
What if?
Agricultural
Water Optimization
Task Force
June 9, 2023

What if we could optimize water and agricultural management practices to maintain or increase viable agriculture while minimizing negative impacts upon water supply, water quality and the environment?

Can we optimize ag water use and how?

# Task Force Members – Thank you!

- Ron Gibson – Producer – co-chair
- Jay Olsen – Department of Ag and Food – co-chair
- Mike Adams – Producer
- Dustin Christensen – Producer
- John Mackey – Division of Water Quality
- Paul Monroe – Water Conservancy Districts
- Jordan Nielson – Environmental Interests
- Jim Reese – Division of Water Rights
- Kyle Stephens – Div of Water Resources
- Ken White – Higher Education
- Brandon Yardly - Producer

# Task Force Members – Thank you!

- Ron Gibson – Producer – co-chair
- Jay Olsen – Department of Ag and Food – co-chair
- Mike Adams – Producer
- Dustin Christensen – Producer
- John Mackey – Division of Water Quality
- Paul Monroe – Water Conservancy Districts
- Jordan Nielson – Environmental Interests
- Jim Reese – Division of Water Rights
- Kyle Stephens – Div of Water Resources
- Ken White – Higher Education
- Brandon Yardly - Producer

Also….

- Paul Burnett
- Erica Gaddis
- James Greer
- And many alternates and participants!

# Legislature passed House Bill 381 in 2018 ($1.3M)
## Agricultural Water Optimization Task Force

1. The task force…shall:
   - A. Identify critical issues facing the state's long-term water supply, particularly in regard to how the state should optimize agricultural water supply and use in light of future population growth, and the future water needs of Utah agriculture;
   - B. Identify current obstacles to, and constraints upon, quantification of agricultural water use, and recommend means, methods, technologies, or other opportunities to improve the quantification of agricultural water use on a basin level; and
   - C. Identify means, methods, systems, or technologies with the potential to maintain or increase agricultural production while reducing the agriculture industry's water diversion and consumption.
2. The task force shall issue requests for proposals and award grants to study the issues identified in Subsection (1), prioritizing proposals and grants as necessary.

3. In identifying critical issues as described in Subsection (1), and prioritizing requests for proposals and grants as described in Subsection (2), the task force shall:
   - a. Identify, develop, and apply sound science and relevant research on optimizing agricultural water use;
   - b. Measure gains at the basin level;
   - c. Take into account the variety of agricultural products, opportunities to improve water use practices, and local needs;
   - d. Address and account for farm economics at the enterprise and community level
   - e. Work within existing agricultural markets or encourage market behavior that financially rewards improved practices;
   - f. Recognize established water rights;
   - g. Create meaningful benefits for farmers to optimize water use and protect water quality;
   - h. Monitor..projects, evaluate…efficacy, and disseminate research findings.

# Legislature passed House Bill 381 in 2018 ($1.3M)

## Agricultural Water Optimization Task Force

1. The
   A. in regard to how the state should optimize
   he future water needs of Utah agriculture;
   B. tural water use, and recommend means, methods,
   tural water use on a basin level; and
   C. ntain or increase agricultural production while
2. The ues i ion (1), prioritizing
   prop
3. In i sts for proposals an as described in
   Sub
   a. izing agricultural wat
   b.
   c. rove water
   d. Address and account for farm economics at the enterprise and community level
   e. Work within existing agricultural markets or encourage market behavior that financiall
   f. Recognize established water rights;
   g. Create meaningful benefits for farmers to optimize water use and protect water quality;
   h. Monitor..projects, evaluate…efficacy, and disseminate research findings.

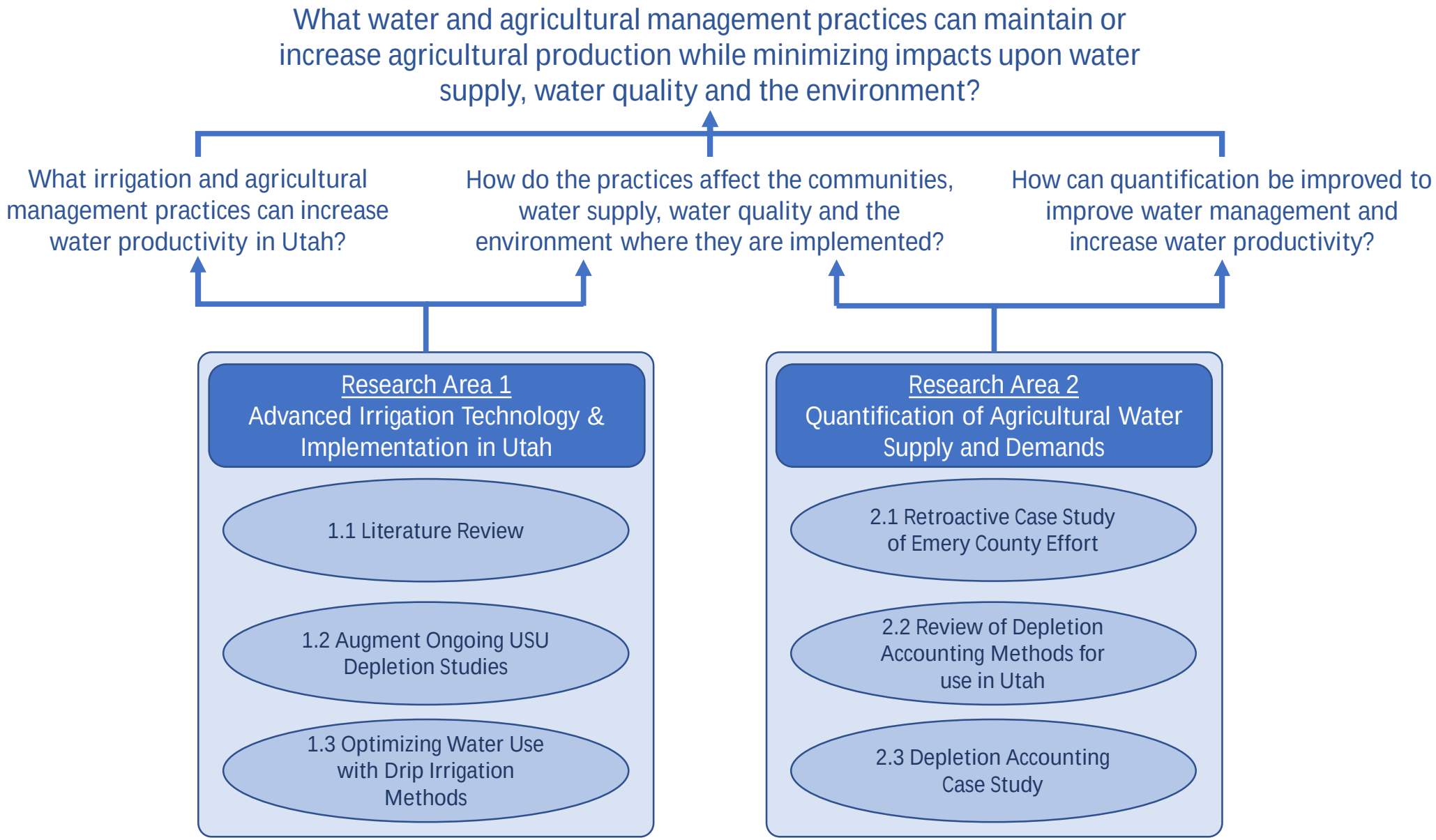
**Objective**

Identify and initiate research that identifies how the State can:

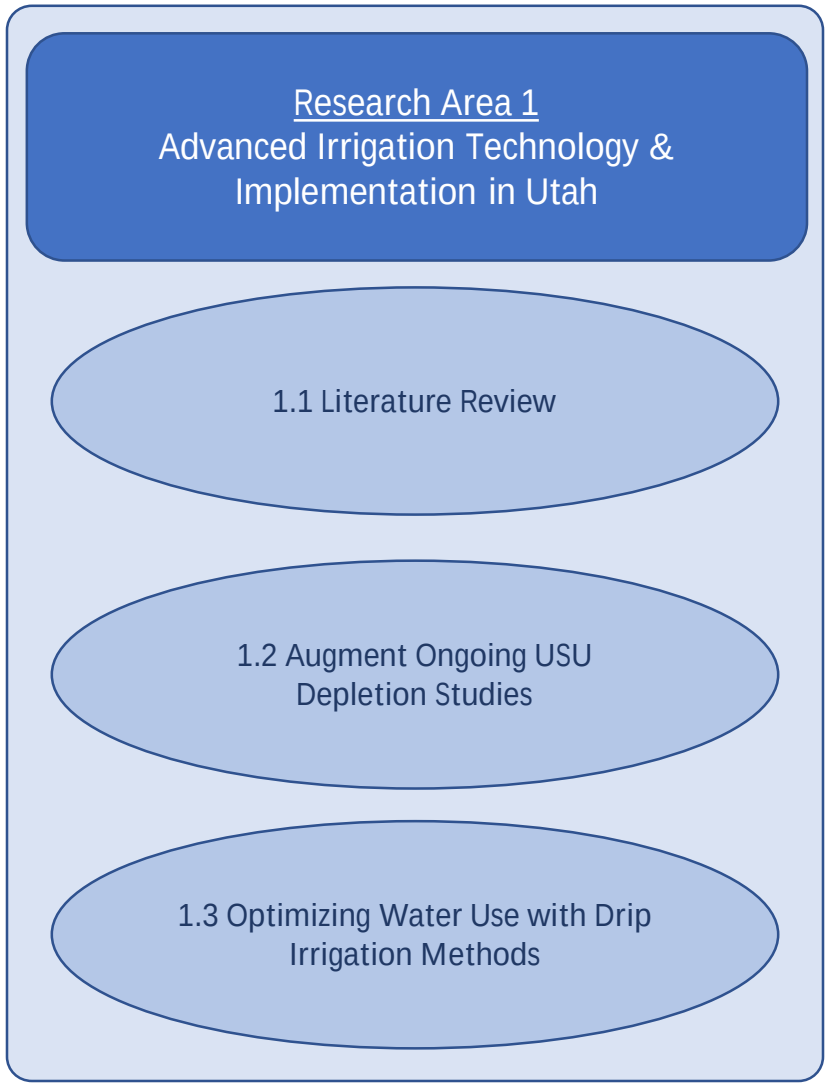
1. Optimize agricultural water supply and use
2. Improve quantification of agricultural water use

Assess the possibilities

# 2019 Research Plan



# Advanced Irrigation Technology & Implementation in Utah




1. Literature Review (UofU, UofWashington)
   - a systematic review of literature describing prevalent and promising advance irrigation application technologies and agricultural management practices that are applicable for use in Utah
2. Augment USU Depletion Studies
   - Which combinations of pivot irrigation and crop management practices result in optimized use of limited water supplies, reduced consumptive use, and the best yield and profit outcomes for producers?
3. Optimizing Water Use with Drip Irrigation
   - Mirror USU's ongoing "Optimizing Water Use with Advanced Irrigation and Crop Management" project but do so with the use of drip irrigation methods

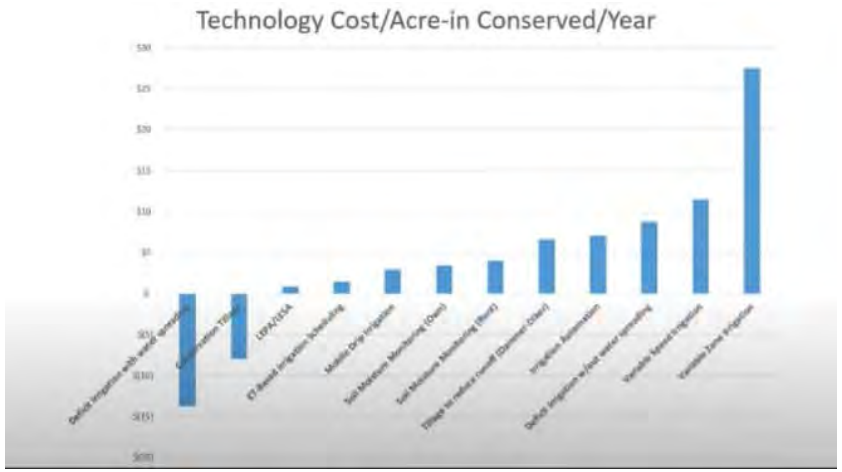

IMAGINE THE UNIVERSITY OF UTAH
CIVIL & ENVIRONMENTAL ENGINEERING
Literature Review of Current & Upcoming Irrigation Technologies and Practices Applicable to Utah
Rajendra Khanal
Troy Peters
Michael Barber
May 2020

# Literature Review

- Historic and Current Irrigation/Tillage Practices
- Upcoming Technologies
  1. Irrigation System Conversions
  2. Data-based Irrigation Scheduling
  3. Irrigation Automation
  4. Variable Rate Irrigation
  5. Low Elev Spray Application/Low Energy Precision Application for Center Pivots
  6. Mobile Drip Irrigation for Center Pivots
  7. Deficit Irrigation
  8. Tillage to Control Runoff
  9. Conservation Tillage (No-Till & Strip-Till)

1.Options

2.Costs




3.Calculator

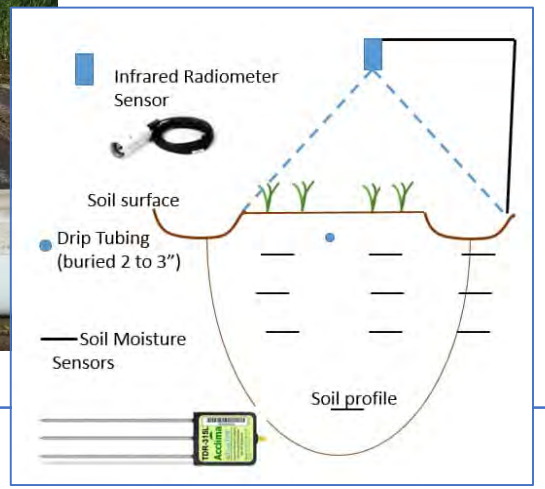
# USU 2019/2020 Depletion & Center Pivot Optimization Studies

Previous 2019 Field Studies

1. Process 2019 Remote Sensing and Field Data

2. Economic Analysis

3. Interim 2019 Report (June 2020)




Takeaways

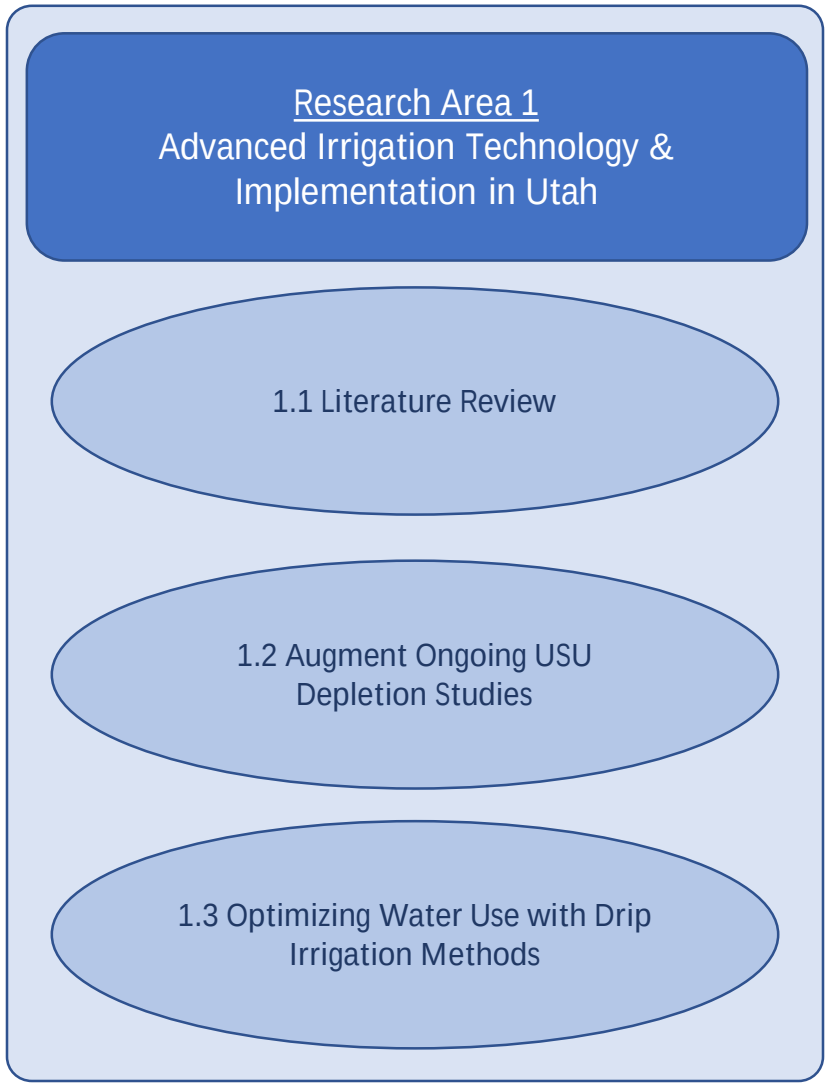
- Drip Irrigation
  - Less depletion
  - Less percolation
  - Less runoff
- Shows Promise

# USU 2019/2020 Depletion & Center Pivot Optimization Studies

- Is there benefit to combining water conservation practices?
- Multi-year study: 2019 – ongoing
- Study sites in Logan, Vernal and Cedar City

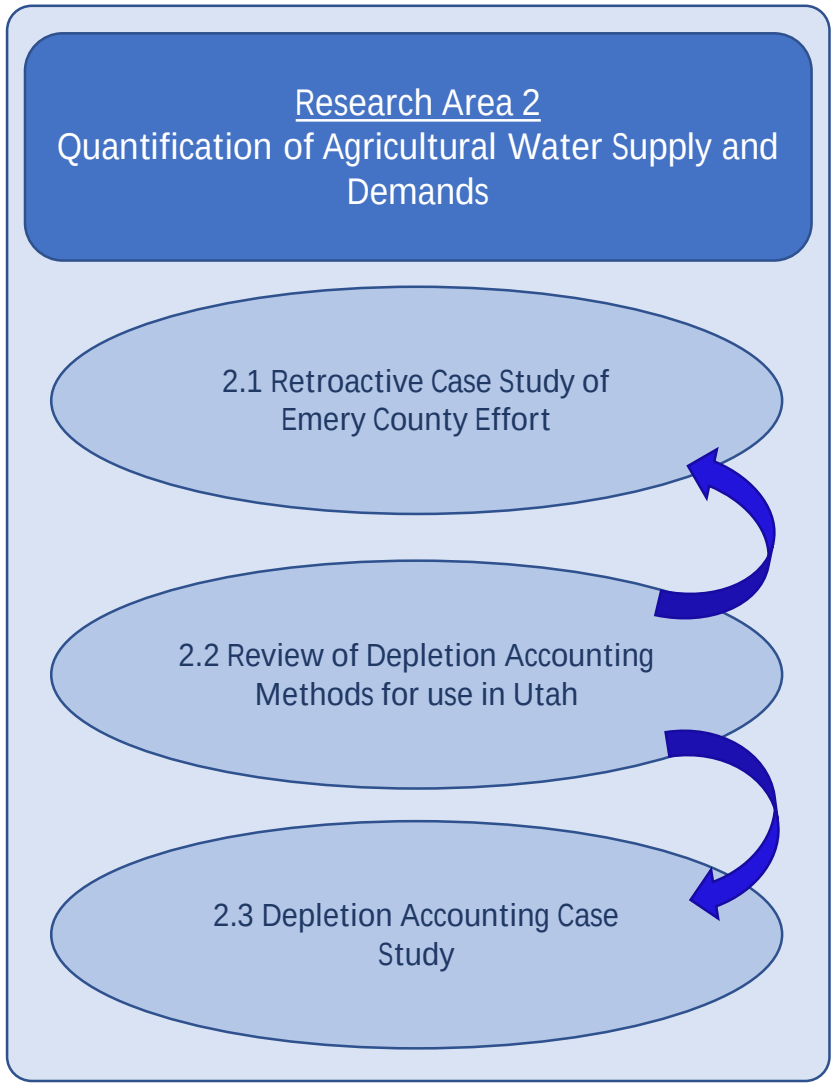
- Evaluating combinations of :
  - Advanced irrigation methods
  - Tillage
  - Different crops including different genetics
  - Cover crops
  - Deficit irrigation

# Advanced Irrigation Technology & Implementation in Utah



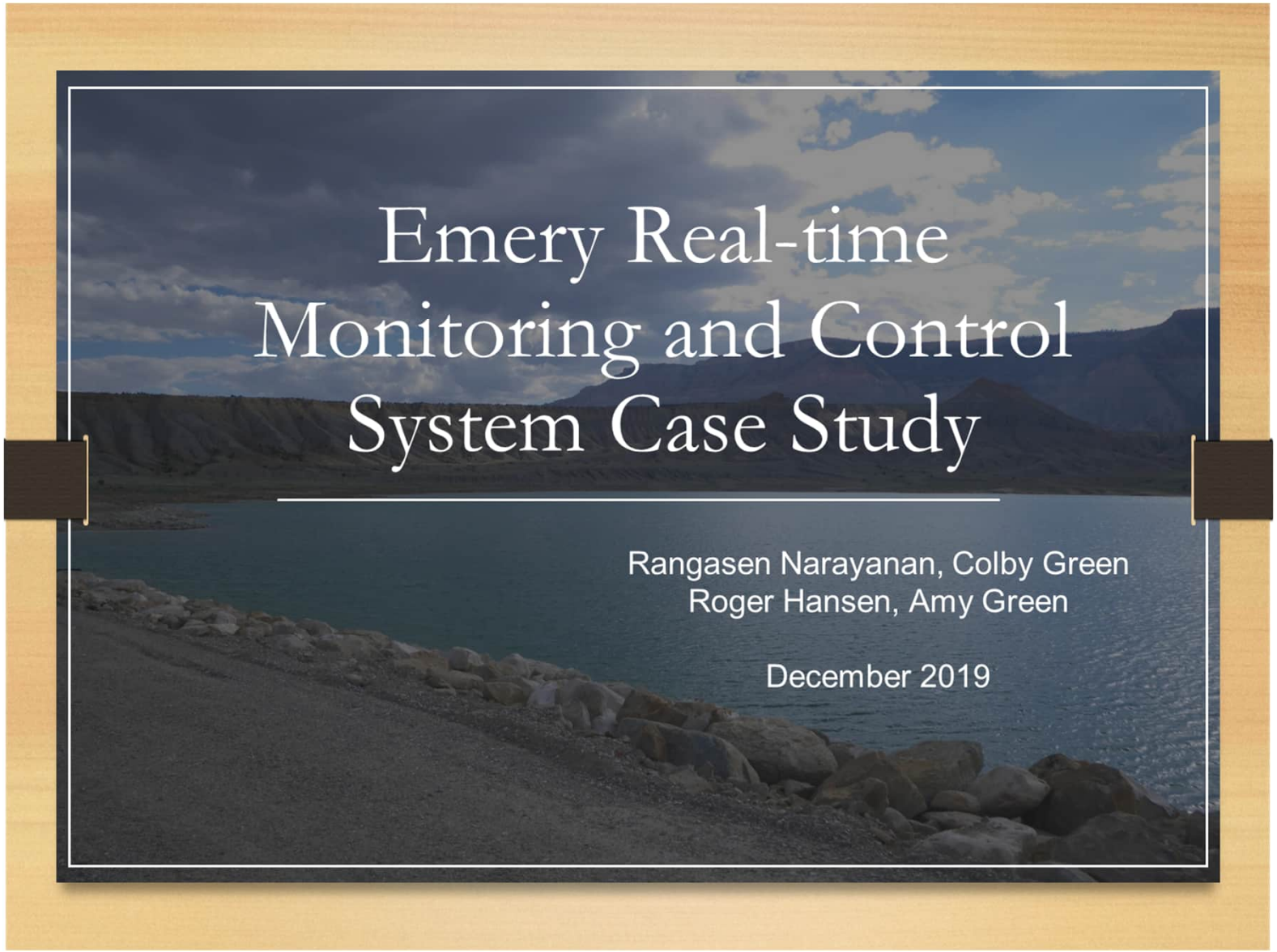

1. Literature Review
   - Proven technologies and methods for optimizing irrigation, cropping, and tillage already exist that can reduce water consumption and maintain agricultural production. These can be leveraged, improved and implemented in Utah.
2. Augment USU Depletion Studies
   - Field testing of different combinations of LEPA/LESA sprinkler systems, tillage, crops, cover crops, and deficit irrigation have proven the feasibility of reducing water consumption and maintaining agricultural production in Utah.
3. Optimizing Water Use with Drip Irrigation
   - Drip irrigation works, is less consumptive, requires less diversion, and maintains yield vs. surface irrigation.

# Quantification of Agricultural Water Supply and Demands

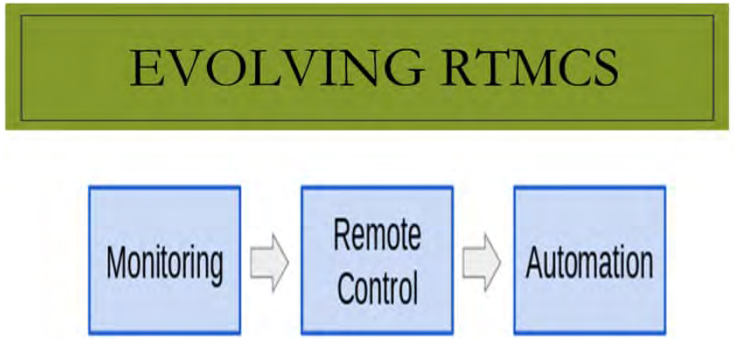



1. Retroactive Case Study of Emery County Effort
   - Understand the risks and benefits from and evaluate how water users in Emery County successfully improved quantification of available water supply and use to improve water management and increase water productivity

2. Depletion Accounting Methods
   - To investigate [and demonstrate in a future pilot program] possible methods the [DWRi] could implement to manage irrigation water rights by depletion rather than the historic method of Irrigation Diversion Duty and the number of acres irrigated."
   - Complete a pilot program


Emery Real-time
Monitoring and Control
System Case Study
Rangasen Narayanan, Colby Green
Roger Hansen, Amy Green
December 2019

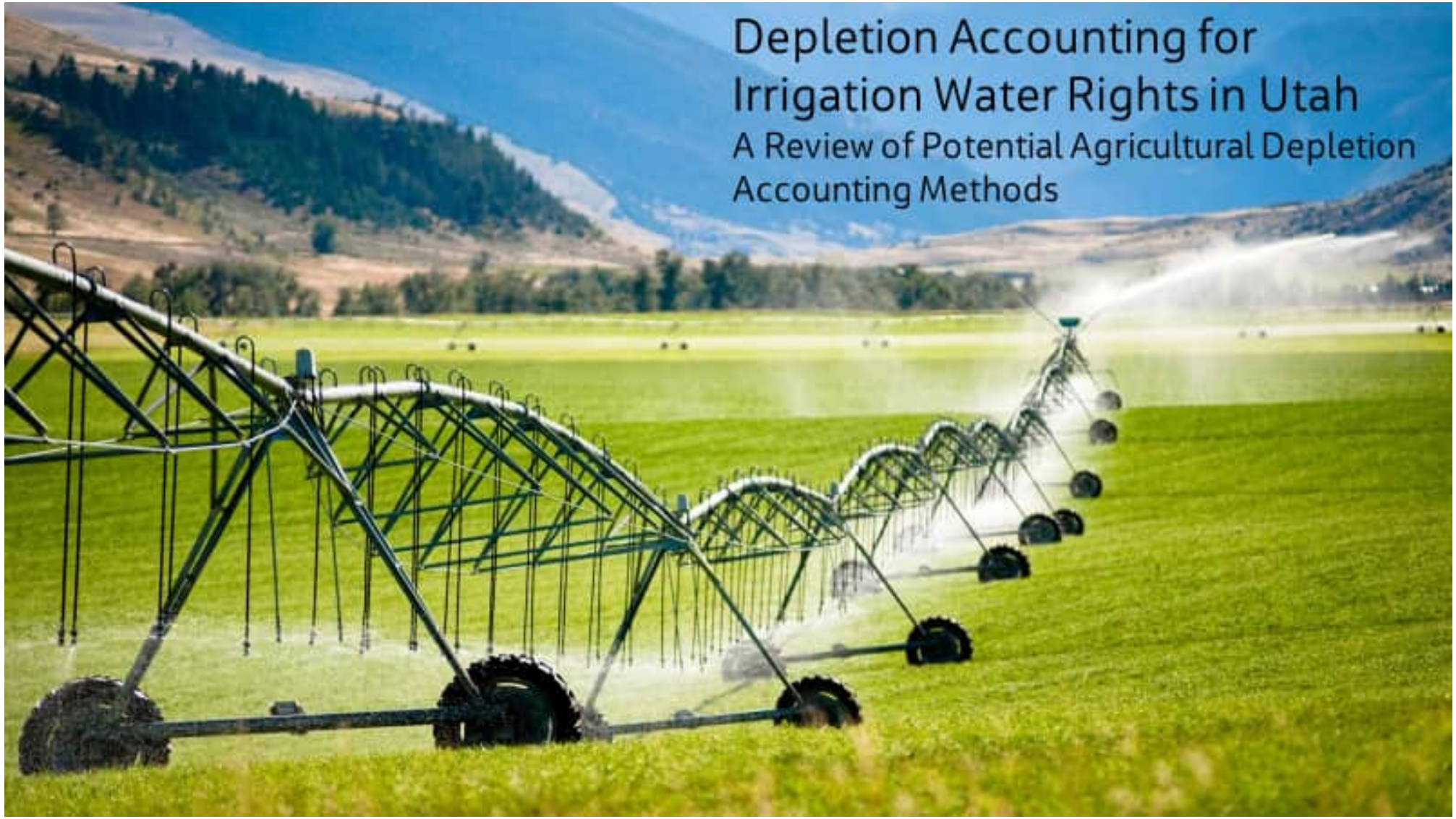
# Case Study




- Reviewed the history
- Identified lessons learned
- Evaluated benefits and costs
- Conclusions
  - Significant benefits to both water users and managers
    - Increased water conservation - reduced losses
    - Reduced diversions – yet, more water delivered at take-outs
    - Significant Return on Investment
    - Improved crop production (longer season)
    - Increased transparency – community benefit
    - Less fertilizer, herbicide, pesticide and salt loading – improved water quality
  - Merits statewide implementation
    - need $$, staff, training, link operational models to real-time data

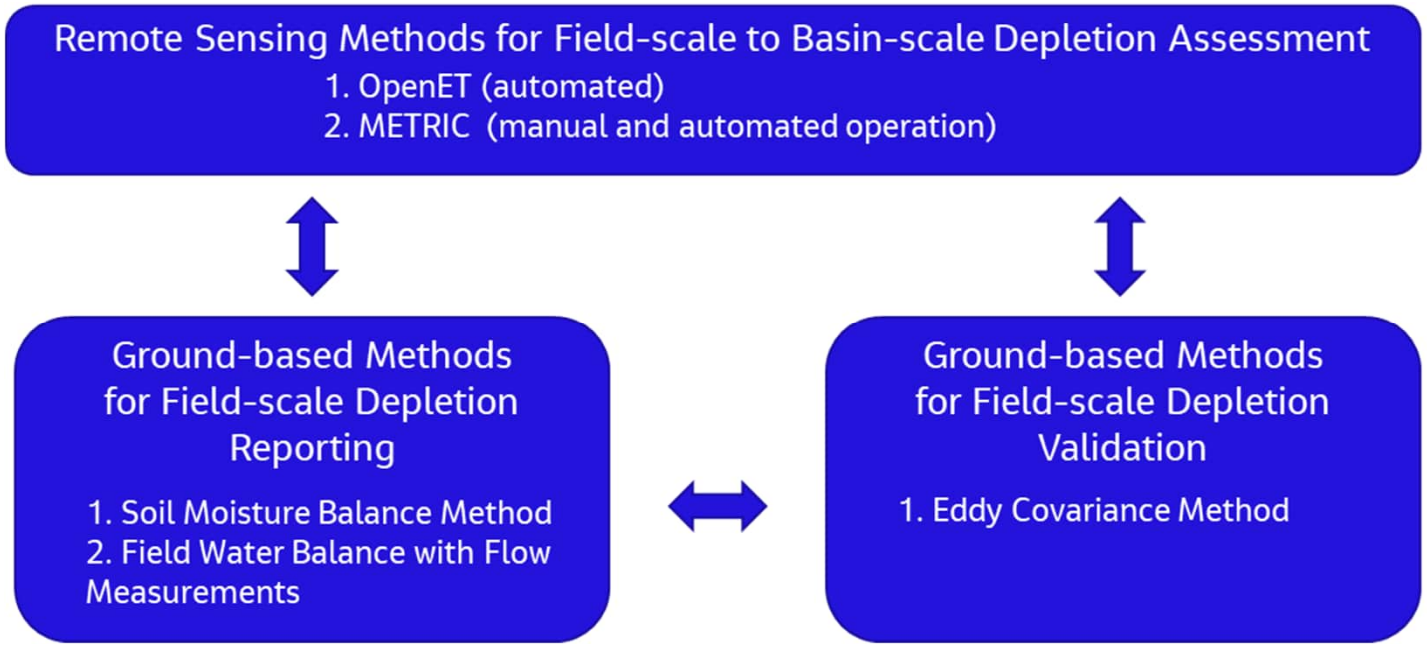
# Case Study

- “The other thing about this system is non-accountable water is very low. All the water is accounted for, and before it was being derived about 25% it was being lost.”
- “...to be able to demonstrate that it [the water] was fairly distributed and distributed in accordance with their shares on the water rights.”
- “I don't think people realized that it would help their farms produce more. I don't think they really realize that.”

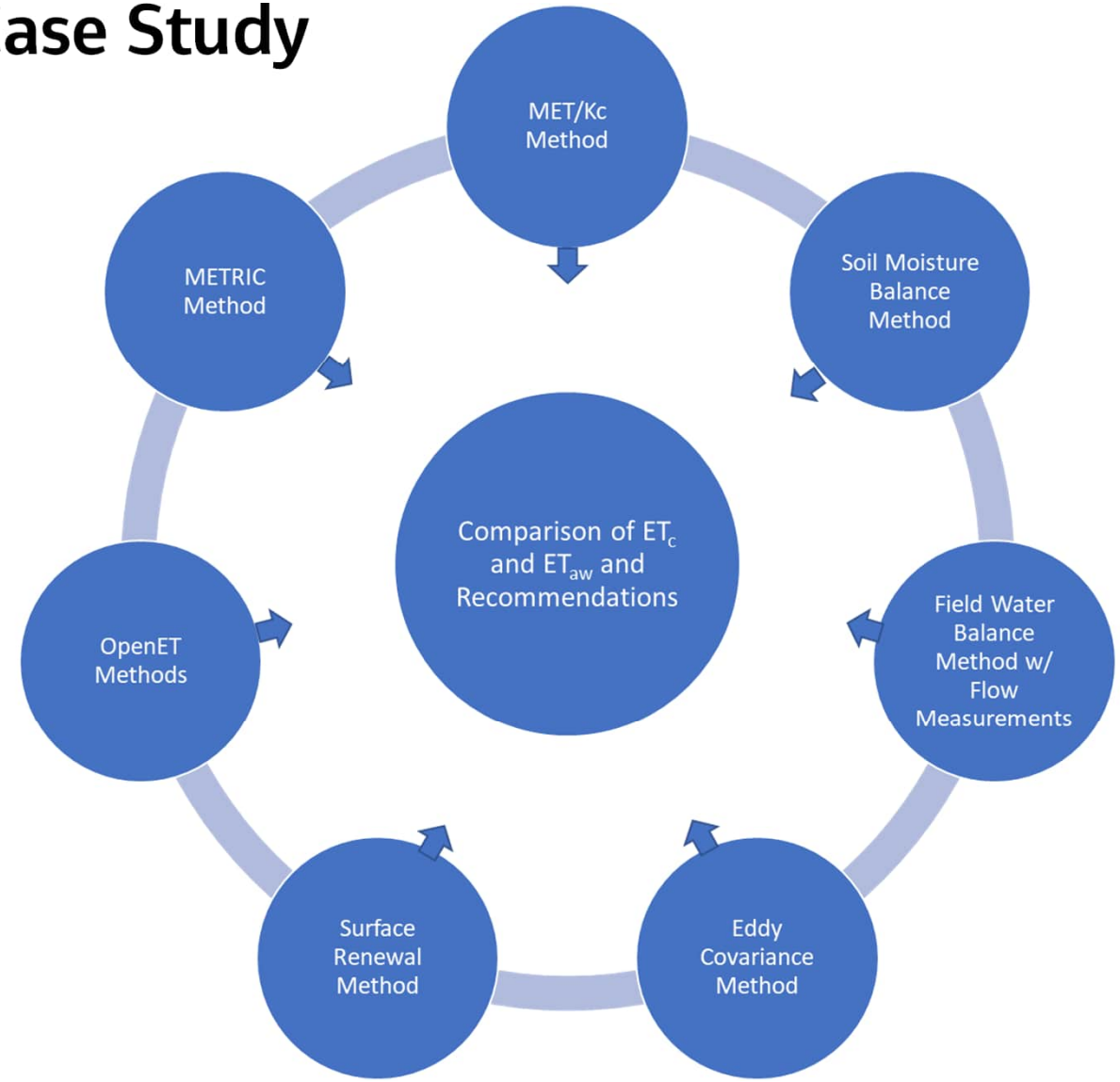

Depletion Accounting for
Irrigation Water Rights in Utah
A Review of Potential Agricultural Depletion
Accounting Methods

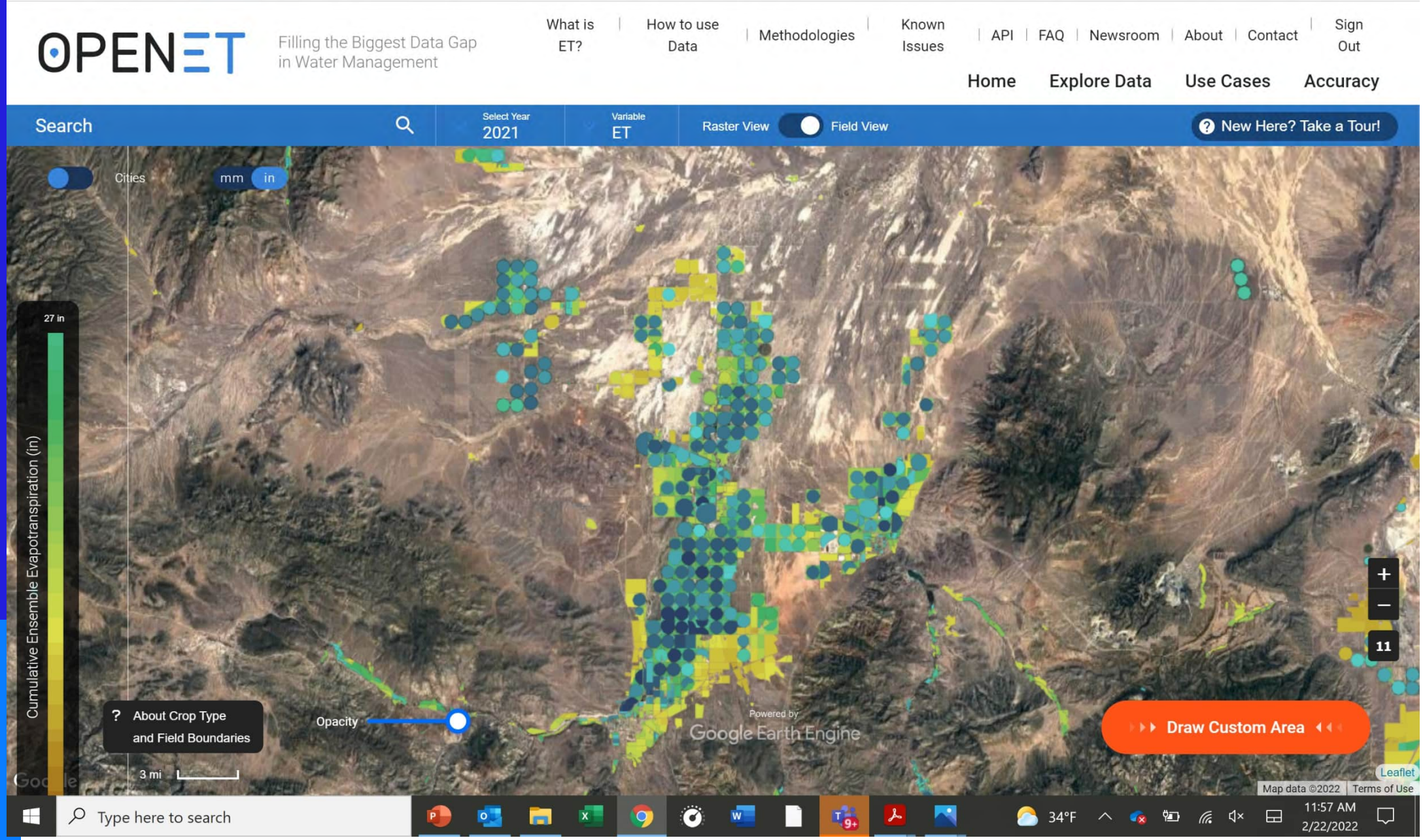
# Depletion Accounting for Irrigation Water Rights in Utah

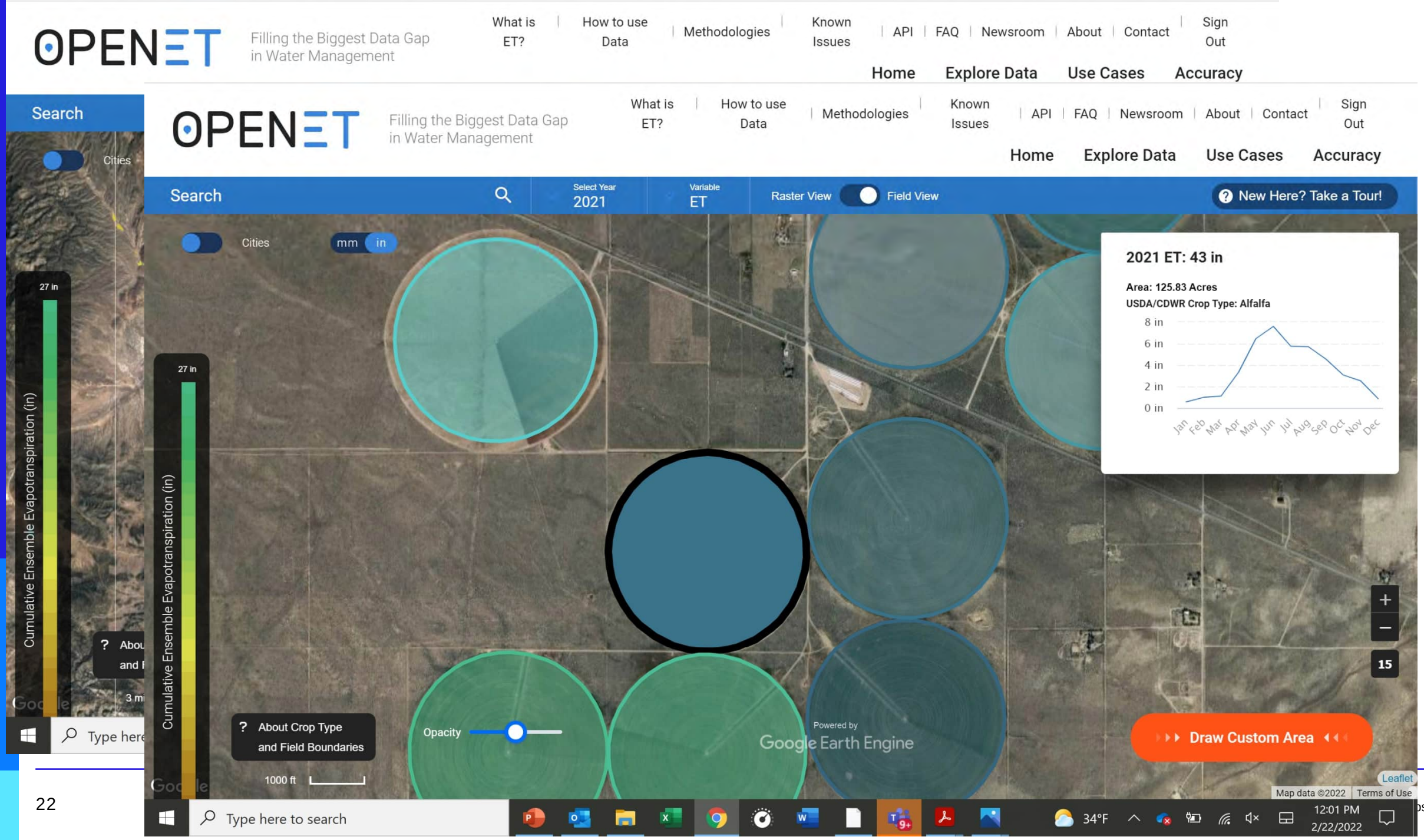
- Expert Panel
  - Developed selection criteria
  - Reviewed ground-based and remote sensing methods for depletion accounting
  - Developed multi-layered approach
  - Recommended methods for a case study

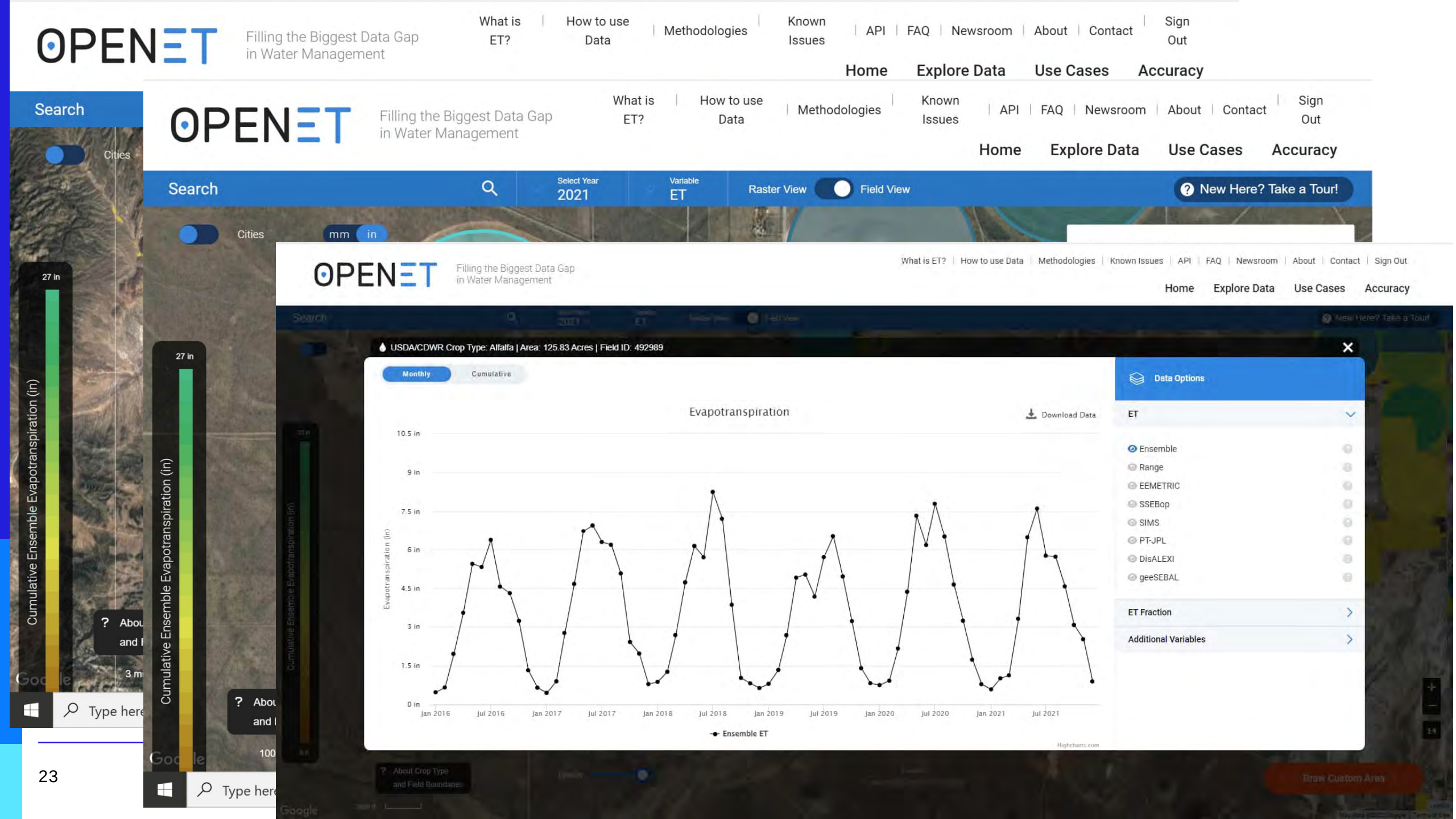


# Case Study


MET/Kc Method
Soil Moisture Balance Method
Field Water Balance Method w/ Flow Measurements
Eddy Covariance Method
Surface Renewal Method
OpenET Methods
METRIC Method
Comparison of $ET_c$ and $ET_{aw}$ and Recommendations

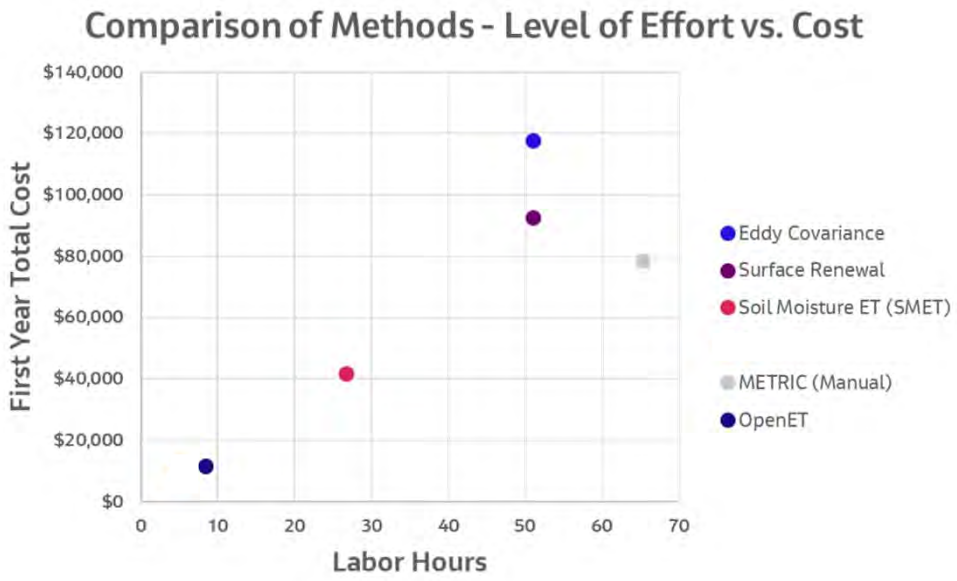

OPENET
Filling the Biggest Data Gap in Water Management
What is ET?
How to use Data
Methodologies
Known Issues
API
FAQ
Newsroom
About
Contact
Sign Out
Home
Explore Data
Use Cases
Accuracy
Search
Select Year
2021
Variable
ET
Raster View
Field View
New Here? Take a Tour!
Cities
mm
in
27 in
Cumulative Ensemble Evapotranspiration (in)
About Crop Type and Field Boundaries
Opacity
3 mi
Powered by
Google Earth Engine
Draw Custom Area
11
Leaflet
Map data ©2022
Terms of Use
Type here to search
34°F
11:57 AM
2/22/2022

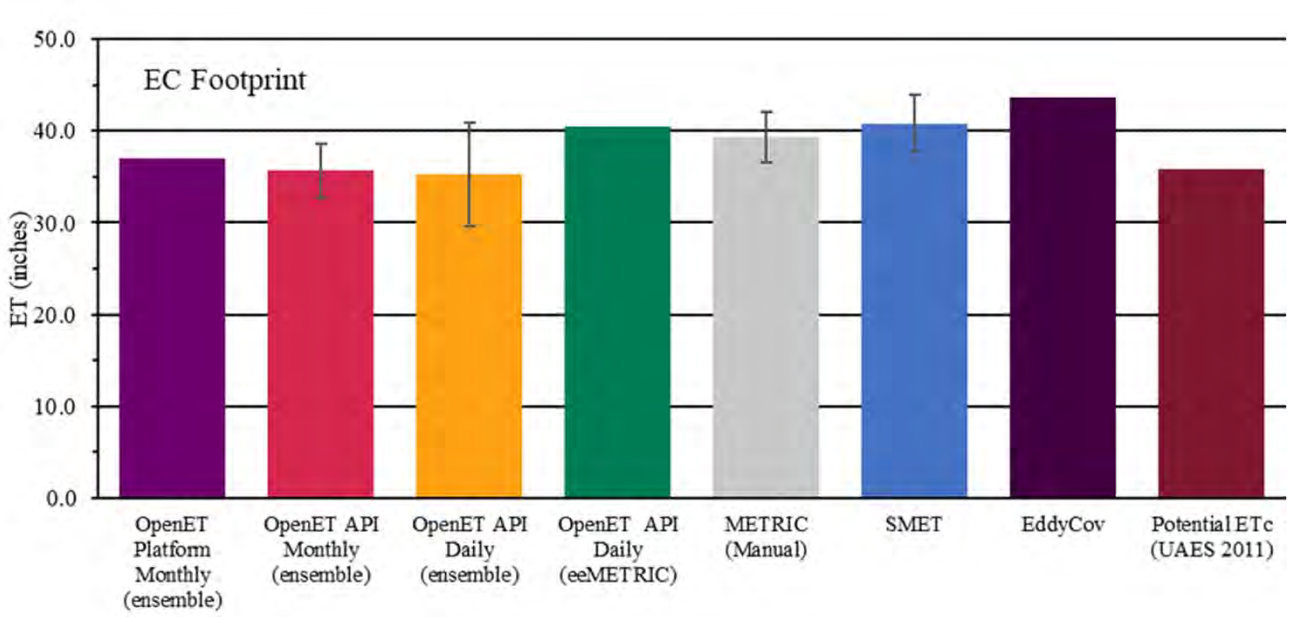

OPENET
Filling the Biggest Data Gap in Water Management
What is ET?
How to use Data
Methodologies
Known Issues
API
FAQ
Newsroom
About
Contact
Sign Out
Home
Explore Data
Use Cases
Accuracy
Search
Select Year
2021
Variable
ET
Raster View
Field View
New Here? Take a Tour!
Cities
mm
in
27 in
Cumulative Ensemble Evapotranspiration (in)
2021 ET: 43 in
Area: 125.83 Acres
USDA/CDWR Crop Type: Alfalfa
8 in
6 in
4 in
2 in
0 in
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
? About Crop Type and Field Boundaries
Opacity
1000 ft
Powered by
Google Earth Engine
Draw Custom Area
15
Leaflet
Map data ©2022
Terms of Use
Type here to search
34°F
12:01 PM
2/22/2022


OPENET
Filling the Biggest Data Gap in Water Management
What is ET?
How to use Data
Methodologies
Known Issues
API
FAQ
Newsroom
About
Contact
Sign Out
Home
Explore Data
Use Cases
Accuracy
Search
Select Year
2021
Variable
ET
Raster View
Field View
New Here? Take a Tour!
Cities
mm
in
27 in
Cumulative Ensemble Evapotranspiration (in)
USDA/CDWR Crop Type: Alfalfa | Area: 125.83 Acres | Field ID: 492989
Monthly
Cumulative
Evapotranspiration
Download Data
10.5 in
9 in
7.5 in
6 in
4.5 in
3 in
1.5 in
0 in
Jan 2016
Jul 2016
Jan 2017
Jul 2017
Jan 2018
Jul 2018
Jan 2019
Jul 2019
Jan 2020
Jul 2020
Jan 2021
Jul 2021
Ensemble ET
Data Options
ET
Ensemble
Range
EEMETRIC
SSEBop
SIMS
PT-JPL
DisALEXI
geeSEBAL
ET Fraction
Additional Variables
Draw Custom Area
Type here

# Measuring Evapotranspiration

- The SMET and eeMETRIC methods provided the best comparison with Eddy Covariance evapotranspiration measurements.

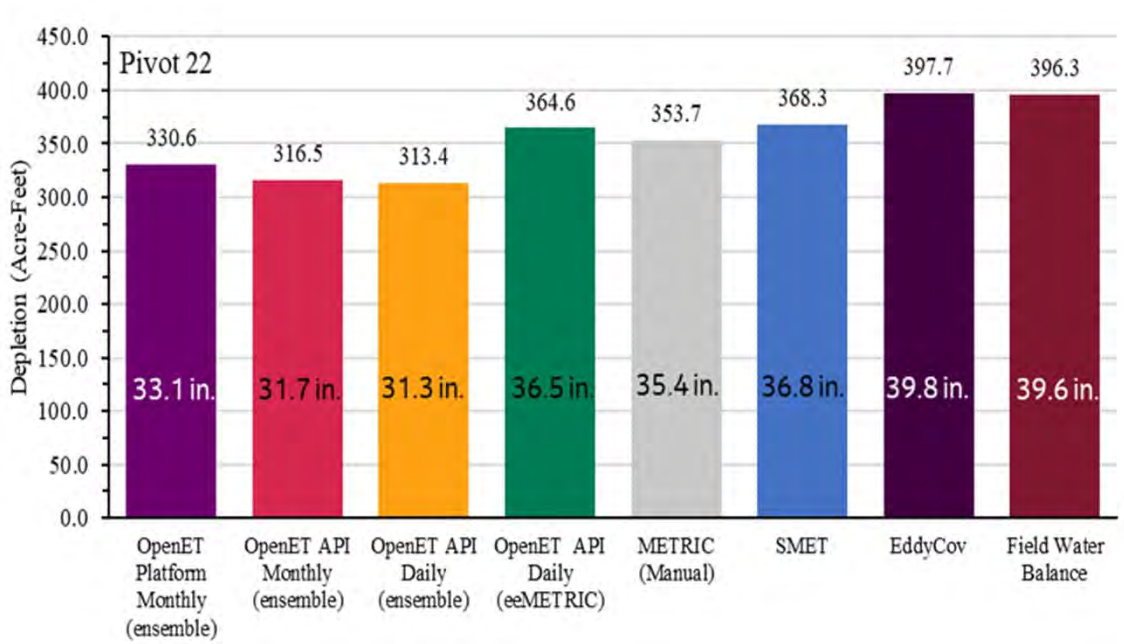



- eeMETRIC appears to provide the best measurement of ET with the least cost and effort.
- Significant investment by other s into continuing to improve eeMETRIC and its funtionality

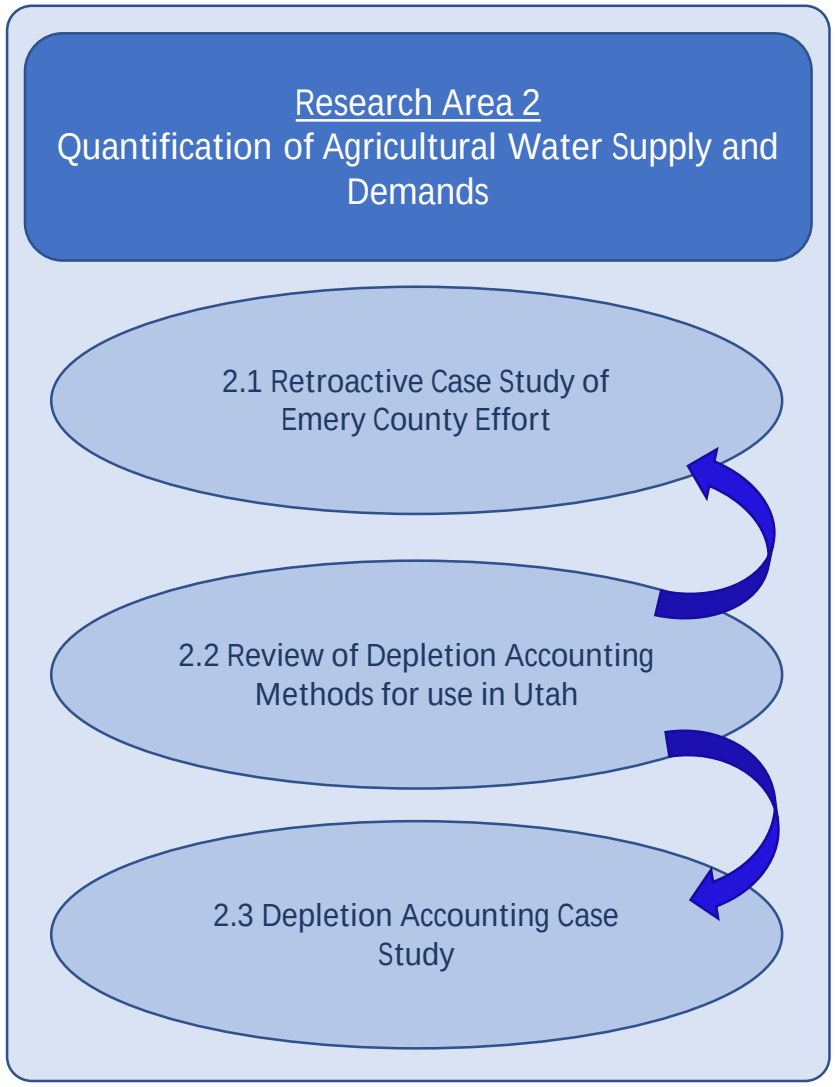
# Reporting Depletion of Applied Water

- Depletion as estimated using the field water balance method provided results closest to depletion estimated using Eddy Covariance data. However, this method is limited to ideal, site-specific conditions.
- eeMETRIC provided results similar to SMET and the Eddy Covariance method but at a much lower cost.
- Results are encouraging.




- Actual method used will depend upon specific need.
- Continued study is recommended to continue to improve confidence in results at locations around the state of Utah.

# Quantification of Agricultural Water Supply and Demands




1. Case Study of Emery County Effort
   - Quantification of diverted and applied water provides significant benefits to the producer, community, and environment and is desired by water users and water managers. The Emery County experience is proof positive that this works in Utah.
2. Depletion Accounting Methods
   - Ground-based and remote sensing technology exists to provide water users and water managers with the water diversion, application, and depletion information they need.
3. Depletion Accounting Case Study
   - Preliminary results indicate it is feasible and can help reduce consumptive use.

# Summary (2018-2021)

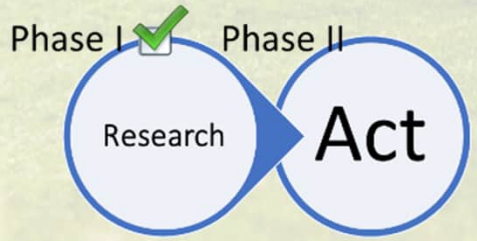
- Acute droughts are a significant threat to the viability of our farms and ranches.
- Agriculture is facing relentless pressure from growth that is transforming ag lands and increasing demands on a limited water supply.
- Long-term climate trends have decreased and will likely continue to decrease the available water supply.

# Key Conclusions (2018-2021)

1. Utah must innovate and adapt to address acute drought and chronic water supply and demand challenges
2. There are readily available and proven tools and approaches that can be implemented to incentivize and make progress toward agricultural water optimization and resiliency
3. The State of Utah must invest now to preserve agriculture in Utah and enable the growth that is envisioned.

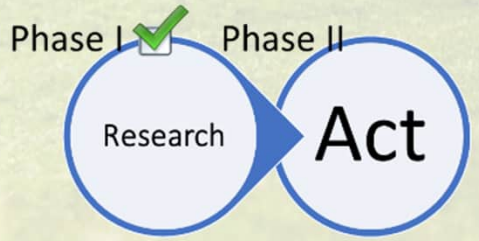
# The question was no longer what if…

# but how?



# How do we pivot from Research to Action?

## We Invest



# We need a plan for ag water resiliency

- The plan must:

1. Preserve agriculture and enable smart growth in Utah for future generations
2. Boost the resilience of Utah's agriculture to anticipate, respond, and succeed in spite of drought and other impacts of climate change
3. Expand the capacity of agriculture to adapt to increasing demands upon a decreasing water supply

# How do we approach this?

- Maintaining or increasing viable agriculture places a special focus upon the water user
- How can we incentivize users to change? Or perhaps more importantly:

  Why haven't water users already optimized?

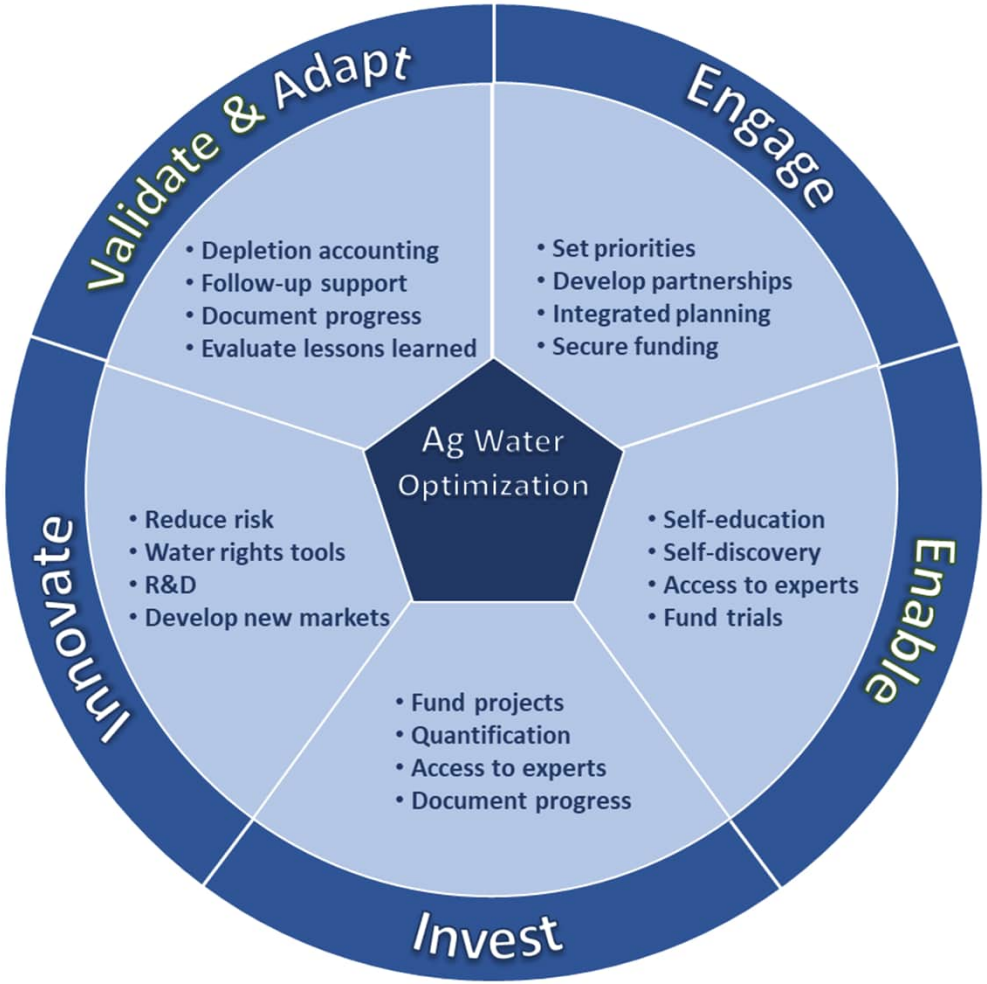
# Why haven’t water users already optimized?

- Is there really a need?
  - Illustrate existing supply is consumed by increasing demands
- Tradition is hard to change
  - Preserve and enhance our agricultural legacy
- We hate to be told what to do
  - Make it voluntary, enable users to persuade themselves
- Too large of a change
  - Take small steps, make it the norm
- Inadequate resources, cant afford it
  - Provide technical and financial resources, compensated change
- Too much uncertainty and risk
  - Alleviate or eliminate risks
- Need evidence it will work – prove it!
  - Provide corroborative evidence

How do we translate these into an actionable strategy?

# How do we develop an actionable strategy?

- Engage and enable voluntary changes
- Identify and prioritize investments from local perspective
- Incentivize innovation and temporary changes
- Validate and adapt



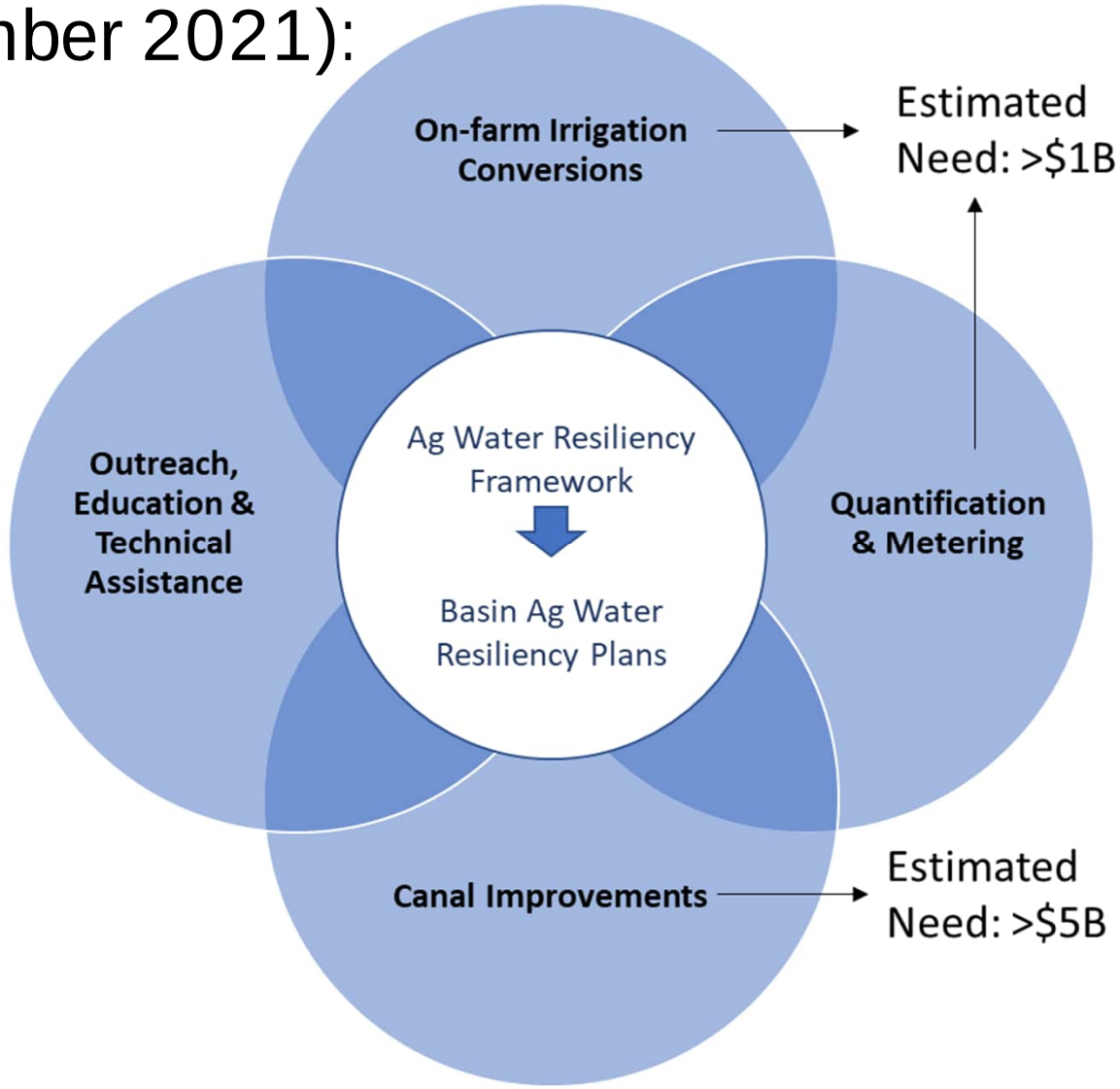
# How do we “move the needle”?

- Develop Local Basin Plans that Focus on Four Areas:
  - On-farm Irrigation Conversions
  - Quantification
  - Canal Conversions
  - Outreach, Education, and Technical Assistance


# The Need - A Down Payment on the Future

The Task Force Recommended (November 2021):

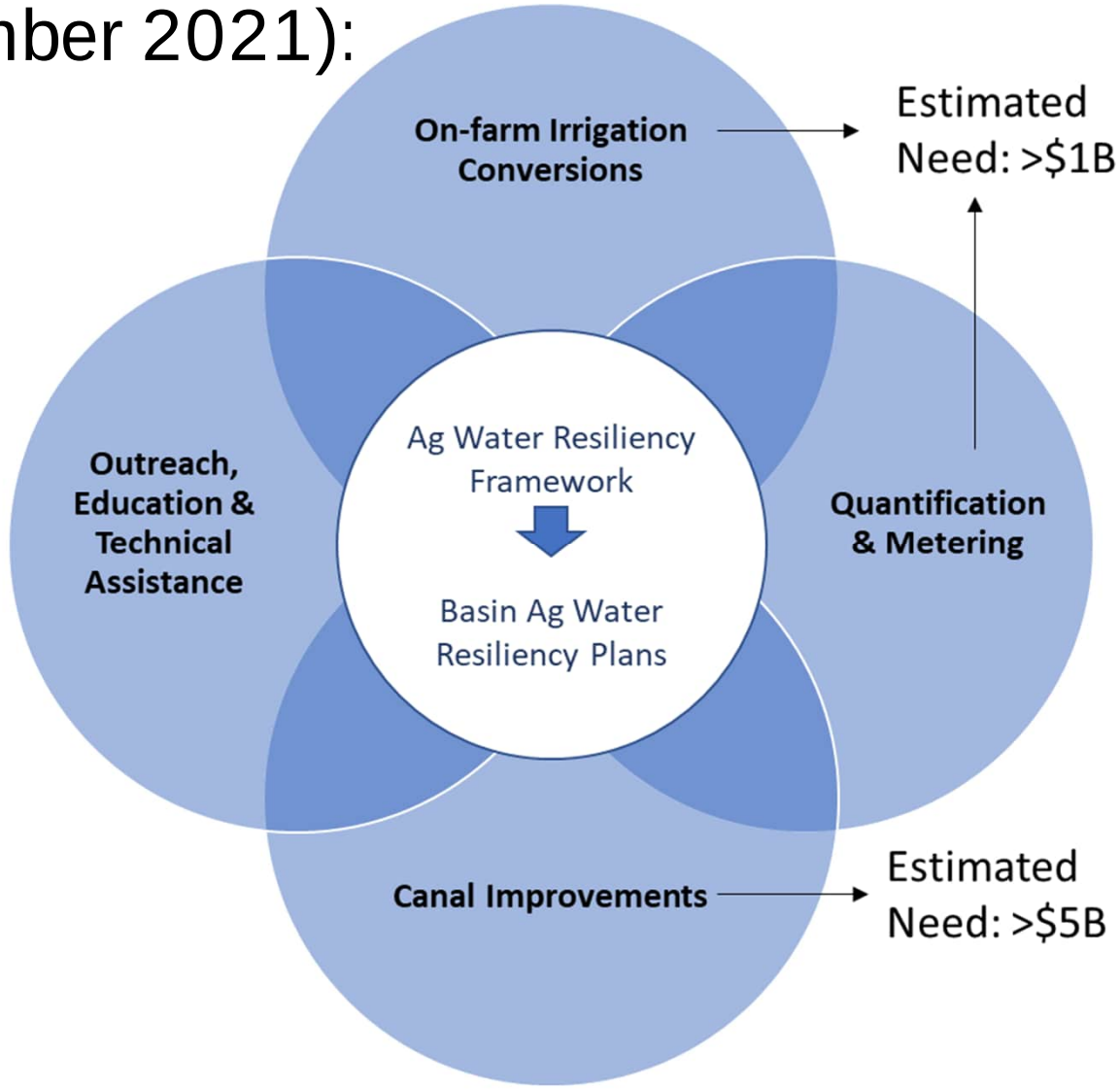
- $7M for planning over 3 years
  - Driven from bottom- up: local
  - Potentially 12 basin plans integrated by a state framework
  - All focused upon a common goals: ag water optimization



# The Need - A Down Payment on the Future

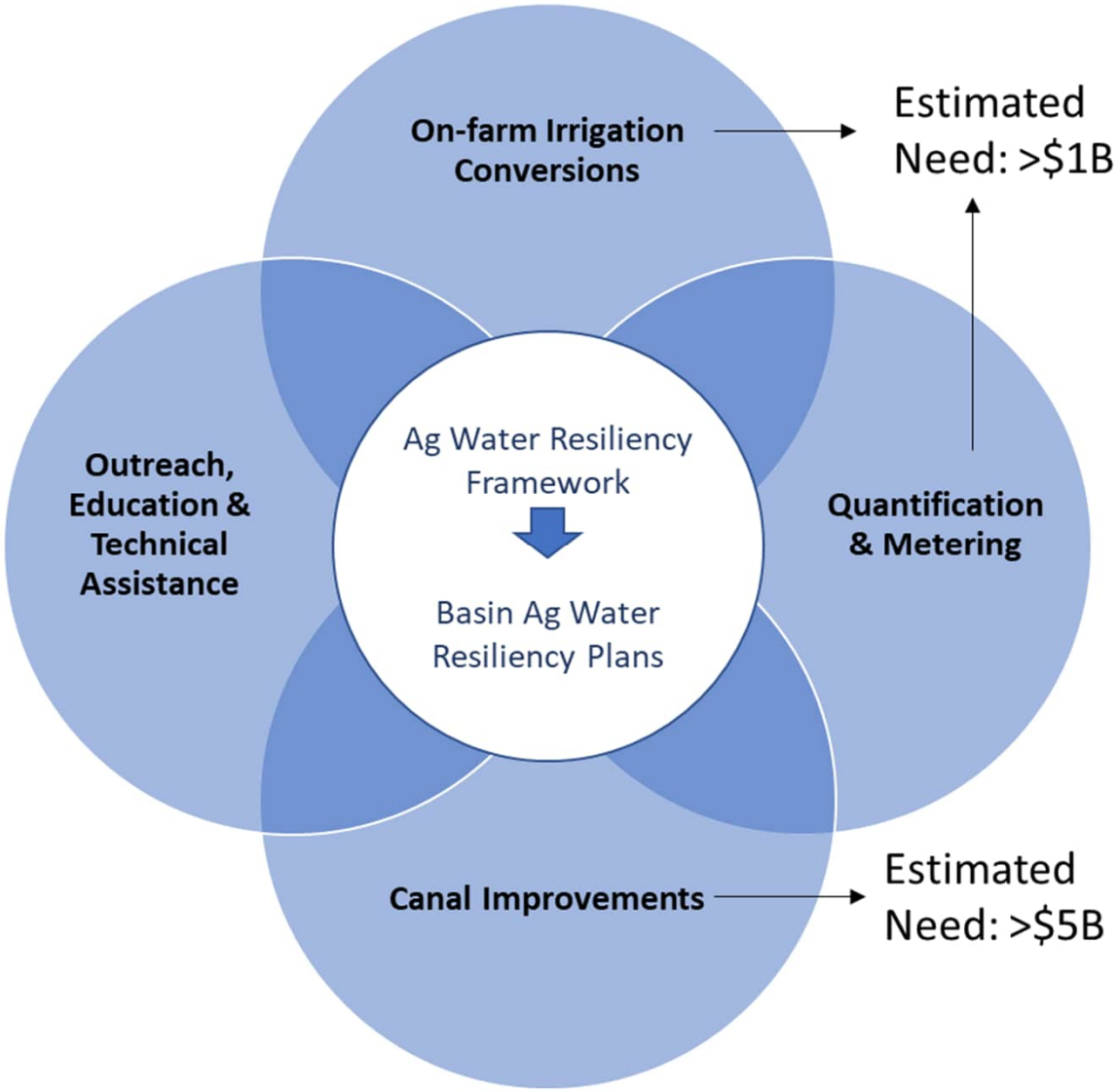
The Task Force Recommended (November 2021):

- $7M for planning over 3 years
- $5M for outreach, education & technical assistance to producers
- $95M down payment on ag water infrastructure



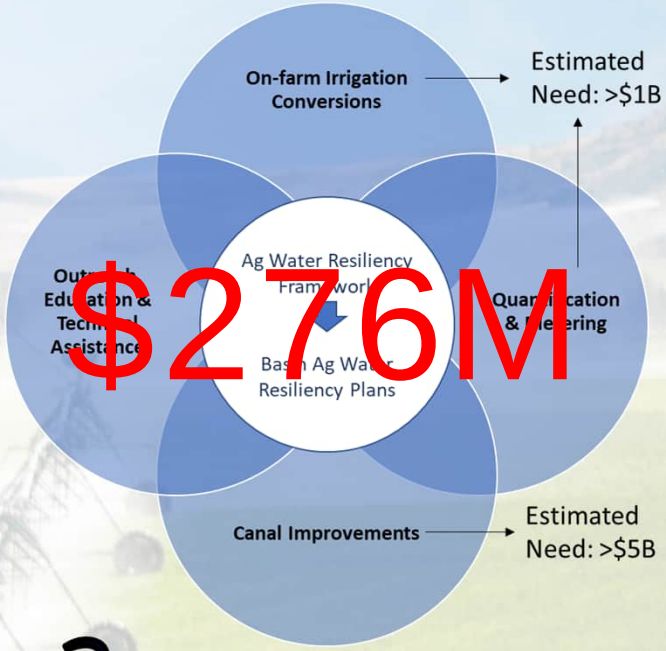
# Success!

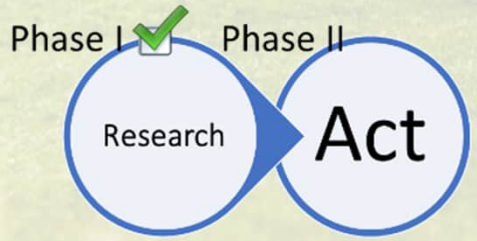
- Ag Water Optimization
  - $76M appropriated through 2022
  - $200M appropriated in 2023
- Plus, other groups are moving forward with similar efforts
  - Div Water Resources
  - Div Water Rights
  - Col R Authority of Utah
  - Great Salt Lake Water Trust
  - Utah Water Ways



# A Path Forward

1. ☑ Investment in Focus Areas
2. ☐ Ongoing funding
3. What obstacles might there be?



# What obstacles might there be?

## Key Obstacles for Ag Water Users

- Preserving water right if a water user reduces their diversion and/or depletion
- Funding
- Education
- Quantification of water supply and use – depletion accounting, validation

- ☑ Request to Utah Water Task Force and Legislative Water Development Commission – SB 277
- ☑ Request for additional Ag Water Optimization Funding – SB 277
- ☑ Ongoing by UDAF/USU Extension
- ☑ AgDRIP in the Colorado River Basin
- ☑ Funding for Ag Water Optimization
- ☑ Funding to DWRi for GSL Basin
- ☑ Funding to CRAU for Colorado River Basin

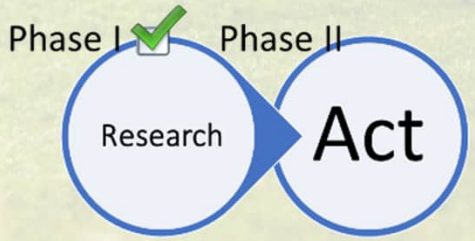
## Key Obstacles for the Public

- The Value of Agriculture in Utah
- Economic impact of Agricultural Water Use
- Understanding their “water footprint”

- ☑ Media, editorials, etc.
- ☑ Bear River economics
- ☑ Utah Water Ways

# A Path Forward

- [x] 1. Investment in Focus Areas
- [ ] 2. Ongoing funding
- [x] 3. What obstacles might there be?
- [ ] 4. How can we advance Ag Water Optimization?



# How can we advance AWO?

The Task Force identified areas that will require further work to overcome obstacles and advance optimization in Utah

Research Needs 2022

Cultivating Agriculture Water Resiliency in Utah

The Challenge and Need

Acute droughts such as what we experienced in 2021 and 2022 are a significant threat to the viability of our farms and ranches. Utah agriculture is facing relentless pressure from growth that is transforming agricultural lands and increasing demands on a limited water supply. Long-term climate trends have decreased and will likely continue to decrease the available water supply. Immediate action that optimizes the use and management of our finite water supplies is needed to both preserve agriculture and sustain the desired growth in Utah for future generations.

The Goal – Complete the Research Required to Enable Action

To Develop and implement an agricultural water resiliency plan for Utah that accomplishes the following objectives:

1. Preserve agriculture and enable smart growth in Utah for future generations
   a. Preserve Utah's agricultural economy
   b. Increase local use of Utah agricultural products
   c. Adapt agricultural market to products that consume less water
   d. Promote smart growth; protect critical agricultural lands
2. Boost the resilience of Utah's agriculture by enhancing its ability to anticipate, respond, and succeed in spite of drought and other impacts of climate change
   a. Quantification – Provide water users and water managers with the data (for example via metering) they need to optimize their operation and increase water use accountability/transparency
   b. Markets – Evaluate and implement opportunities to optimize the agricultural markets such that less water is required
   c. Tools – Reduce agricultural water diversions and consumption through improved infrastructure and methods
   d. Education – Increase agricultural irrigation outreach, technical assistance, education and demonstration projects
3. Expand the capacity of agriculture to adapt to increasing demands upon a decreasing water supply
   a. Preserve an adequate water supply to maintain Utah's agricultural economy
   b. Protect non-consumptive system uses of water
   c. Develop basin integrated plans
   d. Avoid regulatory curtailments through voluntary efficiency measures that maintain agricultural production

Four Focus Areas

The Agricultural Water Optimization Task Force recommends four areas of focus to initiate a bold vision for agriculture water resiliency in Utah, lay the foundation for a Utah Agriculture Water Resiliency Plan, and represent a critical down payment on the future of Utah. The 2022 Utah Legislature generously allocated $70M toward implementation of these strategies.

1

Agricultural Water Optimization Task Force 2022

# Research Needs – Cultivating Ag Water Resiliency in Utah

## Preserving and Enhancing Agriculture

1. Communicate the Value of Agriculture
2. Discover Local Food
3. Economic Impact of Ag Water Use
4. Develop a Water Footprint Calculator
5. Evaluate Alternative Crops
6. Optimize the Ag Value Chain

## Planning for a Resilient Water Supply

7. Water Rights
8. Depletion Accounting
9. Water Metrics
10. Environmental Benefits & Consequences of Water Optimization
11. Framework for Basin-scale Ag Water Resilience Plans
12. Basin Ag Water Budgets
13. Seasonal Fallowing

## Implementation

14. Education
15. Quantification
16. Farm Irrigation Consultation/Technical Assistance
17. Irrigation Company Consultation/Technical Assistance
18. Field Trials of Improvements to Irrigation Methods
19. Conveyance System Improvements
20. Funding

# Preserving and Enhancing Utah Agriculture

## Education

### 1. Communicate the Value of Ag in Utah
Enable the public to grasp the importance of this segment of the economy in their lives and to understand that reducing ag water use is not a trivial matter.

### 2. Discover Local Food
Enhance food security and increase the value of and thereby preserve and enhance Utah agriculture.

## Economics of Water

### 3. Economic Impact of Agricultural Water Use
Understand the benefits and impacts derived by the consumer, community, the State, and the environment that depend upon ag water use.

### 4. Develop a “Water Footprint” Calculator
Help a consumer better understand the value of and their dependence upon the water used in all of the products and services they rely upon, including agriculture.

## Crop Alternatives

### 5. Evaluate Crops that Consume Less Water
Identify and demonstrate crops that producers could switch to that require less water and can maintain the viability of their operations.

### 6. Optimize the Ag Value Chain to Reduce Consumptive Use of Water
Identify opportunities to change products, processing and marketing of ag products to reduce consumptive use of water.

# Planning for A Resilient Water Supply

## Policy

### 7. Water Rights
Provide clarity in the intent and means for managing water rights with respect to agricultural water optimization.

### 8. Depletion Accounting
Evaluate the options, benefits and impacts of depletion accounting-based water rights.

## Planning

### 9. Water Metrics
Measure and document performance/benefits of ag water optimization and thereby incentivize investments.

### 10. Ag Water Optimization & the Environment
Develop a manual of practice for use in evaluating new projects and communicating with communities.

### 11. Basin-scale Ag Water Resilience Plans
Evaluate and develop the means for local planning that maximizes benefits to water users and basins

### 12. Basin Ag Water Budgets
Evaluate opportunities and benefits of implementing ag water optimization at the basin scale.

### 13. Seasonal Fallowing
Investigate the viability of seasonal fallowing as a means to achieve the goals of ag water optimization.

# Implementation

## 14. Education
Make it easier to access information that will enable water users to learn and discover the reasons for and means to benefit from ag water optimization.

## 15. Quantification
Improve, expand, and maintain a water measurement network that delivers sound and transparent data and builds trust and confidence in our actions.

## 16. Farm Irrigation Consultation/Technical Assistance
Work directly with water users to identify the best ag water optimization options that meet their goals.

## 17. Irrigation Company Consultation/Technical Assistance
Work directly with irrigation companies to identify the best ag water optimization options that meet their goals.

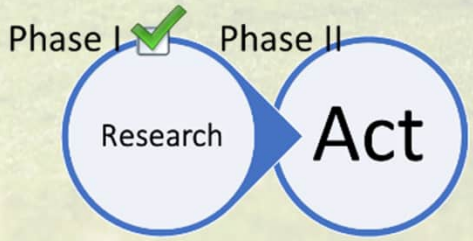
## 18. Field Trials of Improvements to Irrigation Methods
Complete field trials to evaluate and demonstrate the benefits of new ag water optimization practices.

## 19. Conveyance System Improvements
Improve consumptive use estimates and determine ideal ways to optimize conveyance system management and water optimization.

## 20. Funding
Identify the means for sustainable and continued investment in ag water optimization in Utah.

# A Path Forward

- [x] 1. Investment in Focus Areas
- [ ] 2. Ongoing funding
- [x] 3. What obstacles might there be?
- [ ] 4. How can we advance Ag Water Optimization?
- [x] 5. Partnering



# Conclusions

- We can optimize water and agricultural management practices to maintain or increase viable agriculture while minimizing negative impacts upon water supply, water quality and the environment
- Agriculture is about people. We need to engage and enable water users to want to change their practices.
- We made recommendations, identified opportunities and a process and IT IS WORKING!
- This is not an “auto-steer” process. With our partners, we need to maintain focus and adapt to achieve our end objectives

# What if……we don’t?

https://water.utah.gov/agwateroptimization/

Jeff.denbleyker@jacobs.com