkler/emitter application rates, number of sprinklers/emitters, etc.)

If interested in learning more about using IrriWatch to estimate irrigation efficiency, contact

- Ryan Fulton, Davids Engineering, Inc.
- Email: ryan@davidsengineering.com

Leaf Nitrogen



Leaf Nitrogen Sugarcane

Graphs - 4340203



Graphs [Table data](#)



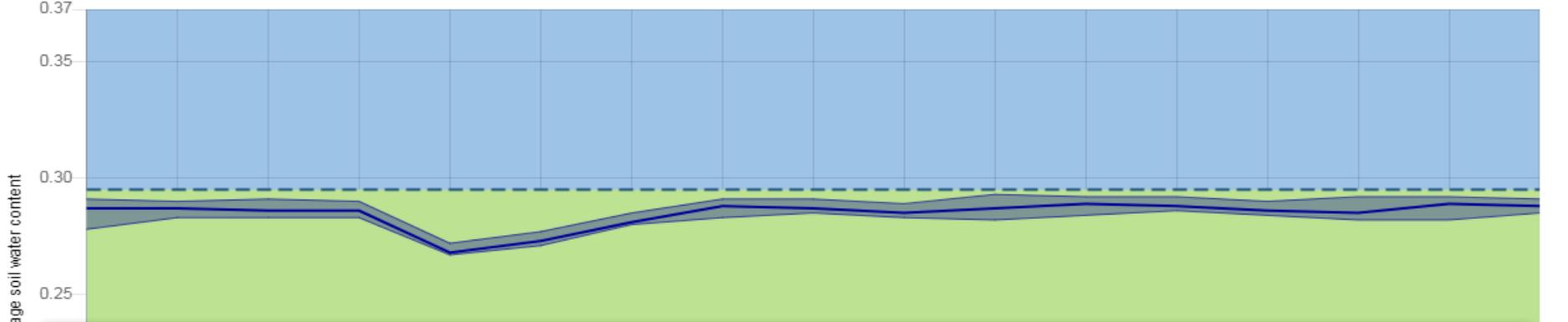
Select graph:



Various graphs (experts)

Graphs **Table data**

■ Field Capacity Soil Moisture
 ■ Soil Moisture Critical Root Zone
 - - - Wilting Point
 □ Soil moisture root zone
 - - - Saturated Soil Moisture



Virtual soil moisture probe

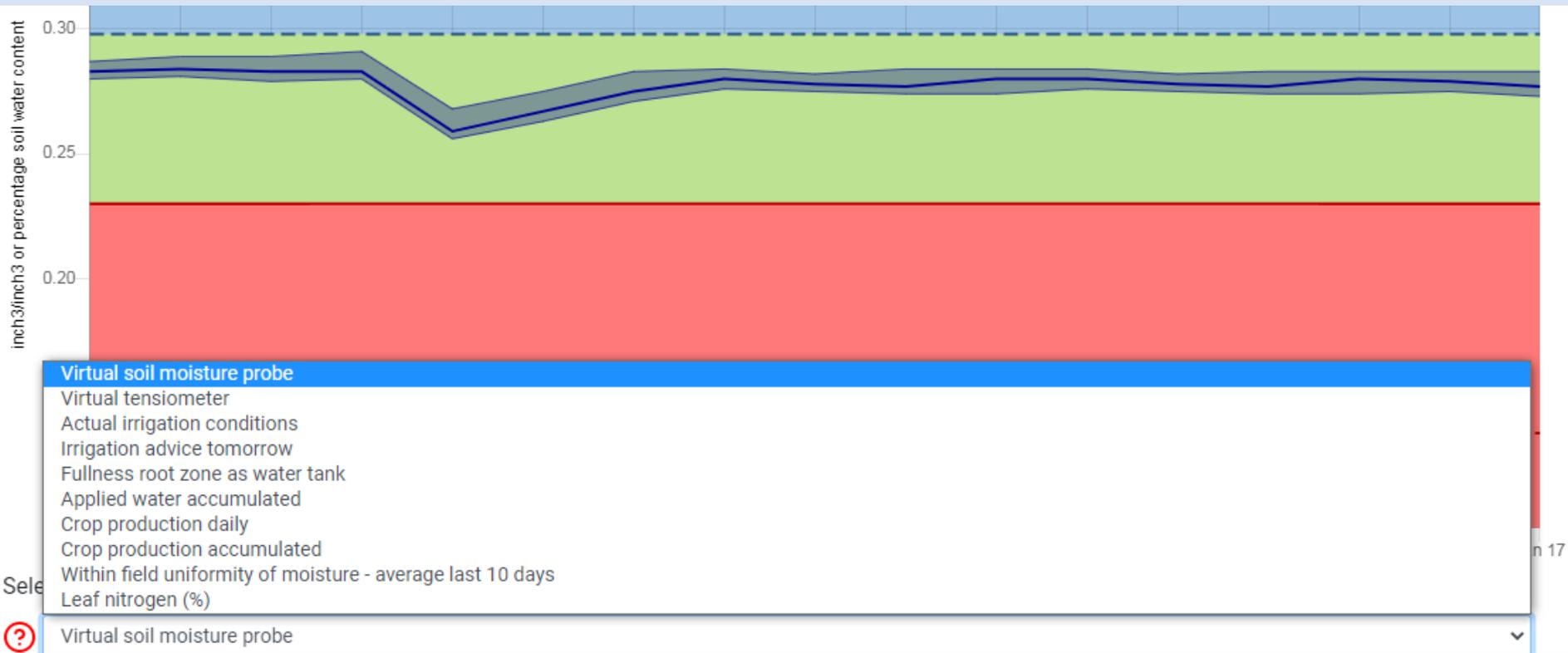
- Virtual tensiometer
- Actual irrigation conditions
- Irrigation advice tomorrow
- Fullness root zone as water tank
- ET consumptive use daily
- ET consumptive use accumulated
- Applied water - average last 10 days
- Applied water accumulated
- Crop production daily
- Crop production accumulated
- Crop Coefficient
- Field irrigation efficiency - average last 10 days
- Water productivity - average last 10 days
- Within field uniformity of moisture - average last 10 days
- Climatological conditions
- Leaf nitrogen (%)

Virtual soil moisture probe

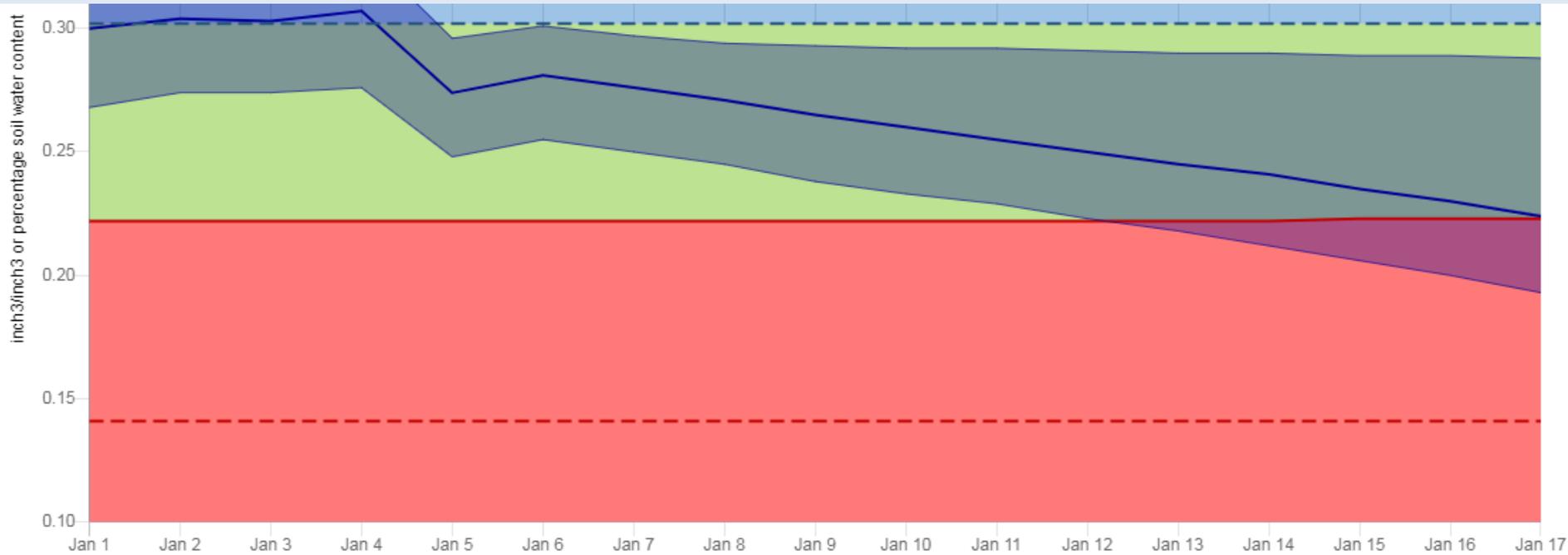
Close



Various graphs (local manager)



Various graphs (field irrigator)



Select graph:

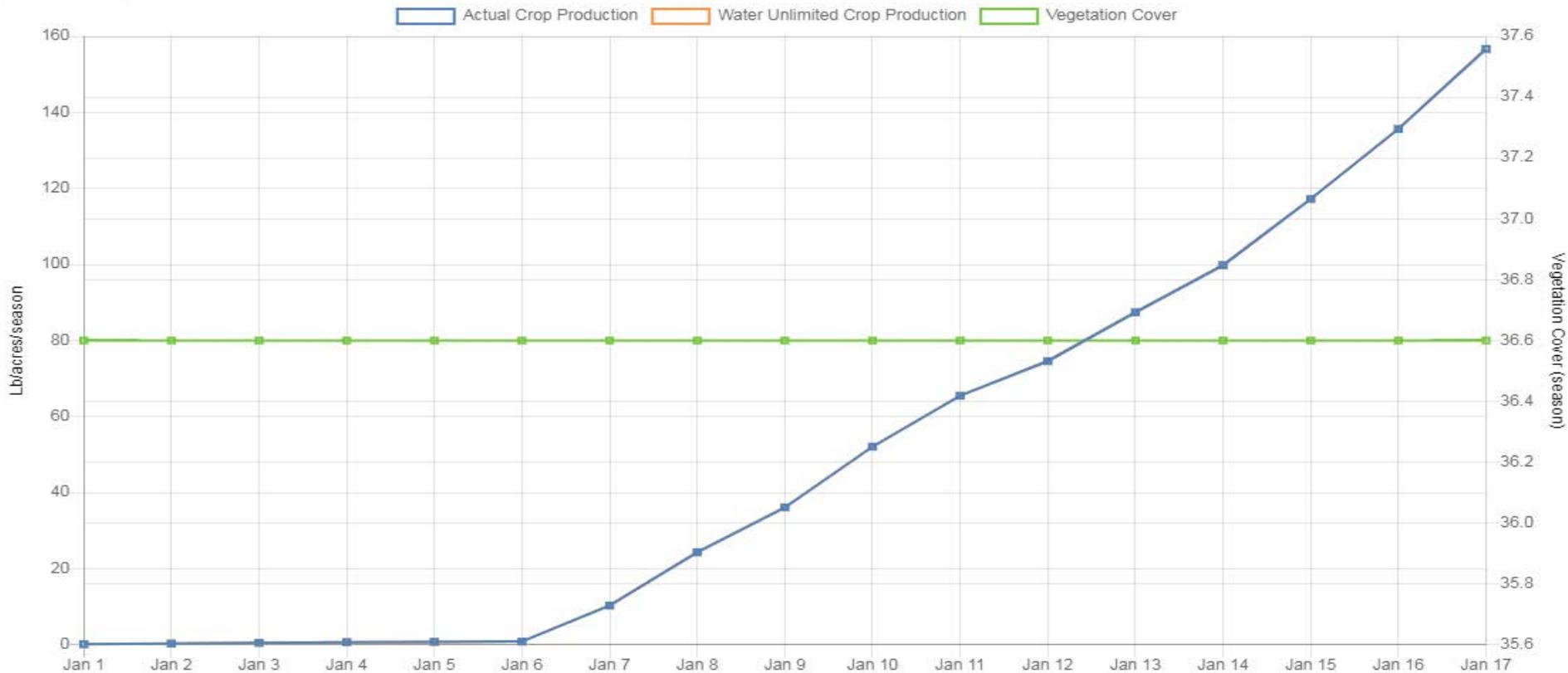


- Virtual soil moisture probe
- Virtual soil moisture probe**
- Actual irrigation conditions
- Irrigation advice tomorrow
- Fullness root zone as water tank
- Within field uniformity of moisture - average last 10 days
- Leaf nitrogen (%)

Other graphs with time series

Graphs - 028180013_134994

Graphs [Table data](#)



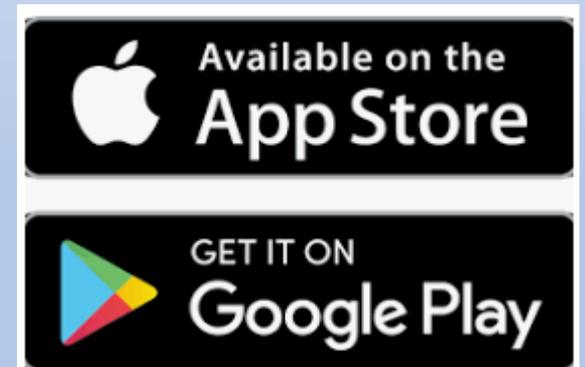
Select graph:



YouTube instruction movie

How the App works

(3 min)



<https://www.youtube.com/watch?v=msB4e7u5oC0>



Wednesday, 09 December 2020

Need to irrigate?

NO

Farm: **PV1**
 Field Code: **PV1**
 Area: (acres): **180.61**
 Crop Type: **Soya Beans**
 Soil Type: **Clay**
 Irrigation Type: **Center Pivot**

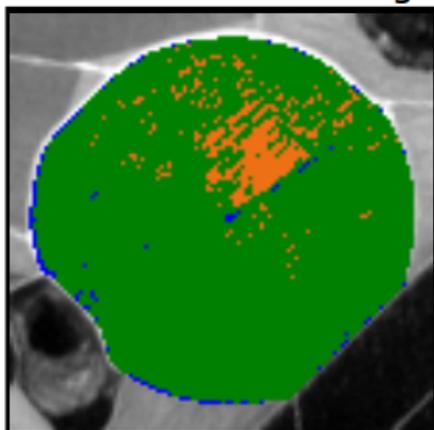
Area Requiring Irrigation

7 %

Field Details

Variable	Today 09-Dec-20	Tomorrow 10-Dec-20
Local Time Satellite Overpass	13:17	-
Vegetation Cover	92.3 %	-
Threshold Area Requiring Irrigation	35 %	-
Area Requiring Irrigation	-	7.0 %
Irrigation Need	-	NO
Area Over-Irrigated	0.0 %	-
Min Applied Water	-	0.0 inch/d
Max Applied Water	-	0.0 inch/d
Time Until Next Irrigation	-	1 days

Irrigation Map



Urgent Irrigation
Irrigation
No Irrigation
Over-Irrigation
No Vegetation

IrriWatch



miércoles, 09 diciembre 2020

¿Necesitas Regar?

NO

Granja: **PV1**
 Campo: **PV1**
 Area (acres): **180.61**
 Tipo de Cultivo: **Soya**
 Tipo de Suelo: **Arcilloso**
 Tipo de Riego: **Pivote Central O Lineal**

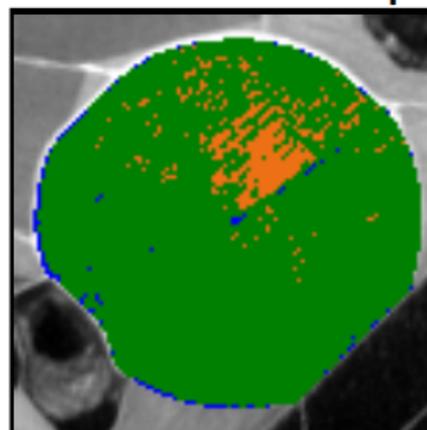
Area Requiriendo Riego

7 %

Detalles Del Campo

Variable	Hoy 09-dic.-20	Mañana 10-dic.-20
Hora Local de Paso Del Satélite	13:17	-
Cobertura Vegetal	92.3 %	-
Umbral de área Requiriendo Riego	35 %	-
Area Requiriendo Riego	-	7.0 %
Necesidad de Riego	-	NO
Area Con Riego Excesivo	0.0 %	-
Mínima Aqua a Aplicar	-	0.0 inch/d
Máxima Aqua a Aplicar	-	0.0 inch/d
Tiempo Hasta el Próximo Riego	-	1 dias

Mapa De Riego



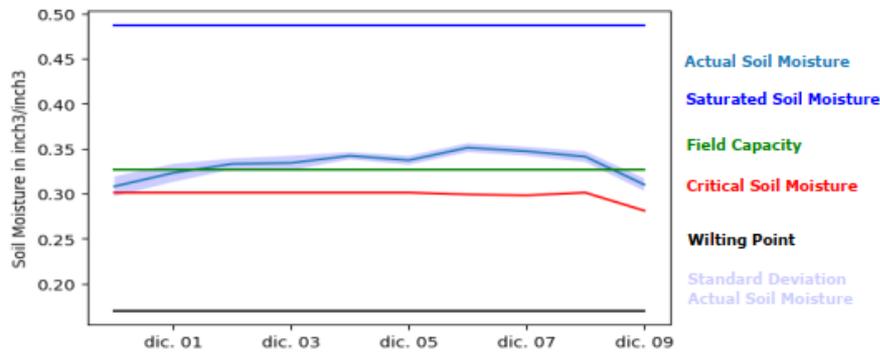
Riego Urgente
Necesita Riego
Sin Riego
Sobre Riego
Sin Vegetación

IrriWatch

Field Details

Variable	Unit	Today 09-Dec-20	Tomorrow 10-Dec-20
Soil Water Potential Root Zone	cm or hPa	-318	-383
Soil Moisture Root Zone	inch3/inch3	0.31	0.293
Critical Moisture Root Zone	inch3/inch3	-	0.281
Actual Evapotranspiration	inch/d	0.2	0.1
Grass Reference Evapotranspiration	inch/d	0.2	0.2
Grass Crop Coefficient	-	0.73	-
Actual Crop Production	Lb/acres/d	255.9	-
Water Unlimited Crop Production	Lb/acres/d	255.9	-

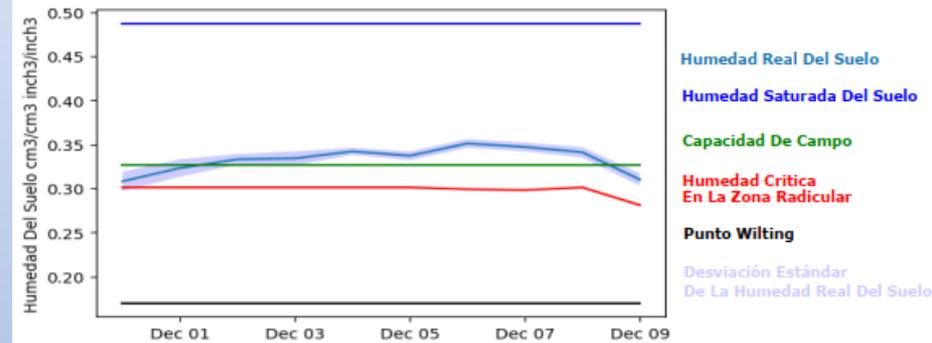
Actual Soil Moisture Last 10 Days



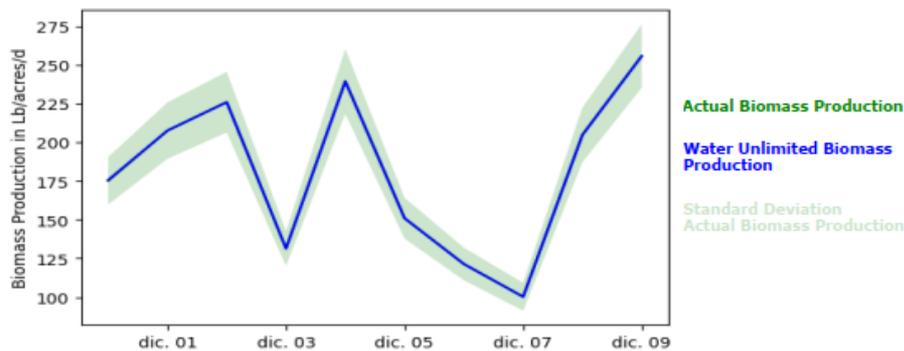
Detalles Del Campo

Variable	Unidad	Hoy 09-dic.-20	Mañana 10-dic.-20
Potencial de Agua del Suelo en la Zona Radicular	cm or hPa	-318	-383
Humedad del Suelo en la Zona Radicular	inch3/inch3	0.31	0.293
Humedad Crítica en la Zona Radicular	inch3/inch3	-	0.281
Evapotranspiración Real	inch/d	0.2	0.1
Evapotranspiración de Referencia del Césped	inch/d	0.2	0.2
Coefficiente de Cultivo del Césped	-	0.73	-
Producción Real de Cultivos	Lb/acres/d	255.9	-
Producción de Cultivos Con Agua Ilimitada	Lb/acres/d	255.9	-

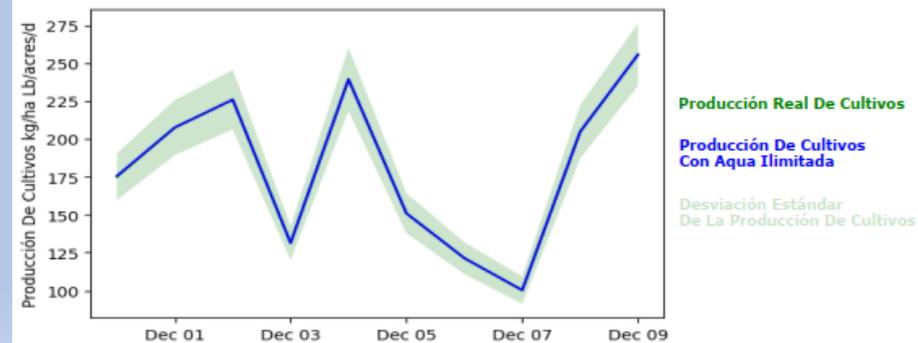
Humedad Real Del Suelo Durante Los Últimos 10 Días



Actual Biomass Production Last 10 Days



Producción De Biomasa Durante Los Últimos 10 Días

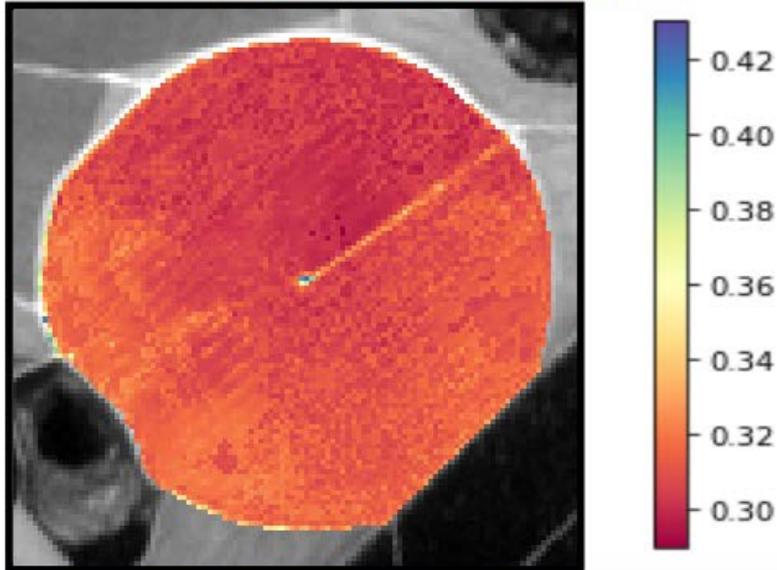


IrriWatch

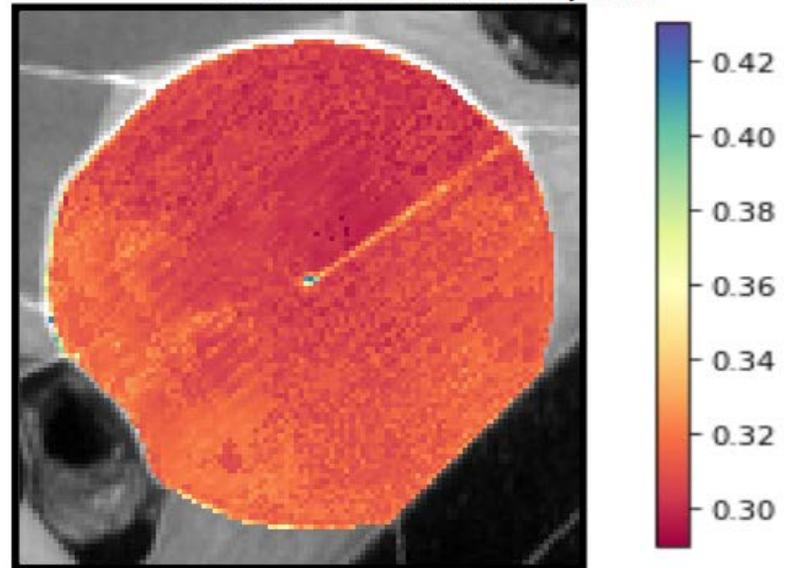
IrriWatch



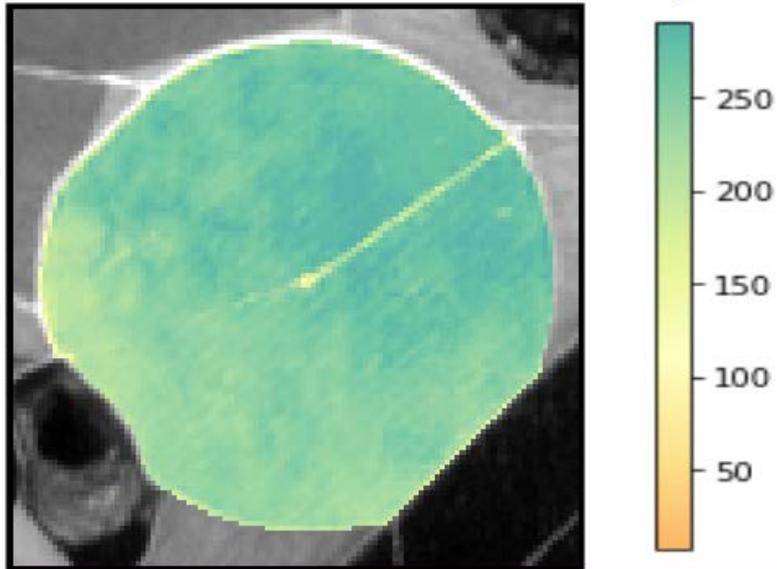
Soil Moisture Root Zone inch3/inch3



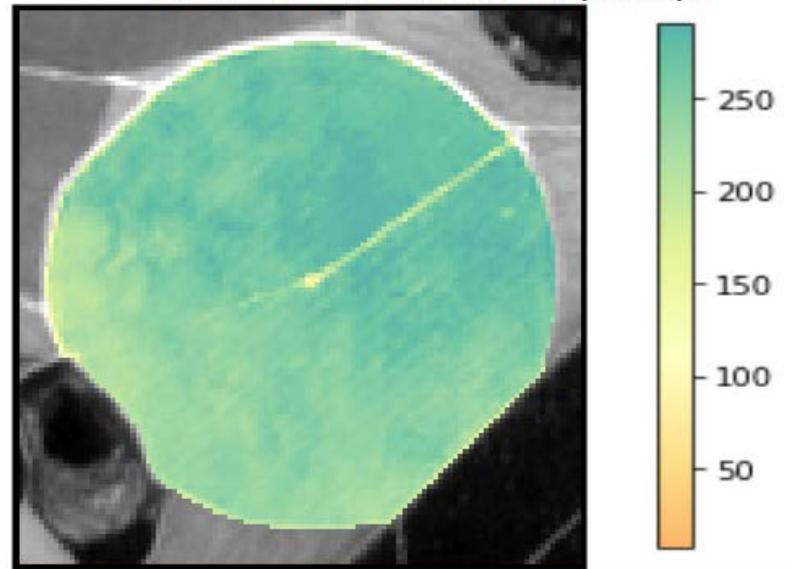
Humedad del Suelo inch3/inch3



Actual Biomass Production Lb/acres/d



Producción real de cultivos Lb/acres/d



IrriWatch

IrriWatch

Familiarize the portal prior to the irrigation season

Remarks and suggestions to support@irriwatch.com