USDA

United States Department of Agriculture

Conservation Innovation Grants: CIG Insights Webinar Series

Innovations in Water Management

September 26, 2019

Natural Resources Conservation Service

nrcs.usda.gov/

Agenda

- Opening Remarks
- Overview of the innovation landscape in ag. water management
- CIG projects
  - Irrigation Automation to Improve the Efficiency of Water Resource Management
  - Mobilizing Access to Low-Cost Irrigation Scheduling Technology and Tools
  - Integrating Precision Irrigation Tech. and Farmer-Ready Dynamic Variable Rate Irrigation Systems
- Closing Perspectives
- Questions and Answers

Natural Resources Conservation Service

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CIG Overview

- **Purpose—to stimulate the development and adoption of innovative conservation approaches and technologies on farms, ranches and forest lands.**

- **CIG projects are expected to lead to the transfer of conservation technologies, management systems, and innovative approaches (such as market-based systems) to agricultural producers, into NRCS technical manuals and guides, or to the private sector.**

- **CIG generally funds pilot projects, field demonstrations, and on-farm conservation research. On-farm conservation research is defined as an investigation conducted to answer a specific applied conservation question using a statistically valid design while employing farm-scale equipment on farms, ranches or private forest lands.**

United States Department of Agriculture

Conservation Innovation Grants

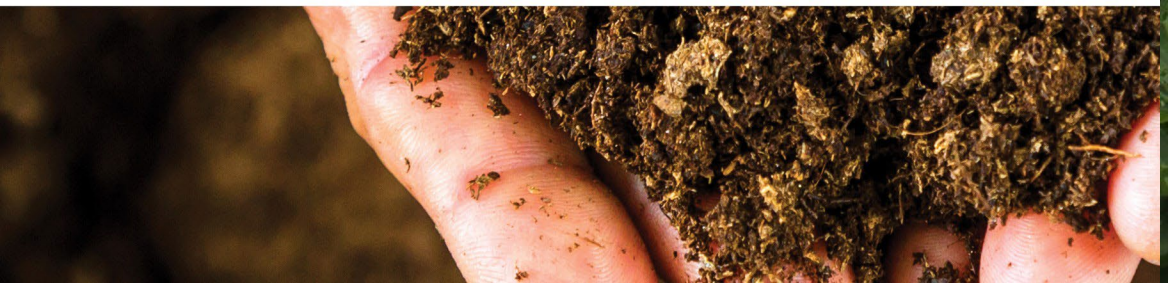
Innovations in Water Management

FLINT RIVER SOIL & WATER CONSERVATION DISTRICT

UNIVERSITY OF GEORGIA

USDA ARS NATIONAL PEANUT RESEARCH LAB

Hamid Farahani, Water Management Engineer, USDA NRCS



FLINT RIVER SOIL AND WATER CONSERVATION DISTRICT

Conservation through Innovation

Conservation Innovation Grant Webinar

September 26, 2019

Background

INTRODUCTION

The District

Project Team

Economic Context

Local Ecology

Natural Resource Challenges

Conservation-Driven Solutions

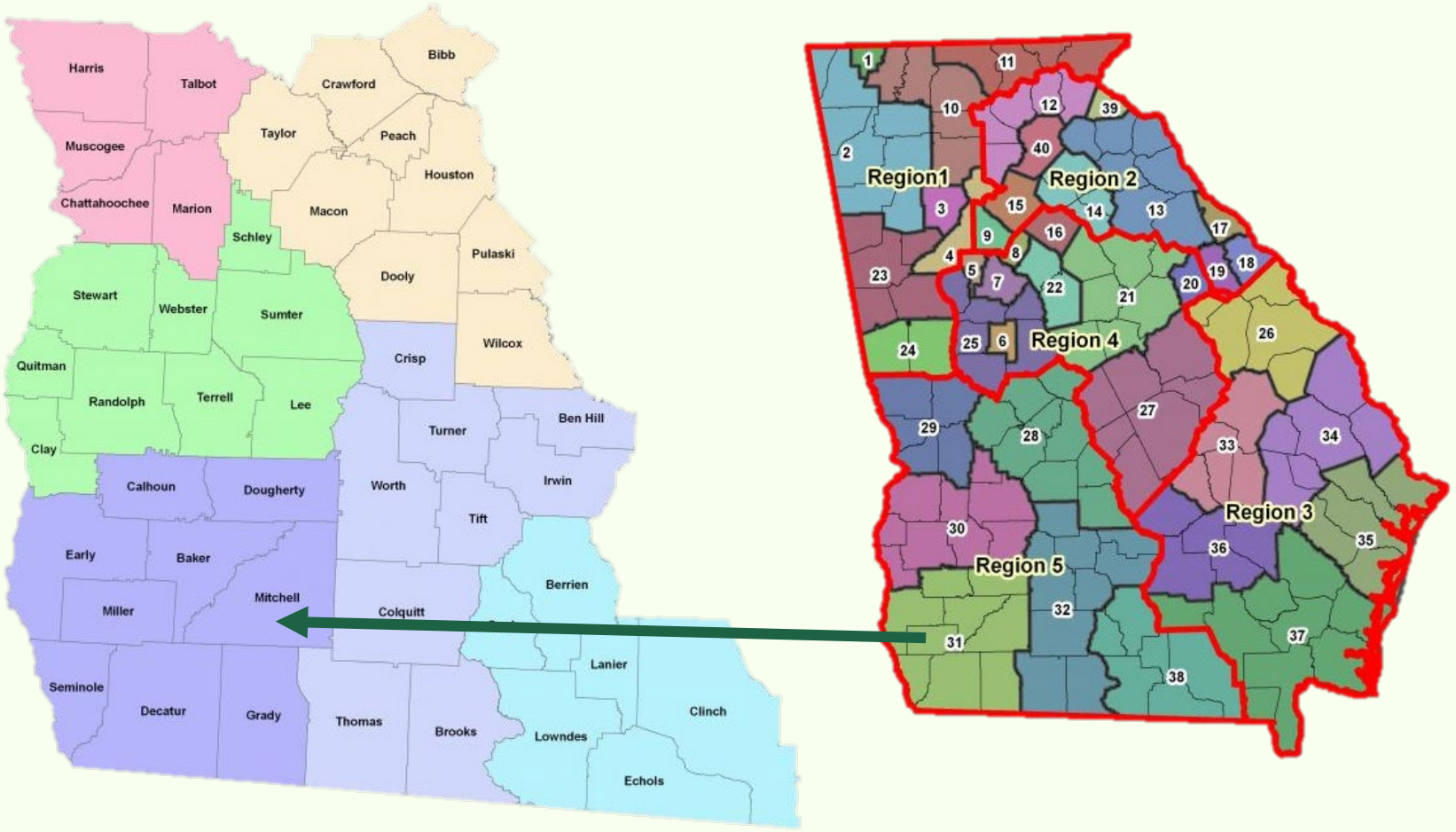
CIG Project Overview

FLINT RIVER

SOIL AND WATER CONSERVATION DISTRICT

The Lower Flint River Basin in southwest Georgia is one of the most ecologically rich river systems in the southeast and the epicenter of Georgia's vibrant agricultural economy. The Flint River Soil and Water Conservation District is dedicated to the stewardship of our natural resources for future generations and the exploration of conservation-driven technologies and strategic partnerships that enhance agricultural sustainability.

The District is comprised of farmers, landowners, and community leaders that are dedicated to the conservation, wise use, and protection of natural resources in the Flint River Basin.


Harris
Talbot
Bibb
Crawford
Taylor
Peach
Muscogee
Houston
Chattahoochee
Marion
Macon
Schley
Pulaski
Dooly
Stewart
Webster
Sumter
Wilcox
Crisp
Quitman
Randolph
Terrell
Lee
Turner
Ben Hill
Clay
Calhoun
Dougherty
Worth
Irwin
Tift
Early
Baker
Berrien
Mitchell
Miller
Colquitt
Seminole
Decatur
Grady
Thomas
Brooks
Lanier
Clinch
Lowndes
Echols
Region1
Region 2
Region 4
Region 3
Region 5

Core Partners

FLINT RIVER
SOIL AND WATER
CONSERVATION DISTRICT

USDA

UNIVERSITY OF
GEORGIA

USDA NRCS

NRCS is a core partner at the local, state, and Federal level.

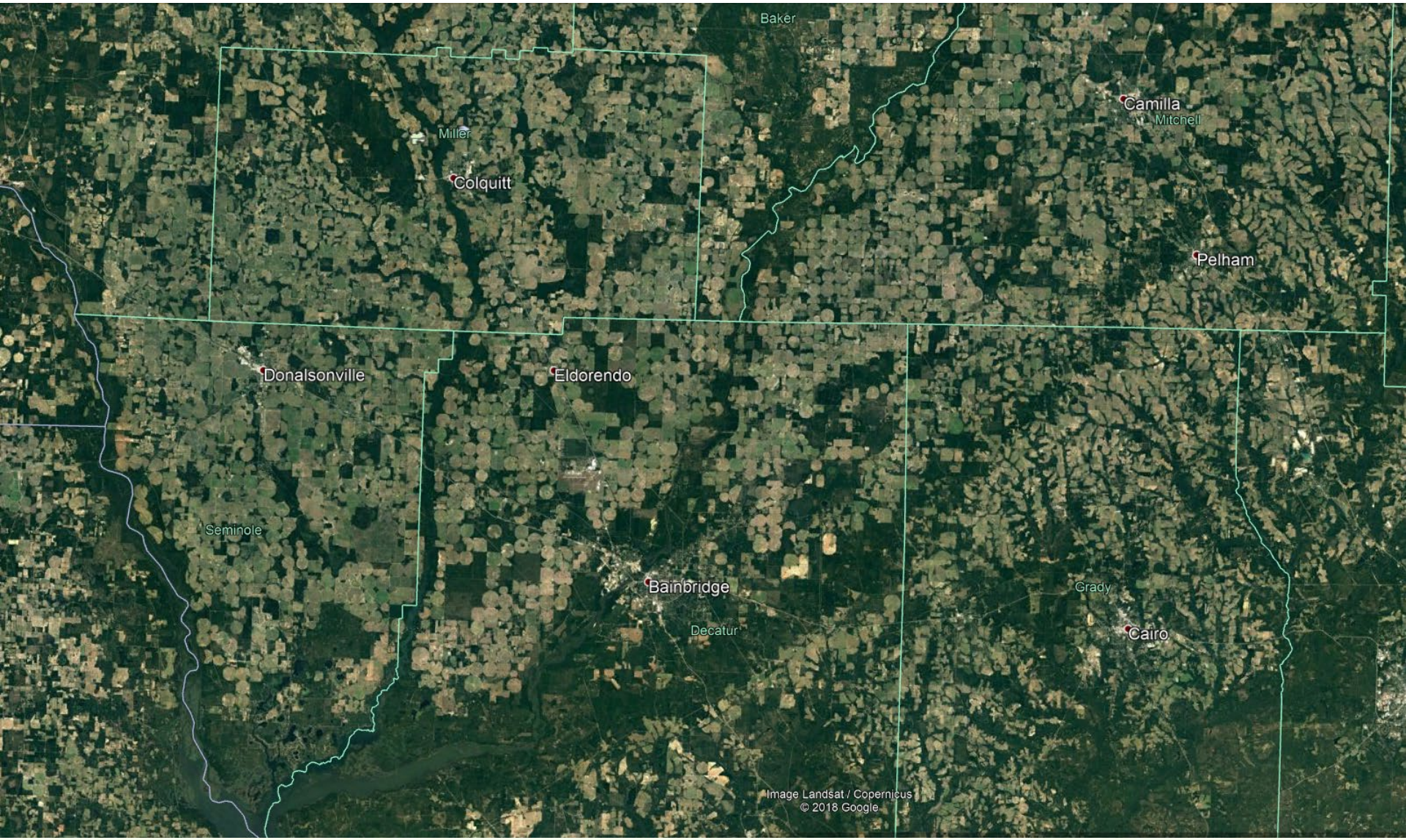
USDA ARS

The District works closely with the ARS National Peanut Research Laboratory in Dawson, Georgia.

UNIVERSITY OF GEORGIA

The University of Georgia (UGA) precision agriculture team within the College of Agricultural and Environmental Sciences conducts research for many of our projects.

Agriculture in Georgia



Lower Flint River Basin

flintriverswcd.org

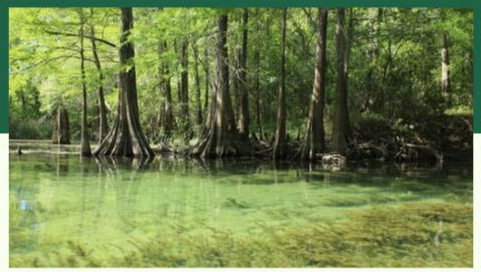
Lower Flint River Basin

flintriverswcd.org

Natural Resource Challenges

DROUGHT

Because of sandy soils, agricultural drought can occur after only a week without rain. Season-long droughts occur with increasing frequency.



"WATER WARS"

The Lower Flint River Basin is at the center of a decades-long dispute among Alabama, Florida, and Georgia on shared water resources in the ACF River Basin.

ENDANGERED SPECIES

Droughts, coupled with peak agricultural water demand, threaten endangered aquatic species due to reduced flow in streams.

Our Approach

CONSERVATION

Enhancing Stewardship and Restoration of Natural Resources

INNOVATION

Optimizing Resource Use through Conservation-Driven Technology

PARTNERSHIP

Developing Strategic Partnerships at the Local, State, and National Level

Conservation Innovation Grants

The District has led three impactful CIG projects over the last ten years, all related to the optimization of water resource management through cutting-edge technology.

2011 CIG

2011 - 2014

Irrigation Automation to Improve the Efficiency of Water Resource Management in Row Crop Production and Maintain Aquatic-Based Ecosystem Services in the Lower Flint River Basin of Georgia

Project Components

VRI

Variable Rate Irrigation (VRI) technology installed on approximately 2,000 acres of land adjacent to Flint River tributaries with known populations of endangered mussel species.

UGA SSA

The University of Georgia (UGA) team developed a high-density, low-cost soil moisture sensor network called the Smart Sensor Array (SSA) to deploy in each of the fields.

AUTOMATION

The project team linked both VRI and the SSA to create irrigation management zones based on real-time data from the fields and prescribed irrigation amounts in cooperation with farmers.

MONITORING

A team of aquatic biologists from the Jones Ecological Research Center at Ichauway monitored the mussel populations for the duration of the project and published their results.

Variable Rate Irrigation (VRI)

Variable Rate Irrigation (VRI) is a tool of precision agriculture that optimizes irrigation water application.

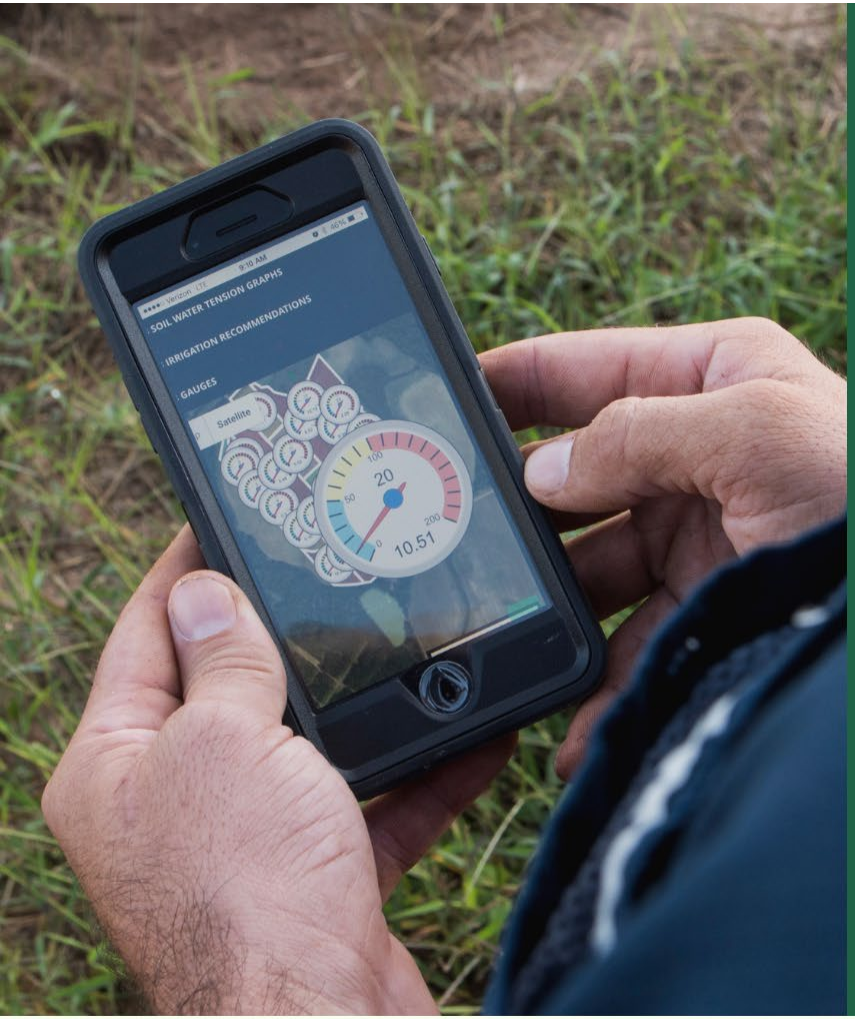
A center pivot system is retrofitted to control irrigation application with GPS guidance by span or individual sprinkler, depending on the type of VRI system.

With VRI, the center pivot applies varying amounts of water across irrigation management zones to address variations in the field, helping farmers determine where to irrigate.

VRI enables farmers to apply customized rates of water based on individual management zones within a field.

Variable Rate Irrigation

flintriverswcd.org/vri

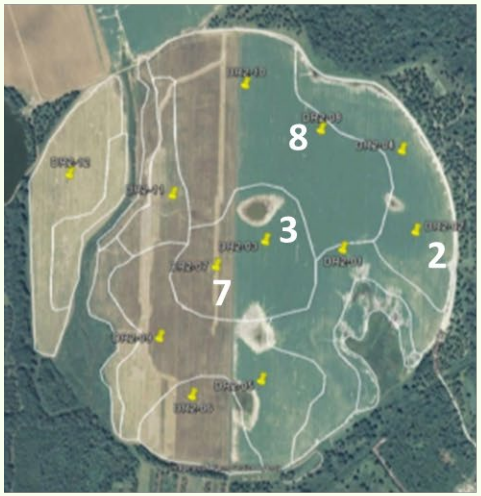


Irrigation Scheduling

Advanced irrigation scheduling is a method of analyzing real-time field data to optimize irrigation application decisions.

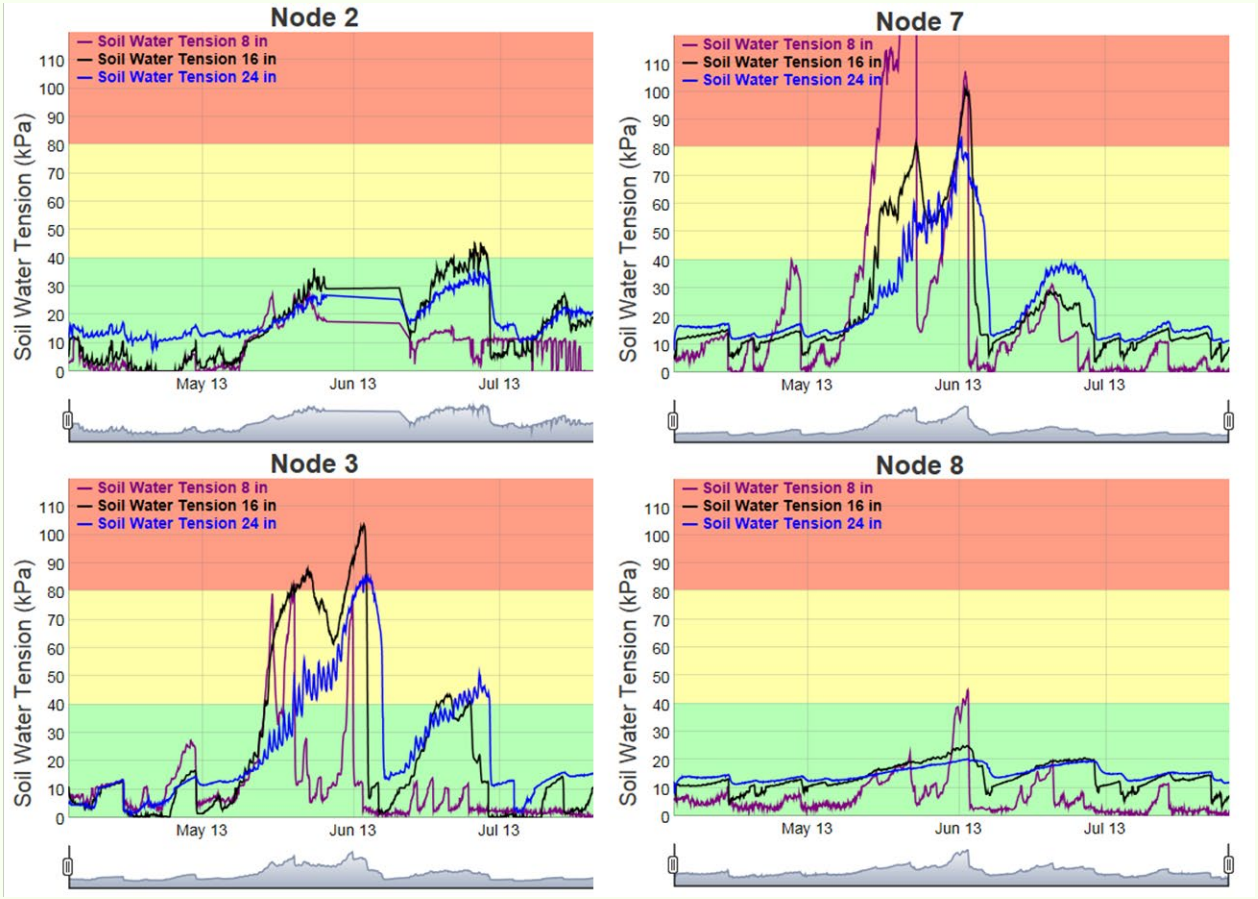
Irrigation scheduling helps determine when to irrigate and how much water to apply. Soil moisture sensors provide a gauge of current field conditions to determine if there is adequate moisture for the crop, if the soil is drying, or if the soil is very dry.

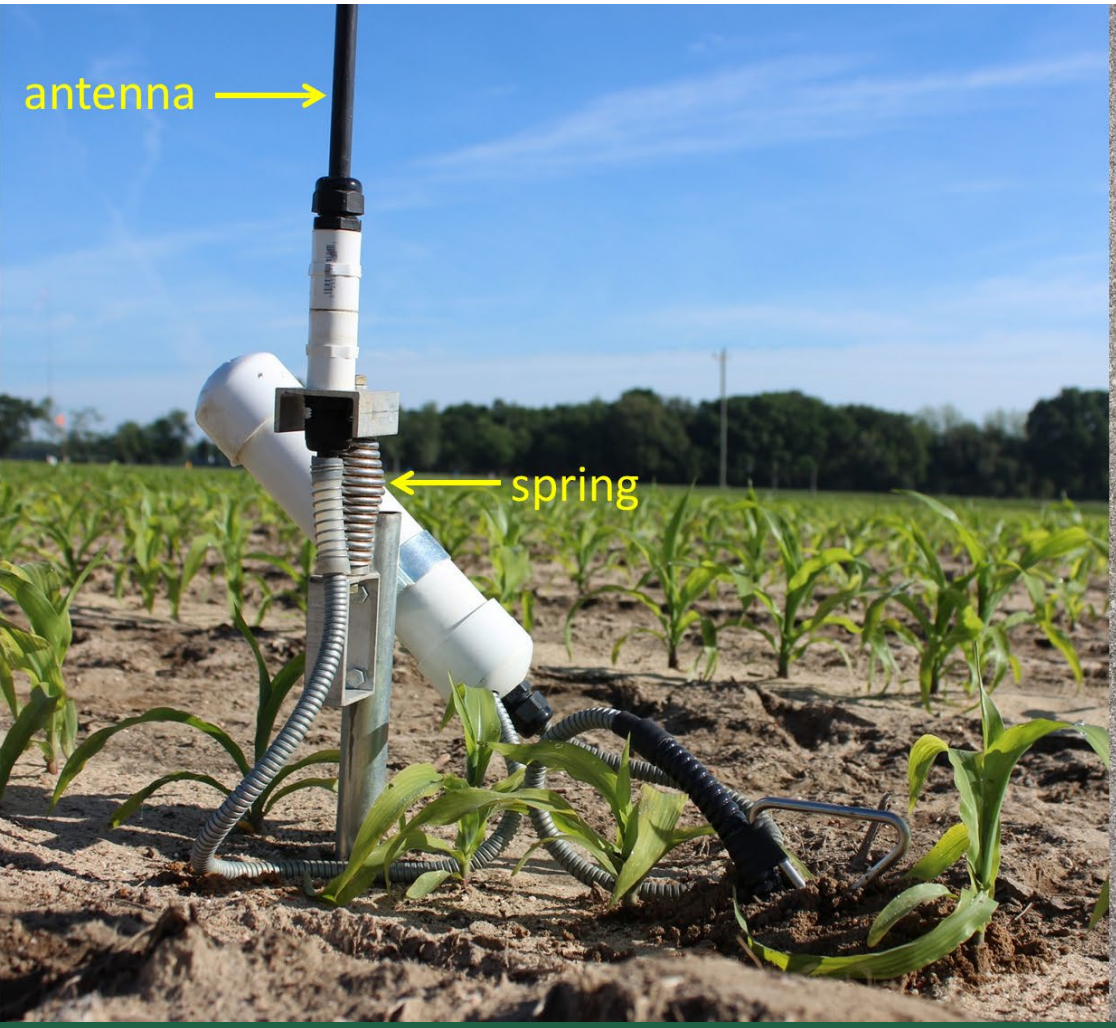
Advanced irrigation scheduling can optimize plant growth, crop yield, crop quality, nutrient management, root zone health, and irrigation decisions.



Corn

- Dry
- Drying
- Adequate Soil Moisture



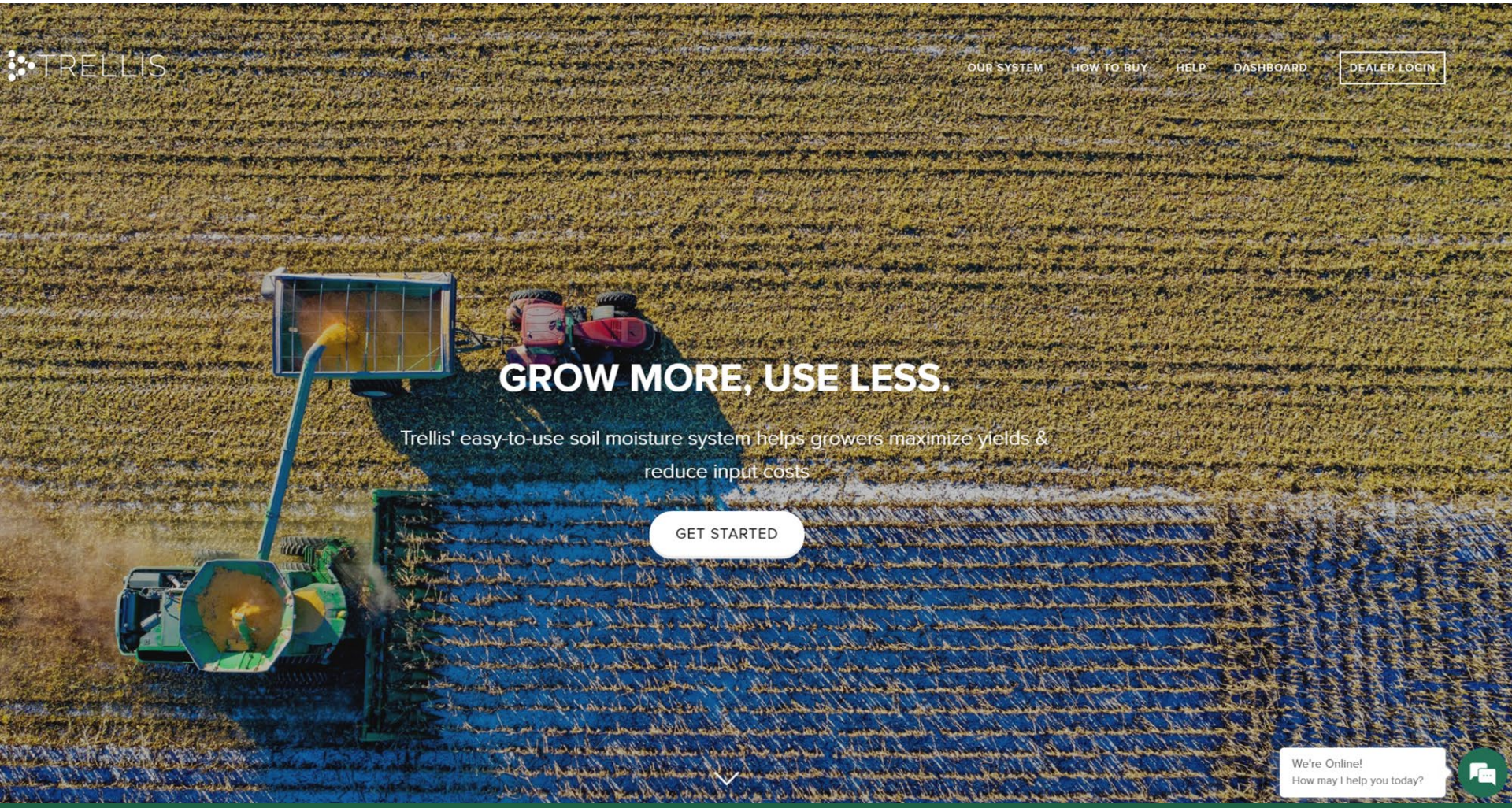


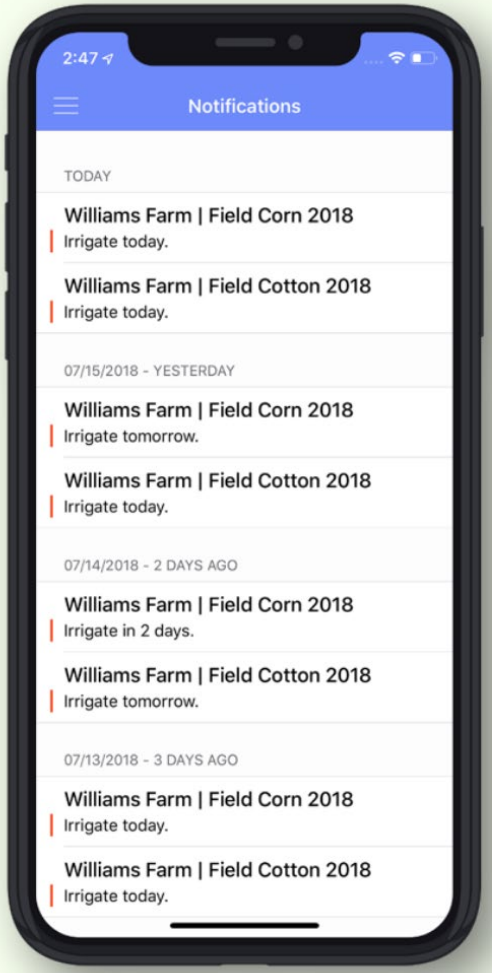
The University of Georgia Smart Sensor Array (UGA SSA)

Precision Irrigation

IRRIGATION MANAGEMENT ZONES

Irrigation management zones are areas within fields that have similar properties and can be managed uniformly.

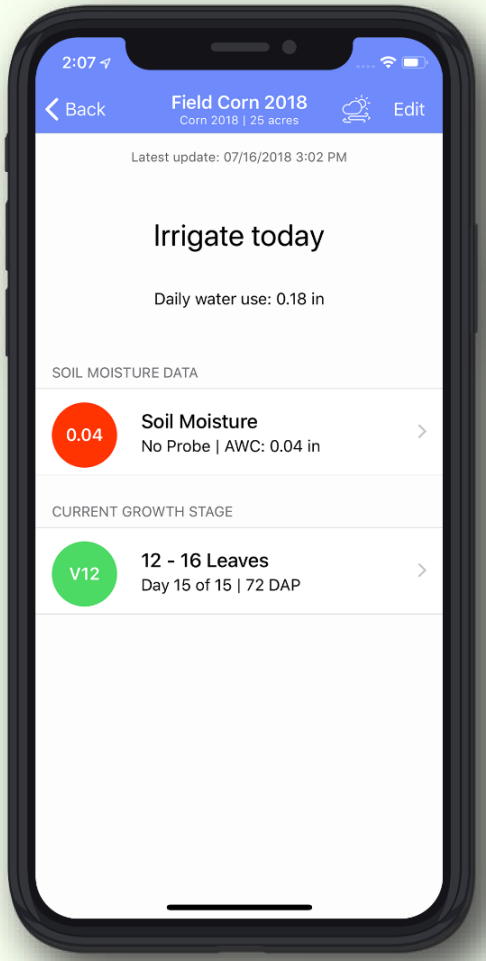

TRELLIS
OUR SYSTEM
HOW TO BUY
HELP
DASHBOARD
DEALER LOGIN
GROW MORE, USE LESS.
Trellis' easy-to-use soil moisture system helps growers maximize yields & reduce input costs
GET STARTED
We're Online!
How may I help you today?



2013 CIG

2013 - 2016

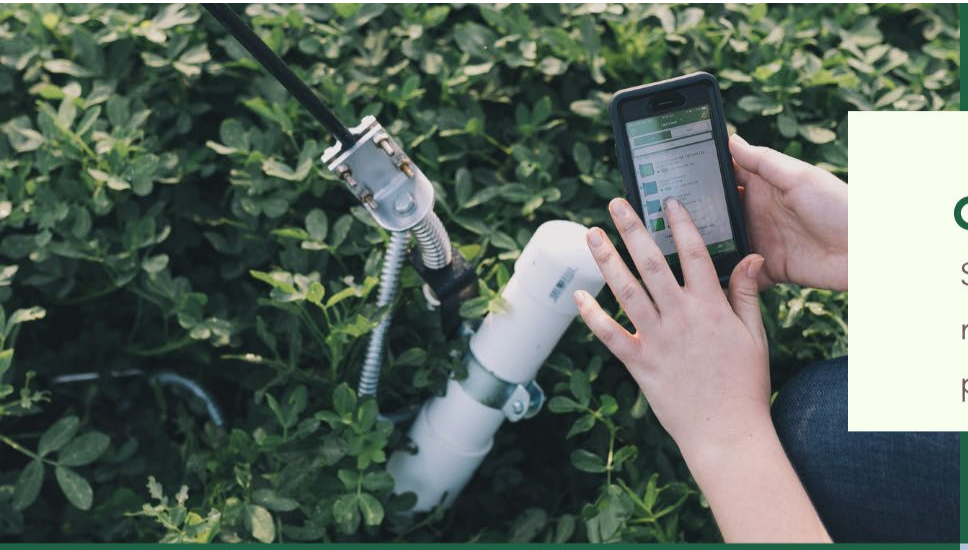
Mobilizing Access to Low-Cost Irrigation Scheduling Technology and Tools in the Lower Flint River Basin of Georgia



Irrigator Pro

IRRIGATION SCHEDULING TOOL

Irrigator Pro is an irrigation scheduling tool for peanuts, corn, and cotton developed by the USDA Agricultural Research Service National Peanut Research Lab. Irrigator Pro is an expert system designed to provide recommendations based on scientific data resulting in conservation-minded irrigation management while maintaining high yields.



ORIGINAL VERSION

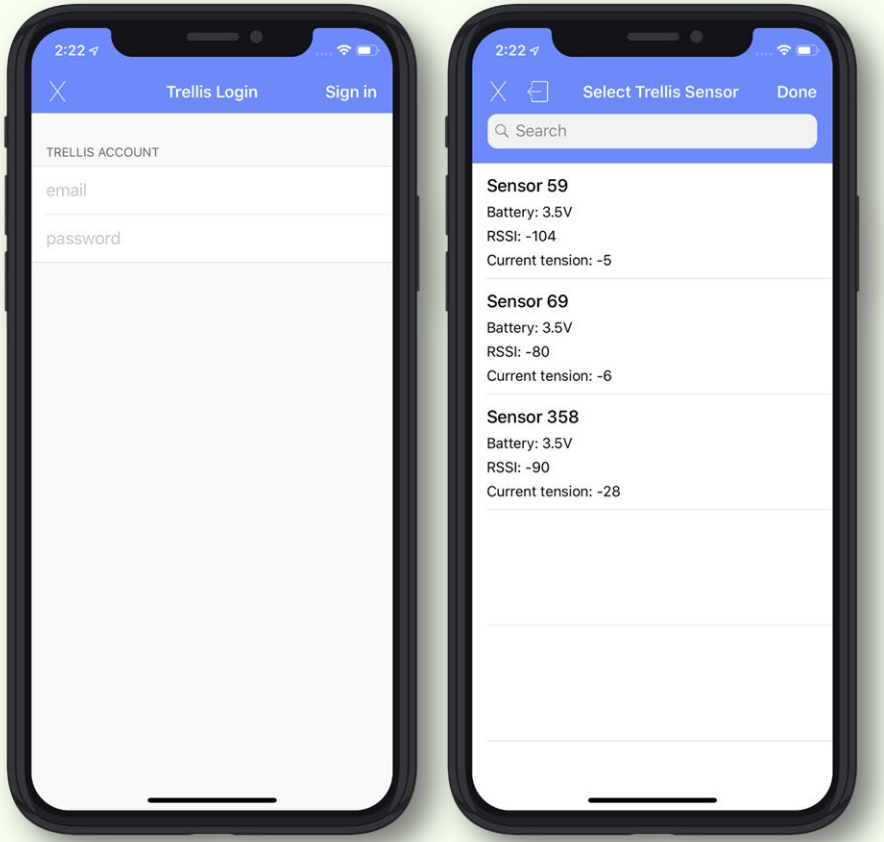
Sensors are hand-read in the field. Data is manually entered into desktop software platform. Recommendation is generated.

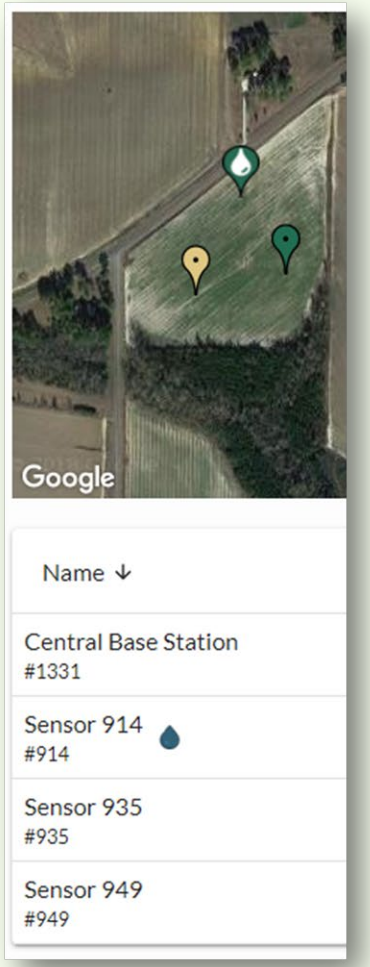
CIG DEVELOPMENT

Smartphone app and cloud-based web platform collect data remotely and process data through Irrigator Pro model to provide real-time recommendation automatically.

Automated Soil Moisture Data

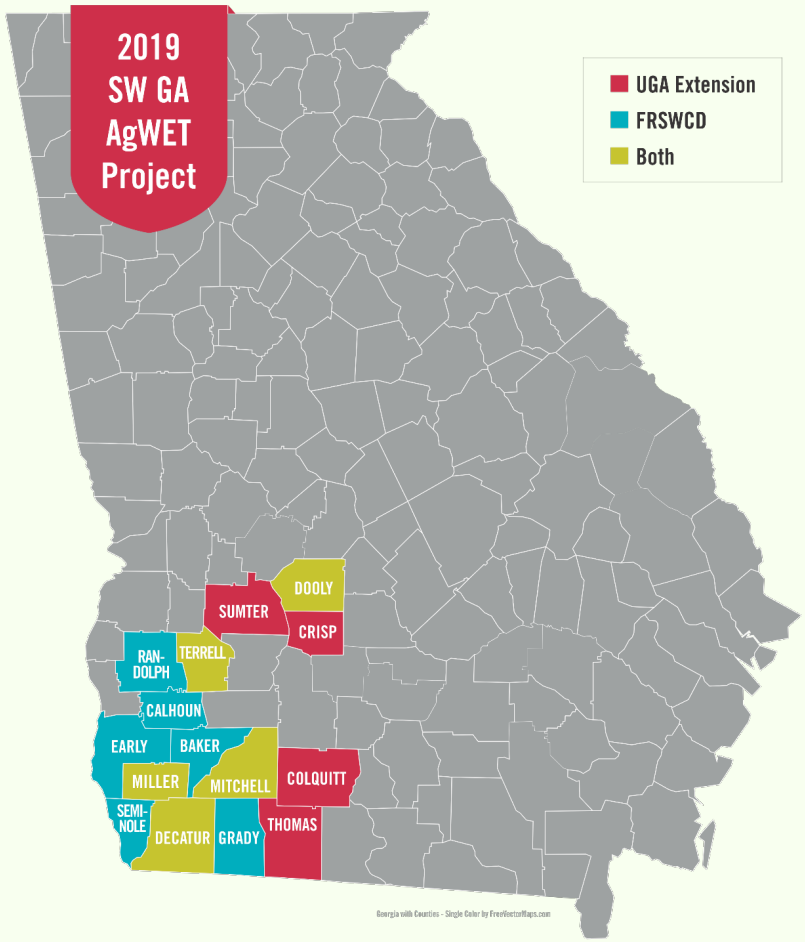
- Trellis Sensor
  - Login with your Trellis account
  - Select sensor





2018 Comparison at UGA's Stripling Irrigation Research Park

Treatments		Yield-Moisture (lb/ac)	Irrigation (in)
Old Checkbook	1	6204	7.8
New Checkbook	2	6147	6.7
50% New Checkbook	3	6231	4.0
Irrigator Pro (Temp)	4	5996	6.3
Irrigator Pro (SSA)	5	6433	3.3
SSA Dynamic VRI	6	5866	3.8
SSA (Porter Method)	7	5849	2.5
Peanut Farm	8	5984	4.8
Rainfed	9	5591	2.5



- 11 counties in Georgia
- 11 county agents
- 3 consultants
- 30 peanut growers
- Participants in Florida and Alabama

Next Steps

2019

Launching Irrigator Pro app with sensor with 40+ growers in AL, FL, GA. Testing capacitance probes for integration into model.

2020

Continuing project with 40+ growers. Beta test model with capacitance probe compatibility.

2021

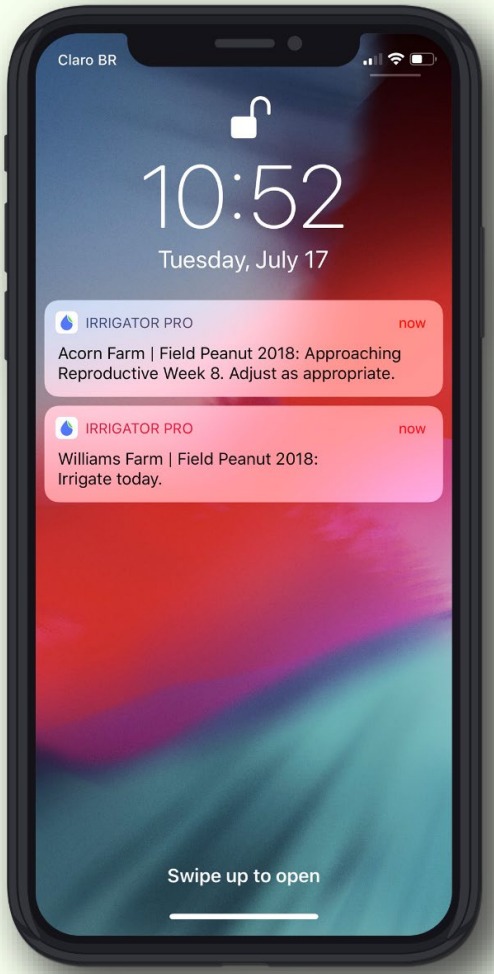
Evaluate expansion of model beyond Southeast. Integrate additional crops into model.

AVAILABLE TO DOWNLOAD IN APP STORE

irrigatorpro.org

Download on the App Store

GET IT ON Google Play



flintriverswcd.org

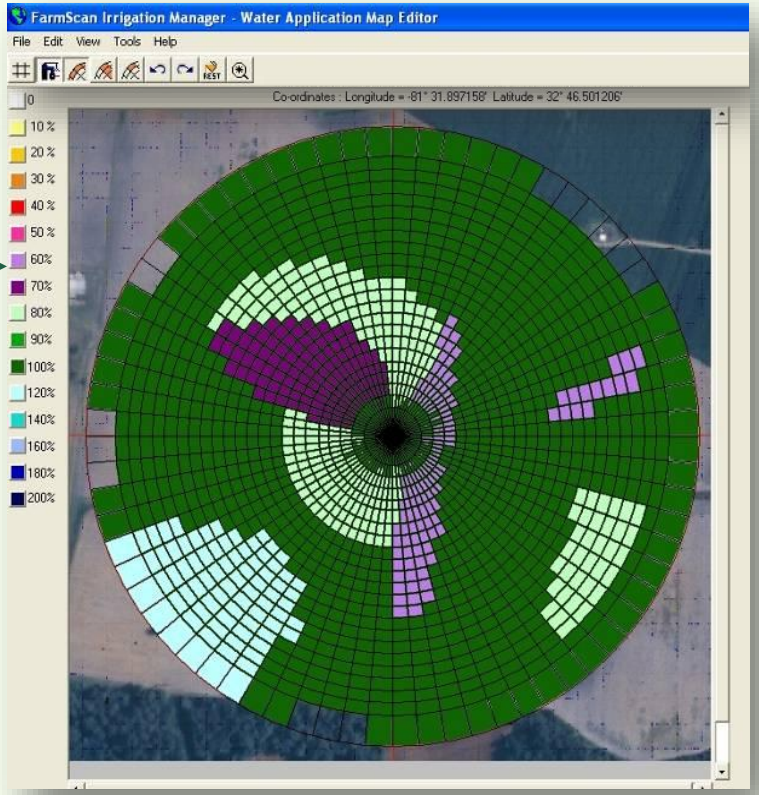
2017 CIG

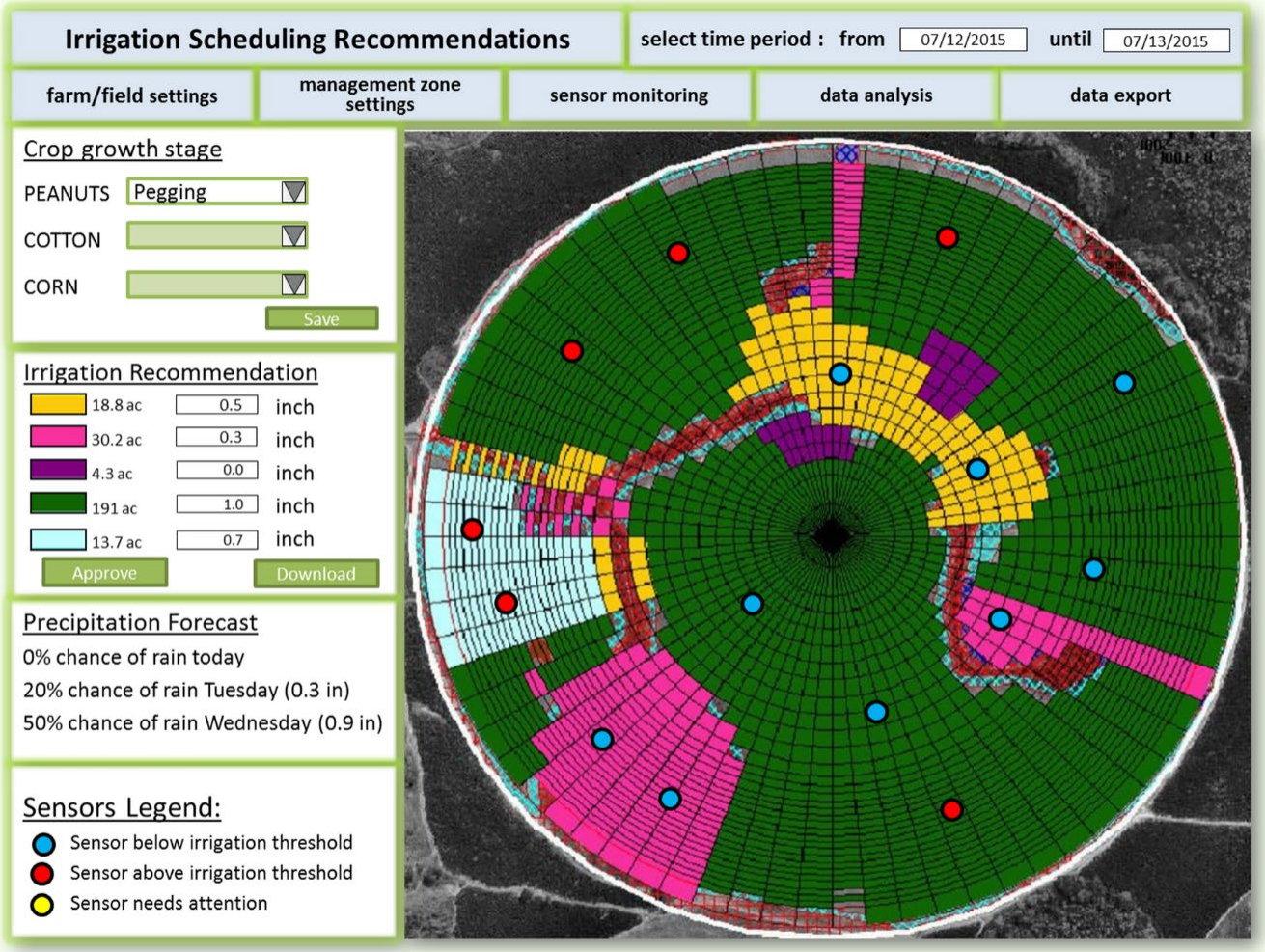
2017 - 2020

Integrating Precision Irrigation Technologies to Demonstrate a Farmer-Ready Dynamic Variable Rate Irrigation System

Status Quo


100%
0%
0%
80%
70%
60%
60%
0%
100%
80%
80%
125%
0%


FarmScan Irrigation Manager - Water Application Map Editor
File Edit View Tools Help
Co-ordinates : Longitude = -81° 31.897158' Latitude = 32° 46.501206'
0
10 %
20 %
30 %
40 %
50 %
60%
70%
80%
90%
100%
120%
140%
160%
180%
200%


Irrigation Scheduling Recommendations
select time period : from 07/12/2015 until 07/13/2015
farm/field settings
management zone settings
sensor monitoring
data analysis
data export
Crop growth stage
PEANUTS Pegging
COTTON
CORN
Save
Irrigation Recommendation
18.8 ac 0.5 inch
30.2 ac 0.3 inch
4.3 ac 0.0 inch
191 ac 1.0 inch
13.7 ac 0.7 inch
Approve
Download
Precipitation Forecast
0% chance of rain today
20% chance of rain Tuesday (0.3 in)
50% chance of rain Wednesday (0.9 in)
Sensors Legend:
Sensor below irrigation threshold
Sensor above irrigation threshold
Sensor needs attention

Dynamic VRI

SENSORS

Real-Time Data

Sensors installed throughout the field in multiple irrigation management zones.

VRI

Remote Upload

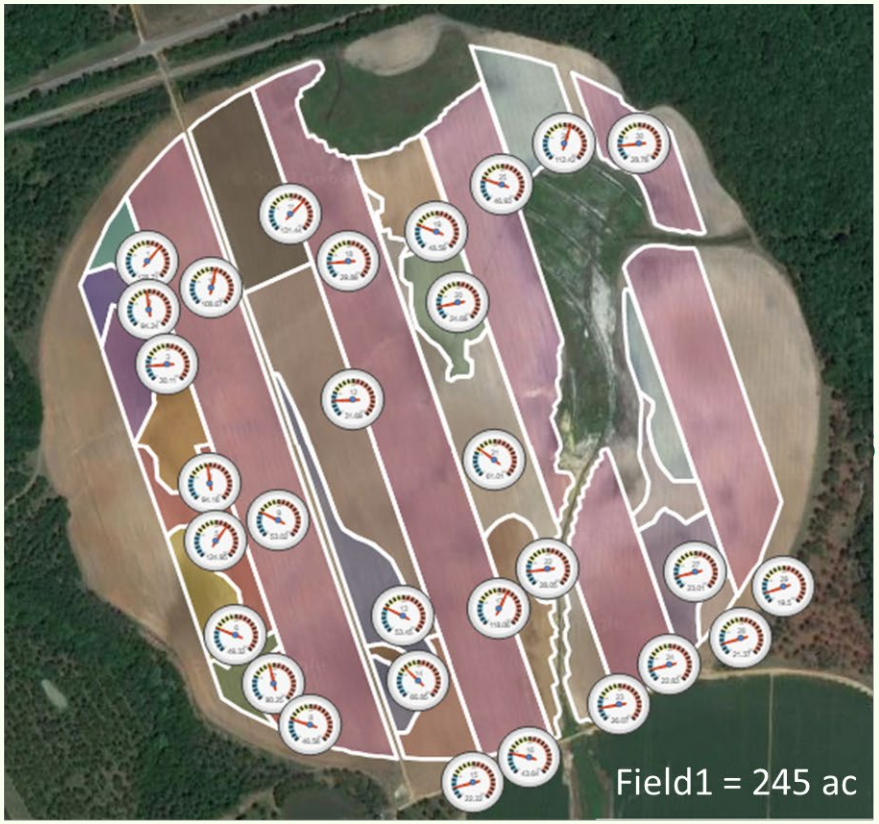
VRI system is upgraded to be capable of remote upload of maps.

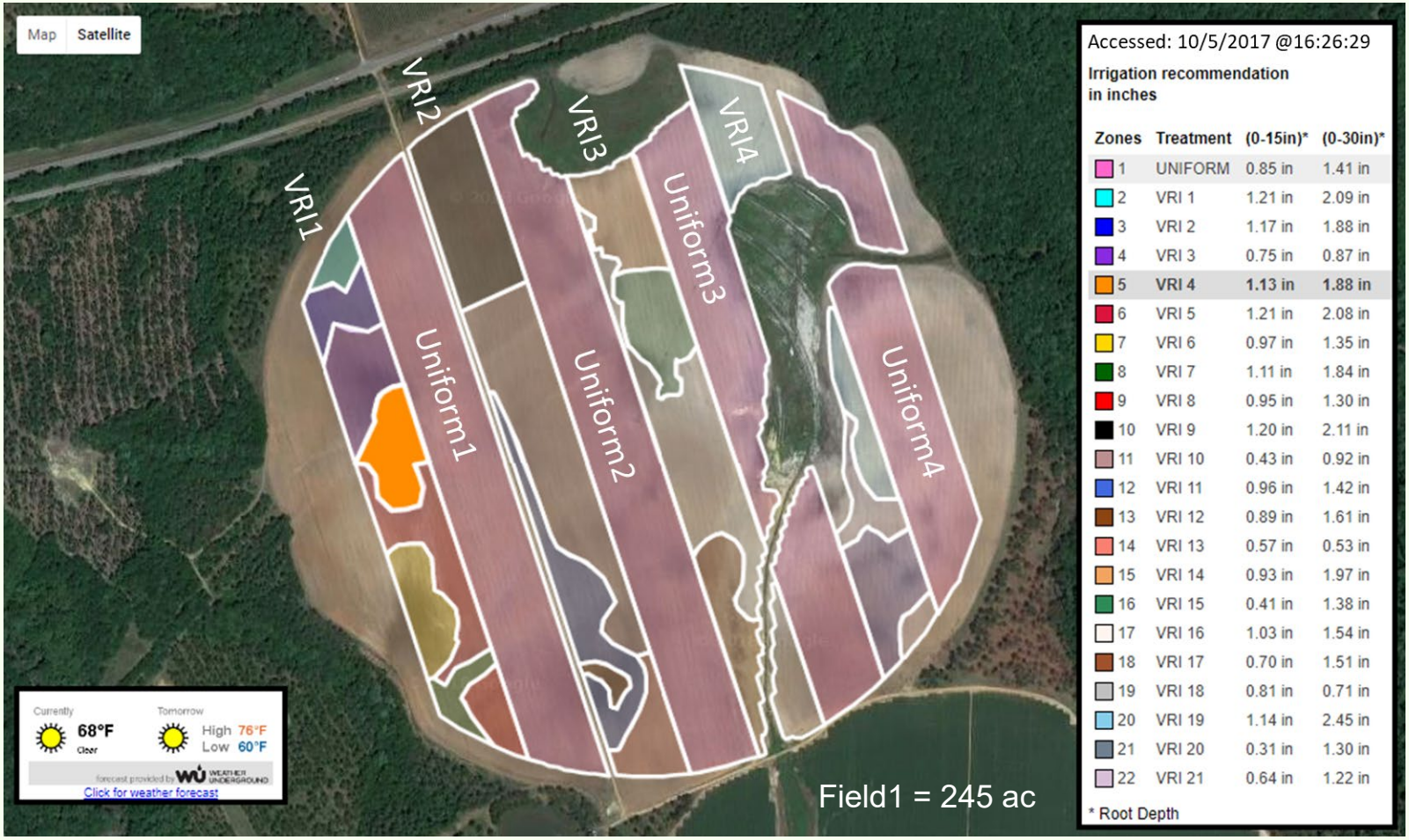
IRRIGATOR PRO

Scheduling

Irrigator Pro is used to determine the timing of irrigation.

2017 Demonstration





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Irrigation recommendation in inches

Zones	Treatment	(0-15in)*	(0-30in)*
1	UNIFORM	0.85 in	1.41 in
2	VRI 1	1.21 in	2.09 in
3	VRI 2	1.17 in	1.88 in
4	VRI 3	0.75 in	0.87 in
5	**VRI 4**	**1.13 in**	**1.88 in**
6	VRI 5	1.21 in	2.08 in
7	VRI 6	0.97 in	1.35 in
8	VRI 7	1.11 in	1.84 in
9	VRI 8	0.95 in	1.30 in
10	VRI 9	1.20 in	2.11 in
11	VRI 10	0.43 in	0.92 in
12	VRI 11	0.96 in	1.42 in
13	VRI 12	0.89 in	1.61 in
14	VRI 13	0.57 in	0.53 in
15	VRI 14	0.93 in	1.97 in
16	VRI 15	0.41 in	1.38 in
17	VRI 16	1.03 in	1.54 in
18	VRI 17	0.70 in	1.51 in
19	VRI 18	0.81 in	0.71 in
20	VRI 19	1.14 in	2.45 in
21	VRI 20	0.31 in	1.30 in
22	VRI 21	0.64 in	1.22 in

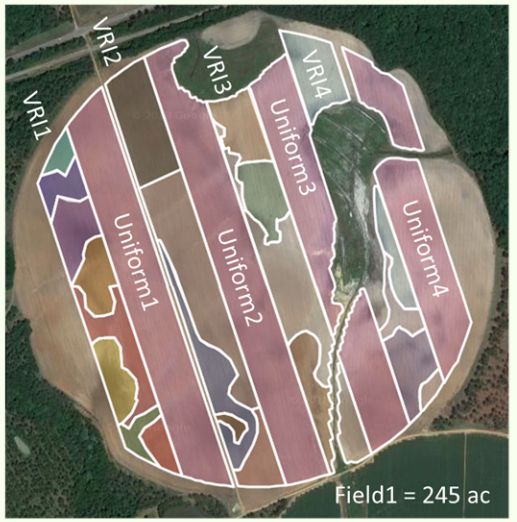
* Root Depth

Results – Field 1

Field	Treatment	Yield (lbs)	Area (ac)	Yield (lbs/ac)	Avg Irrig (in)	IWUE (lb/ac-in)	% Diff Yield	% Diff IWUE
1	VRI 1	52,093	13.6	3830	3.0	1280	-29.9%	12.5%
1	UNIFORM 1	90,948	16.7	5462	4.8	1138		
1	VRI 2	106,525	17.5	6077	3.3	1870	12.8%	66.6%
1	UNIFORM 2	93,046	17.3	5388	4.8	1122		
1	VRI 3	88,251	13.5	6518	4.1	1582	29.3%	50.6%
1	UNIFORM 3	67,060	13.3	5042	4.8	1050		
1	VRI 4	49,744	11.0	4526	4.0	1139	4.8%	26.5%
1	UNIFORM 4	54,040	12.5	4320	4.8	900		
		601,708	115	5215				

Field	Treatment	Yield (lbs)	Area (ac)	Yield (lbs/ac)	Avg Irrig (in)	IWUE (lb/ac-in)	% Diff Yield	% Diff IWUE
1	VRI	296,613	56	5329	3.6	1487	4.3%	39.7%
1	Uniform	305,095	60	5108	4.8	1064		
	Total/Avg	601,708	115	5215				

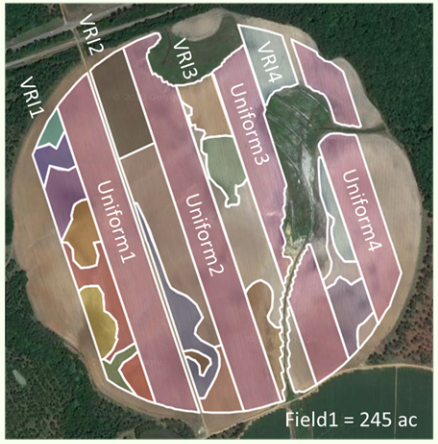
IWUE = Irrigation Water Use Efficiency (lb/ac-in)



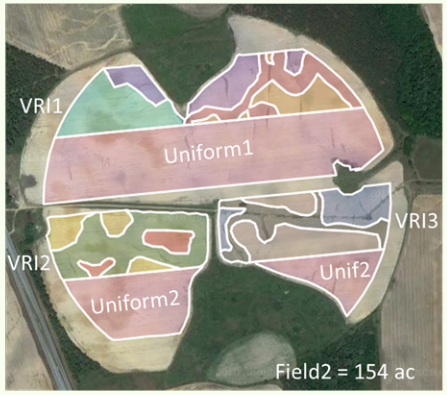
Calhoun County

Results – Field Comparison

Field	Treatment	Area (ac)	Yield (lbs/ac)	Avg Irrig (in)	IWUE (lb/ac-in)	% Diff Yield	% Diff IWUE
1	VRI	56	5329	3.6	1487	4.3%	39.7%
1	Uniform	60	5108	4.8	1064		
2	VRI	56	5182	1.9	2690	2.0%	16.4%
2	Uniform	51	5082	2.2	2310		



Calhoun County

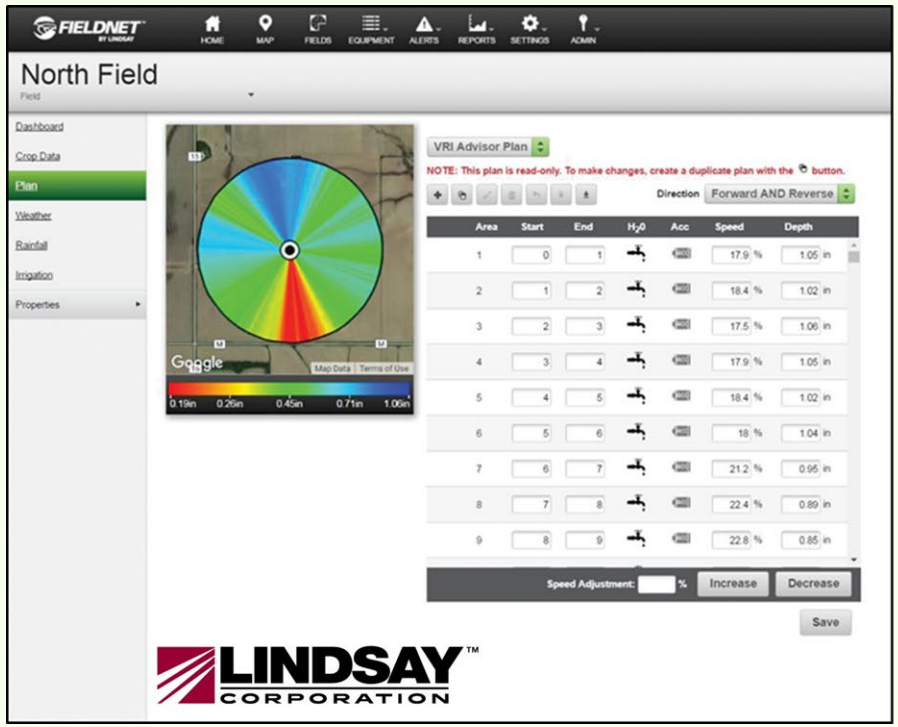


Miller County

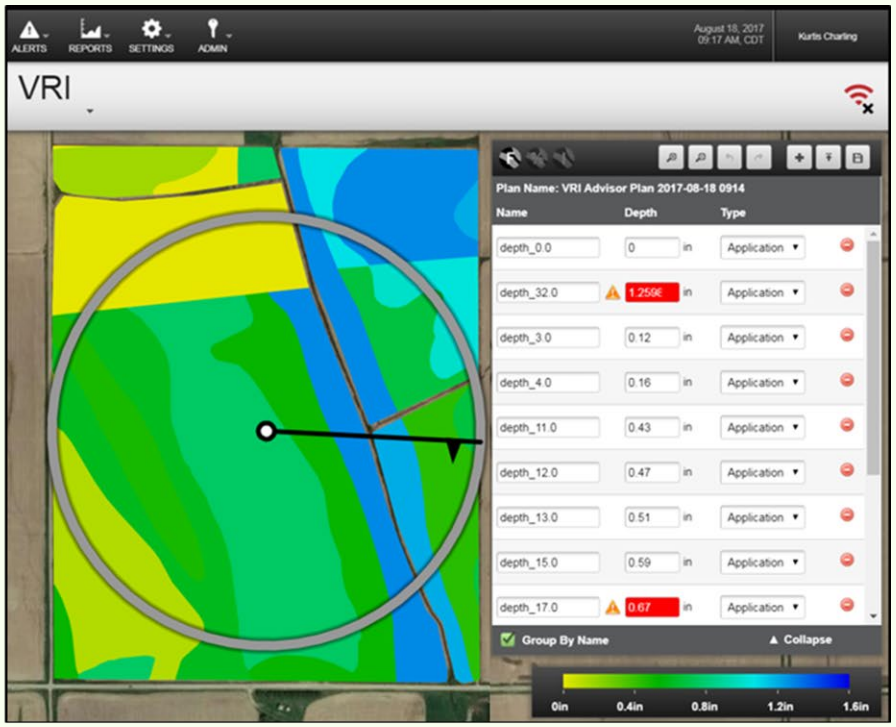
Proven Science & Research x Big Data x Cloud Computing

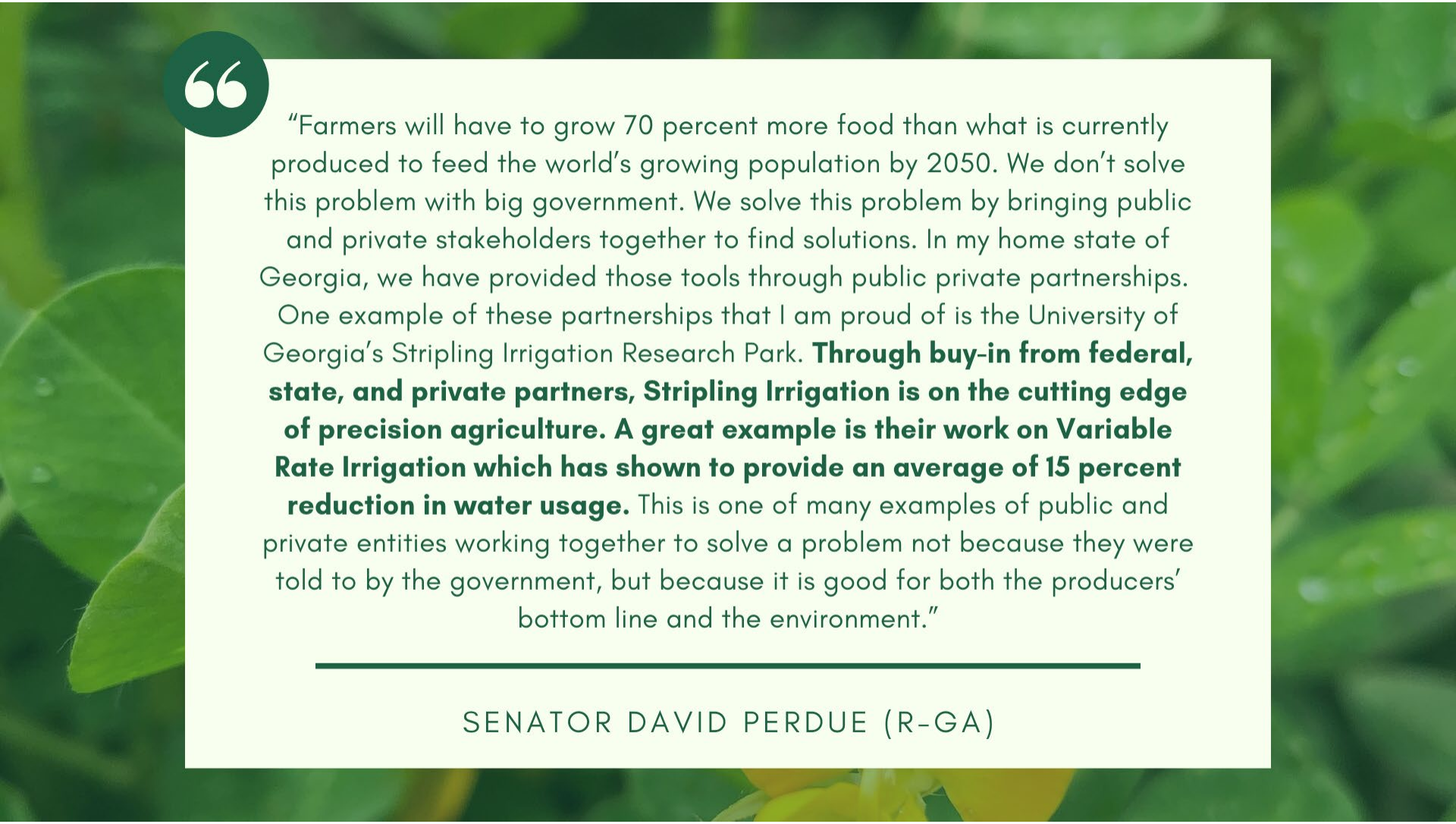
Fully integrated, continuously optimized VRI prescriptions

Sectional VRI (speed based)



Full Precision VRI (individual sprinkler control)





"Farmers will have to grow 70 percent more food than what is currently produced to feed the world's growing population by 2050. We don't solve this problem with big government. We solve this problem by bringing public and private stakeholders together to find solutions. In my home state of Georgia, we have provided those tools through public private partnerships. One example of these partnerships that I am proud of is the University of Georgia's Stripling Irrigation Research Park. **Through buy-in from federal, state, and private partners, Stripling Irrigation is on the cutting edge of precision agriculture. A great example is their work on Variable Rate Irrigation which has shown to provide an average of 15 percent reduction in water usage.** This is one of many examples of public and private entities working together to solve a problem not because they were told to by the government, but because it is good for both the producers' bottom line and the environment."

SENATOR DAVID PERDUE (R-GA)

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CIG Questions and Answers