

National Center for Alluvial Aquifer Research



NCAAR

NATIONAL CENTER FOR ALLUVIAL AQUIFER RESEARCH



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Extension Irrigation Specialist
Delta Research and Extension Center



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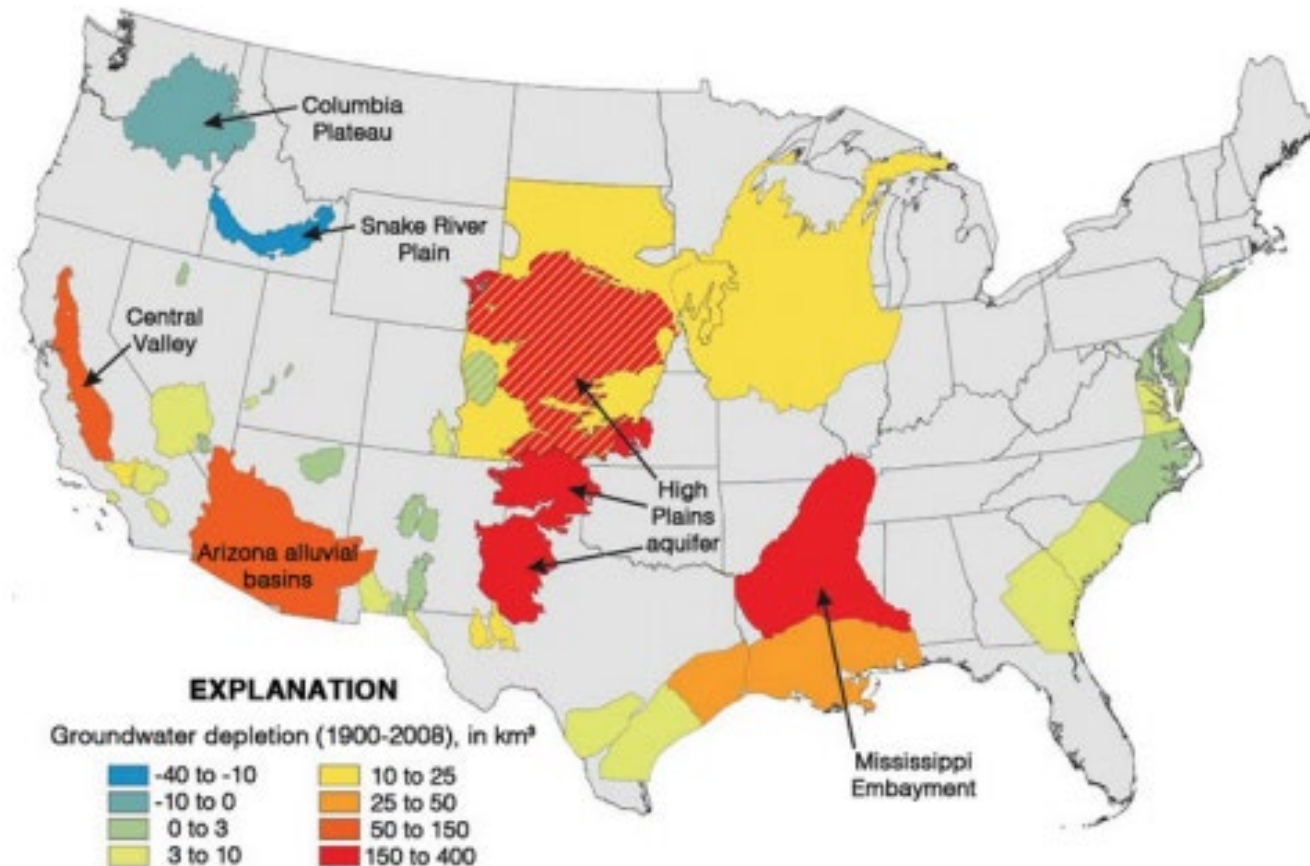
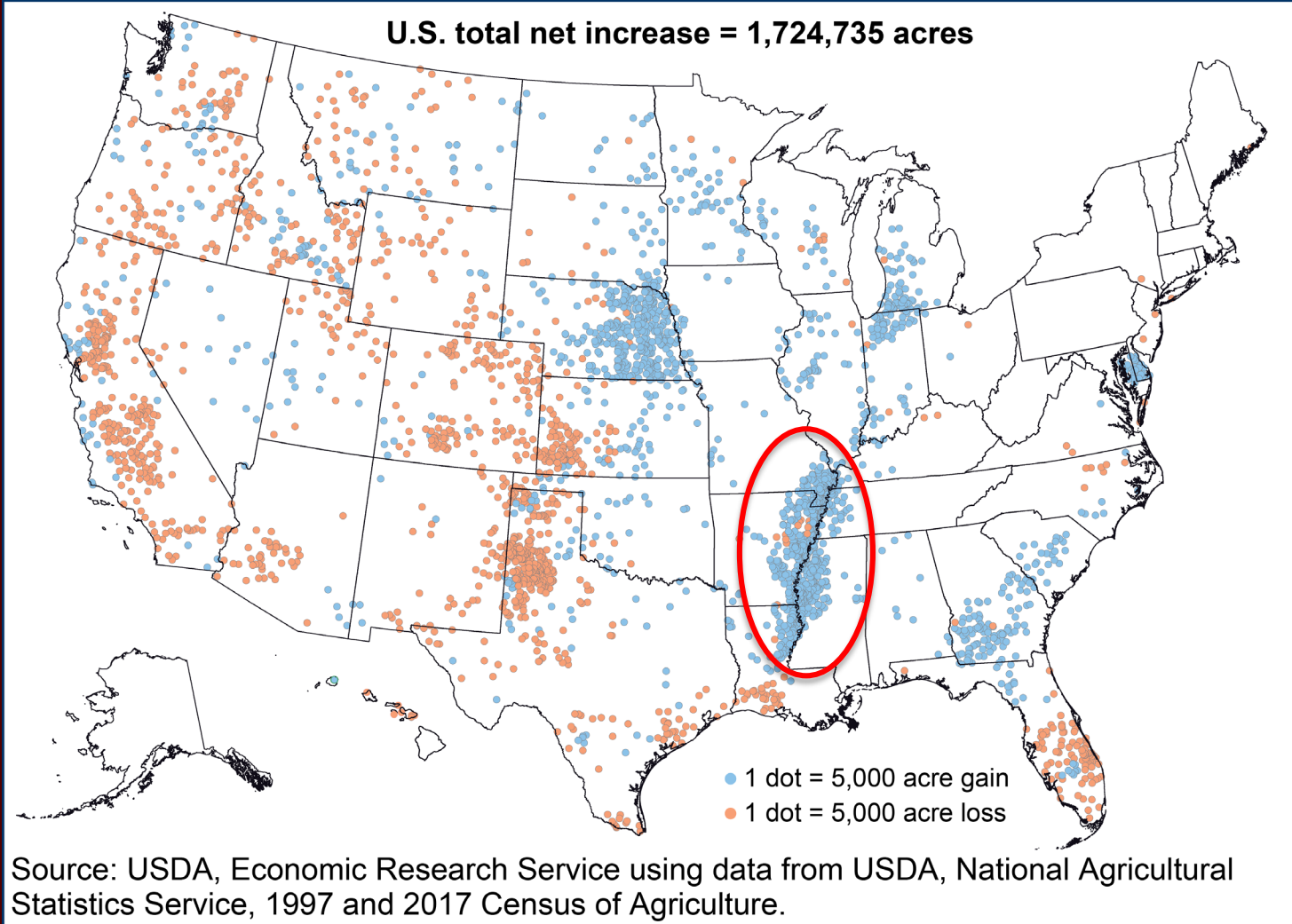


Figure 4. Cumulative long-term volumetric groundwater depletion in the United States during 1900–2008 in km³ (modified from Konikow [2013]). Hatched areas are where a shallow aquifer overlies a deeper aquifer.



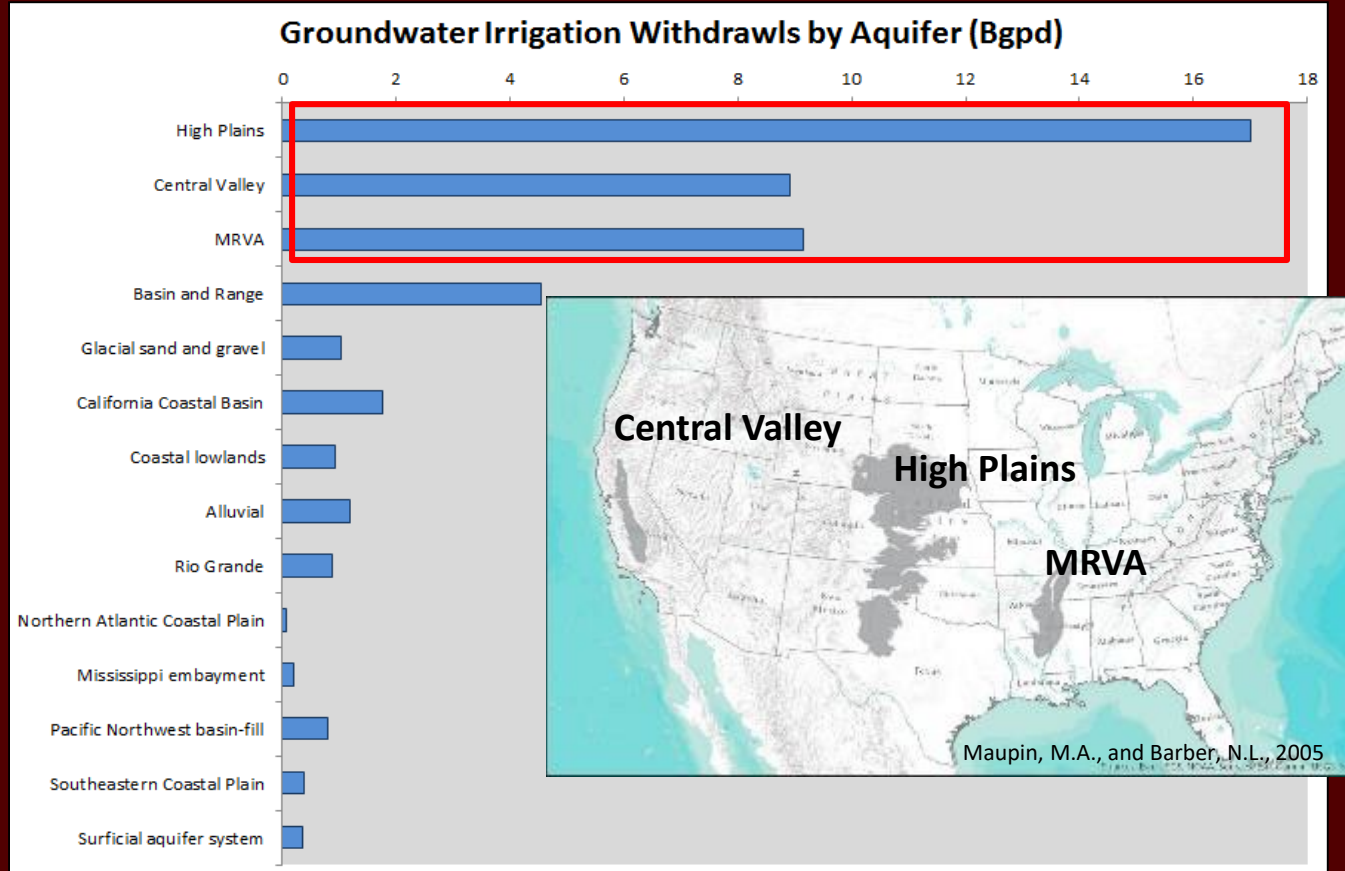
Change in U.S. acres of irrigated agricultural land by county, 1997-2017



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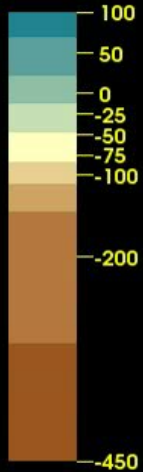
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The Lower Mississippi River Basin is one of the most productive and intensively irrigated agricultural regions in the nation



Modeling MRVAA Decline

Water level change from predevelopment, in feet



USGS
science for a changing world



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About the National Center for Alluvial Aquifer Research – NCAAR

Cooperative program between USDA's Agricultural Research Service (ARS) and Mississippi State University's Delta Research and Extension Center (DREC) to produce and communicate research aimed at:

- Conservation and sustainability of water resources for agriculture
- Development of management systems that increase profitability, conserve water and protect water quality



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Multi-Disciplinary Team



- Soil Scientist
- Plant Physiologist
- Hydrologist
- Physical Scientist
- Hydrologist/Engineer
- Ag Technology Engineer
- Agricultural Engineer
- Research Leader
- Irrigation Engineer
- Natural Resource Economist
- Extension Irrigation Specialist
- Research Agronomist
- Hydrologist/hydrogeologist



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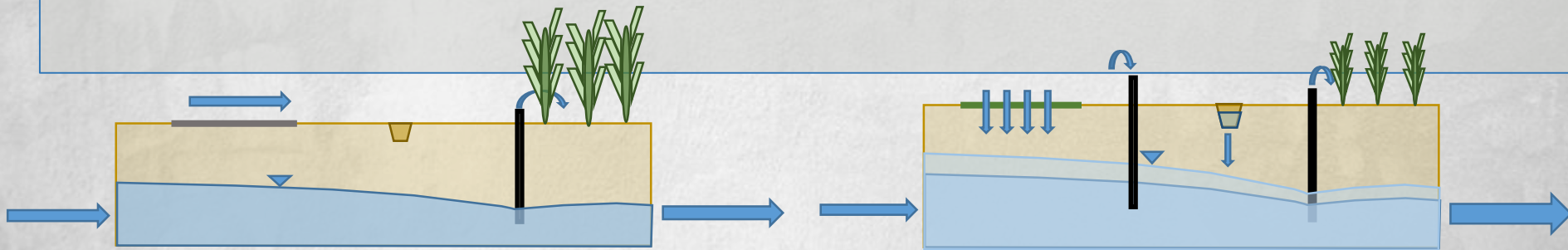
Mitigating Groundwater Depletion

Technological Approaches focus on bringing inflows and outflows into balance.

They can also include methods to decrease the amount of water pumped from an aquifer through the use of:

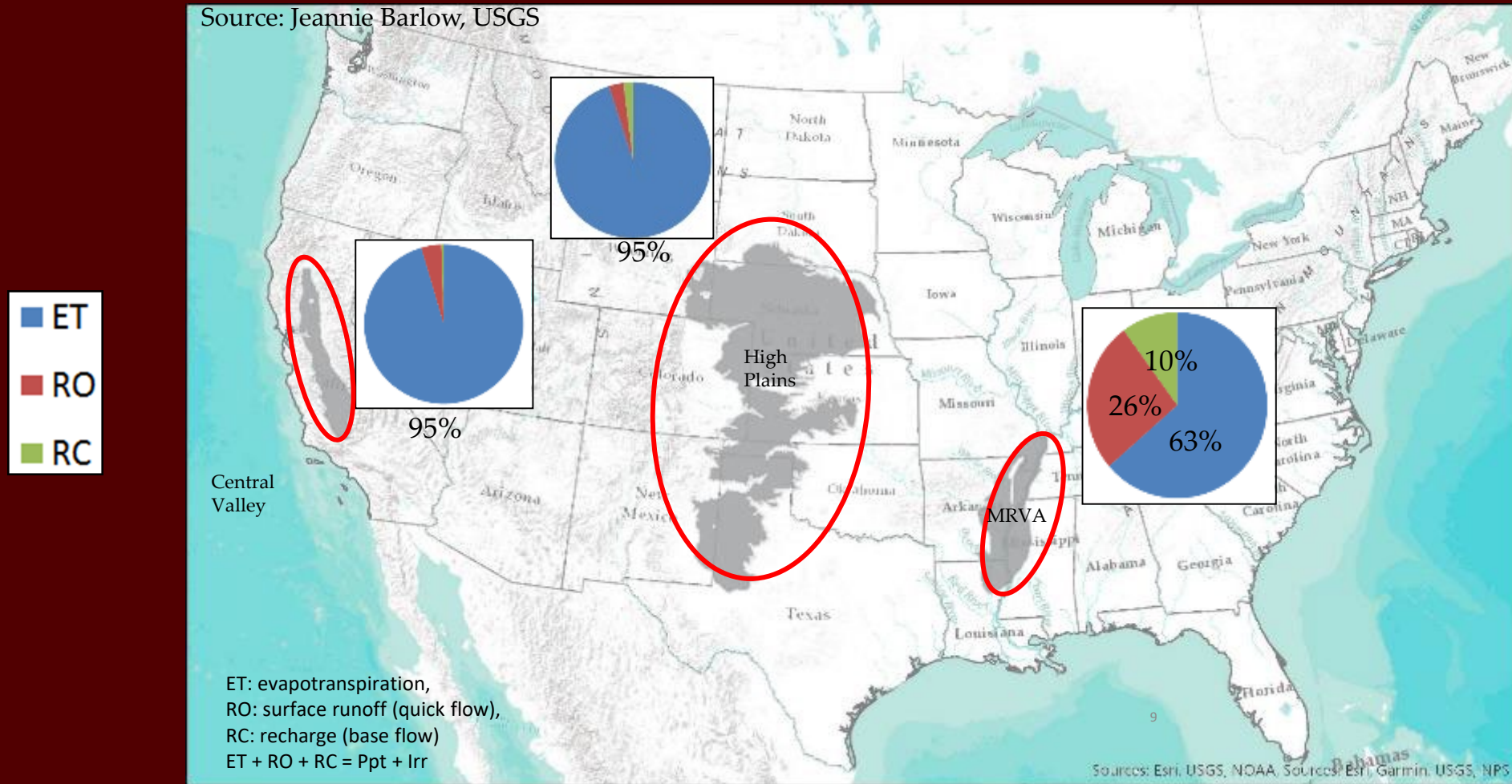
- Irrigation efficiency
- Instream weirs to increase surface-water availability
- Tailwater recovery and onsite farm storage

This can include attempts to increase the recharge to an aquifer, often referred to as Managed Aquifer Recharge (MAR), e.g. ASR, PR, and use of Green Space



Water Budgets of the 3 most used aquifers, all for irrigation

Source: Jeannie Barlow, USGS



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NCAAR CRIS Objectives

Objective 1: Determine the impact of alternate water supplies on aquifer recharge and groundwater levels in the LMRB.



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NCAAR CRIS Objectives

Objective 2: Develop optimized irrigation scheduling tools and recommendations.



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NCAAR CRIS Objectives

- Objective 3: Develop new and novel sensor systems.



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NCAAR CRIS Objectives

- Objective 4: Evaluate and improve current BMPs and the implementation of conservation practices including cover crops, tillage methods, edge-of-field buffers, surface water storage/use, and soil health.



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NCAAR CRIS Objectives

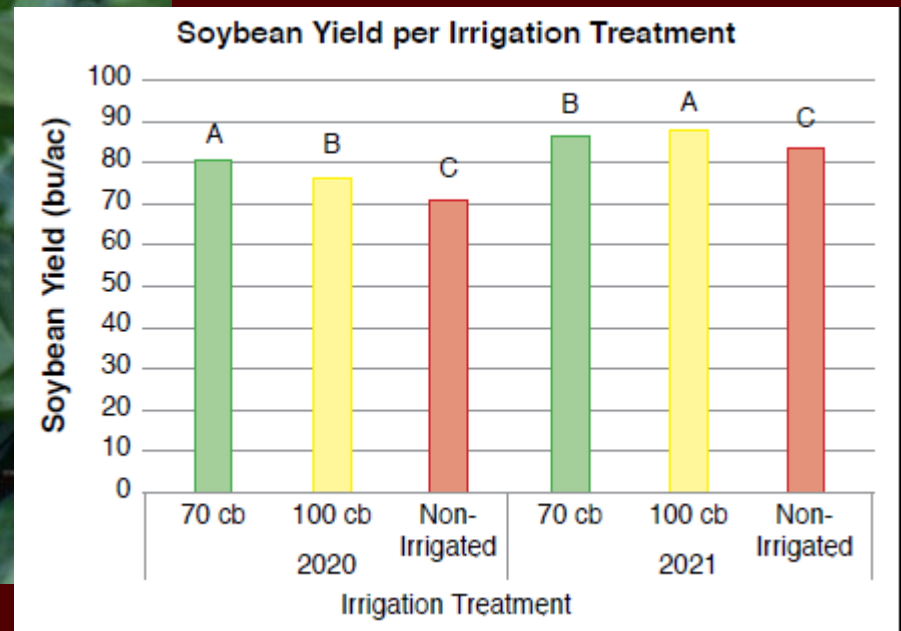
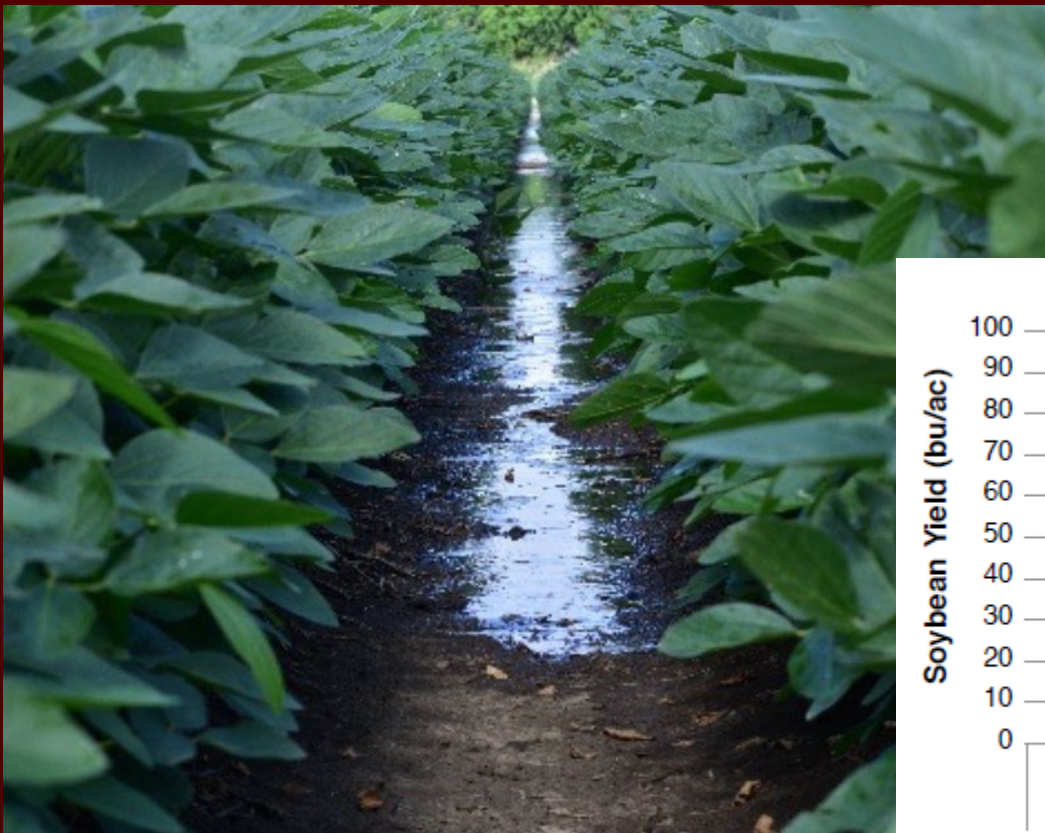
- Objective 5: Engage LMRB stakeholders to characterize producer behavior, adoption, and attitudes.



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Recommendations for Sensor Based Soybean Irrigation



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Field 6 at DREC



Vargas (2021)



Sensor-Based Irrigation Scheduling and Cover Crop Impacts on Corn Production



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Establishing the Water Budget of a Tailwater Recovery System



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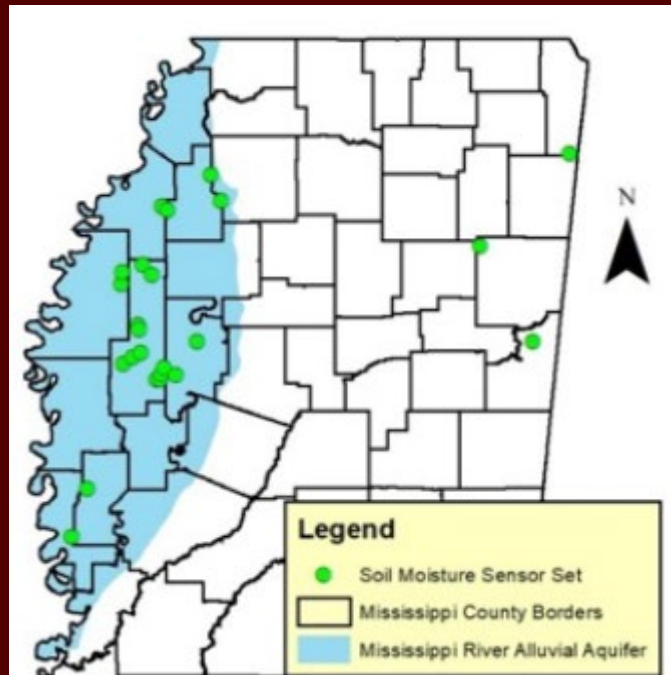
Soil Management Effects on Furrow Infiltration



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Advancing Adoption of Soil Moisture Sensors Through On-Farm Training and Demonstration



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Advancing Adoption

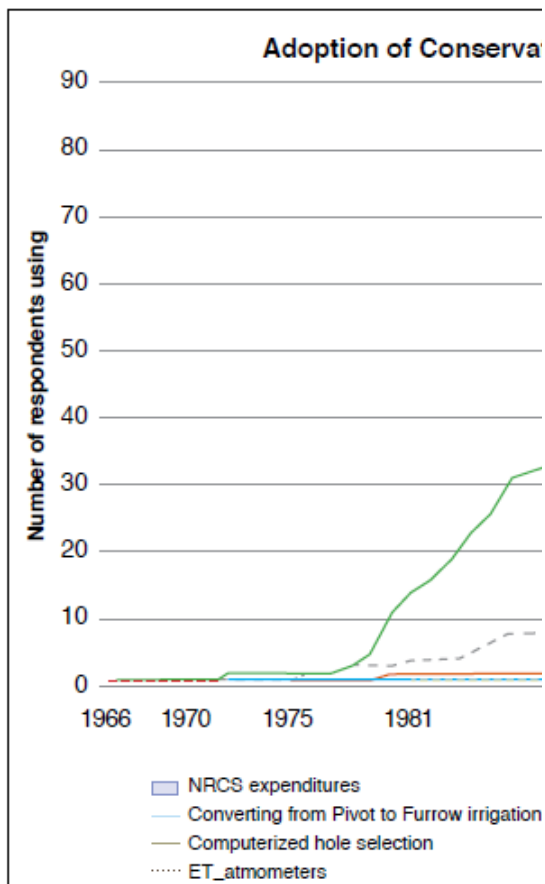


Figure 1. Farmer adoption curves for different conservation practices in Mississippi contrasted with NRCS incentive.

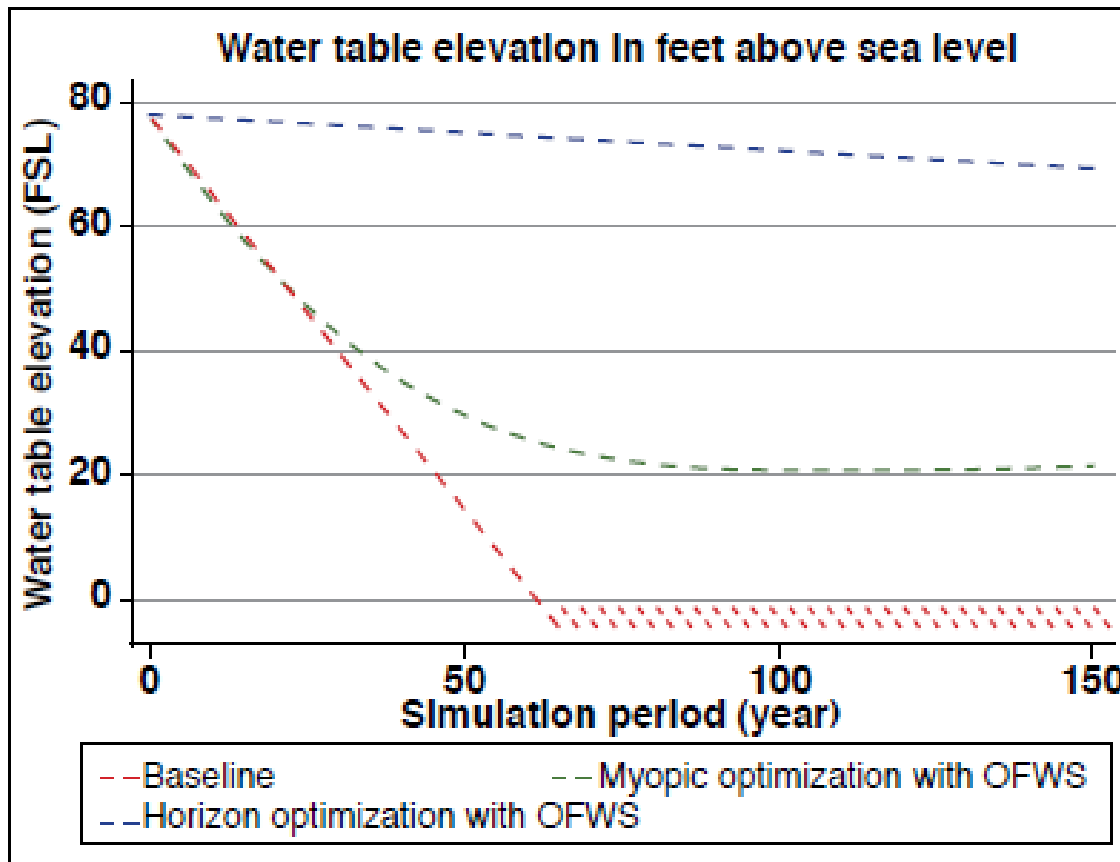


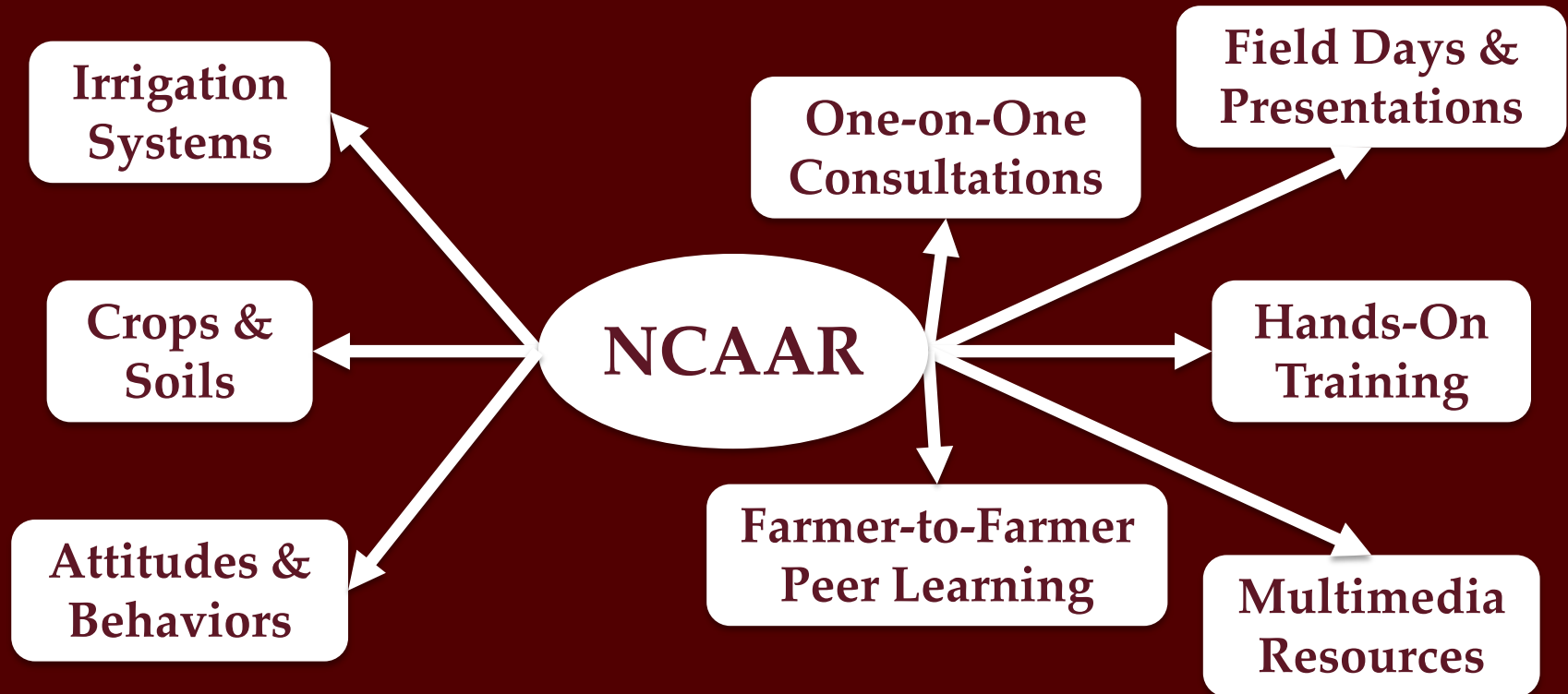
Figure 2. Simulated evolution of alluvial aquifer water table elevation under alternative water use scenarios.



Ongoing Educational Efforts

Topics

Methods





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FORESTRY EXPERIMENT STATION



Agricultural Research Service
U.S. DEPARTMENT OF AGRICULTURE

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Watermark Fundamentals & Application

1. Scientific Background
2. Measurement Devices
3. Sensor Construction
4. Sensor Location
5. Sensor Installation
6. Irrigation Triggers

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IRROMETER WATERMARK SERIES: Irrigation Triggers

This publication series provide a granular matrix sensor common other types of soil moisture sen

Introduction
 An irrigation trigger is the point at starts. Starting too wet wastes water too dry reduces yield. In this publi how to select an appropriate trigg and how to schedule irrigation us

Interpreting Watermark D
 Watermark data can serve as a gau tank" of the crop. Figure 1 illustra weighted average centibars (cb) w Centibars are low when wet and hi

IRROMETER WATERMARK SERIES: Construction Guide

This publication series provides informati a granular matrix sensor commonly used i other types of soil moisture sensors. Users s

Introduction
 This publication provides a step-by-step guide Watermark sensor construction. Following th the sensors easier to install at the intended dep remove at the end of the season.

Preparation
 The tools and supplies pictured below will be i sensor wires is usually convenient.

IRROMETER WATERMARK SERIES: Location Selection

This publication series provides information and recommendations pertaining to the Irrometer Watermark 2005S, a granular matrix sensor commonly used in Mississippi for scheduling irrigation. Future publications will discuss other types of soil moisture sensors. Users should choose tools that best fit their needs.

Introduction
 Where sensors are installed affects the likelihood that the readings are suitable for irrigation scheduling. This publication provides a step-by-step guide to selecting an appropriate sensor location for a field.

Representative Area
 The first step is choosing a representative area within the field. Such an area can be identified based on past experience and observations, along with soil, yield, and aerial maps. The table below suggests criteria for consideration and the associated reasons.

Recommendation	Reason
Place sensors in an area with the major soil type, typical terrain, and average yield.	Avoid measuring irrigation decisions based on abnormal areas.
Place sensors 1/3 to 1/2 of the way down the furrow.	Avoid over-irrigated areas near the crown and the tail end of the field.
Place sensors at least two (2) rows inward from the field edge.	Avoid edge effects (e.g., tree lines, pesticide drift).

Ideal Crop Rows
 The second step is choosing a crop row that is least disturbed by field operations. Installing in a swing row minimizes the risk of sensor damage by tractors and implements. Also, wheel traffic produces compacted, "hard" furrows, which infiltrate less water than uncompacted, "soft" furrows.

For example, if a field is typically farmed using a tractor with dual rear wheels and 8-row implements, the ideal crop rows for sensor installation would be the first and last rows of each 8-row pass.

One set of 6-inch, 12-inch, 24-inch, and 36-inch

<https://www.ncaar.msstate.edu/outreach>

Calculate

Results

Cost	\$/Acre	Total
Pumping	\$8.04	\$1045.20
Labor	\$0.38	\$49.85
Capital	\$1.20	\$156.00
Total Irrigation Event	\$9.62	\$1251.05

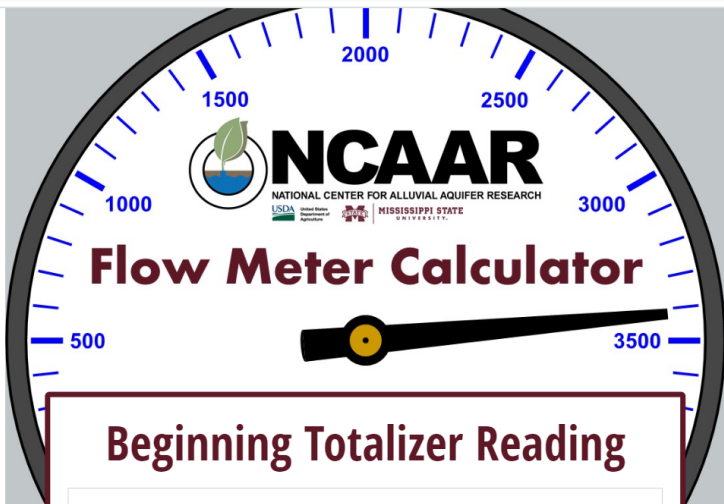
Compare the cost of another irrigation with the expected benefits of additional irrigation; you can expect to profitably irrigate if the next irrigation event will result in the following yield gains:

Commodity	Yield
Corn	1.92 bu/acre
Cotton	9.62 lbs/acre
Soybean	1.07 bu/acre



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Beginning Totalizer Reading

0

Ending Totalizer Reading

0

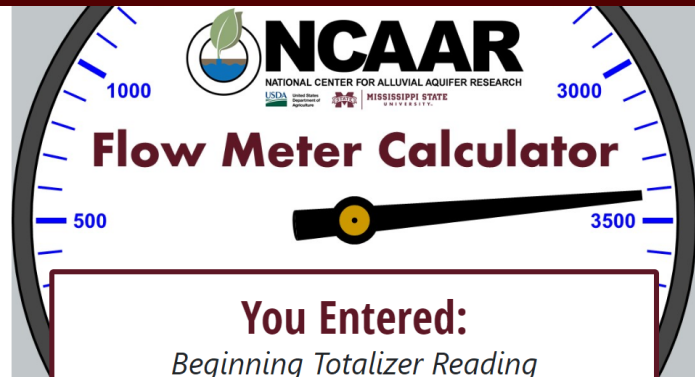
Totalizer Units

~choose units~ ▾

Acres Irrigated

0

Calculate!



You Entered:

Beginning Totalizer Reading

200 acre-inches

Ending Totalizer Reading

600 acre-inches

Area Irrigated

150 acres

You Irrigated:

Gross Water Volume

400 acre-inches

33.333 acre-feet

10861714 gallons

Gross Water Depth

2.67 inches

Reuse Inputs

Reset Inputs



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What is Mississippi Master Irrigator?

A 24-credit hour formal education course designed to educate producers on **water-related** topics which include but are not limited to:

- Agronomics
- Irrigation Scheduling
- Types of Irrigation Systems
- Economics
- Soil Health
- Policy and Management

How will the course be offered?

The course will be offered as a hybrid system which will include online video modules and in-person sessions.

- Video modules and in-person sessions will be conducted by individuals/entities with specialized experience in each of the listed topics. This includes personnel such as:

- **MSU Extension Specialists**
- **YMD**
- **USGS**
- **EPA**
- **Delta F.A.R.M**
- **Farm Bureau**
- **Delta Council**

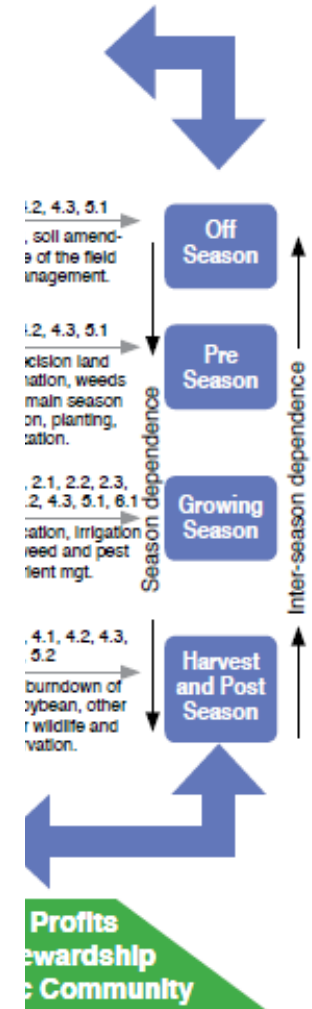
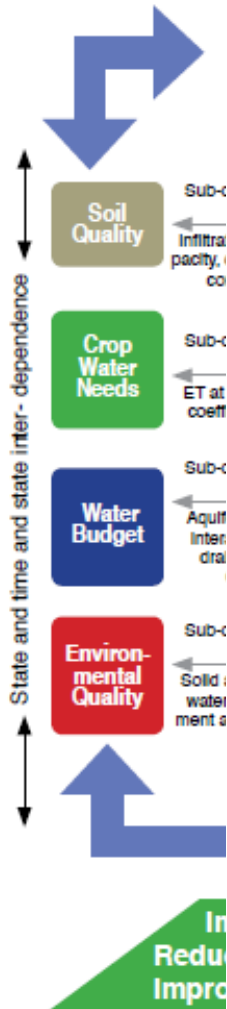


Anticipated Course Timeline:

Completion of videos	Nov. 2022
Completion of online video modules	Jan. 2023
Begin offering course	Mar. 2023
First in-person meeting	Nov. 2023
Second in-person meeting	Feb. 2023

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2021 ANNUAL REPORT



Thank You!



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