Science and data in action

Panelists

Jim Butler, Kansas Geological Survey

Daran Rudnick, University of Nebraska-Lincoln

Jourdan Bell, Texas A&M University

Saleh Taghvaeian, Oklahoma State University

Dave Brauer, USDA-ARS

Jim Dobrowolski, USDA-NIFA

Moderator: Meagan Schipanski, Colorado State University

Science and data in action

Panelists

Jim Butler, Kansas Geological Survey

Daran Rudnick, University of Nebraska-Lincoln

Jourdan Bell, Texas A&M University

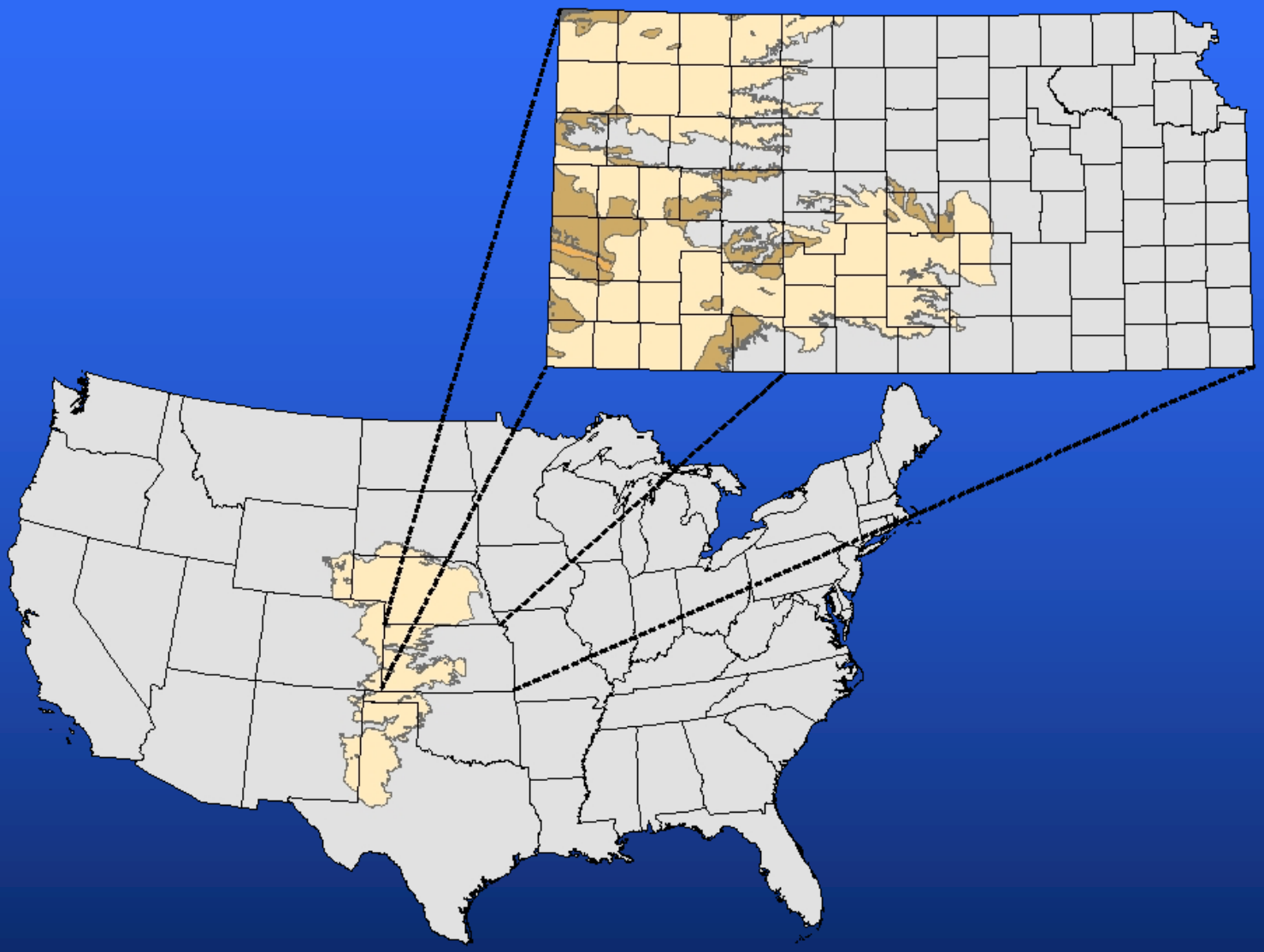
Saleh Taghvaeian, Oklahoma State University

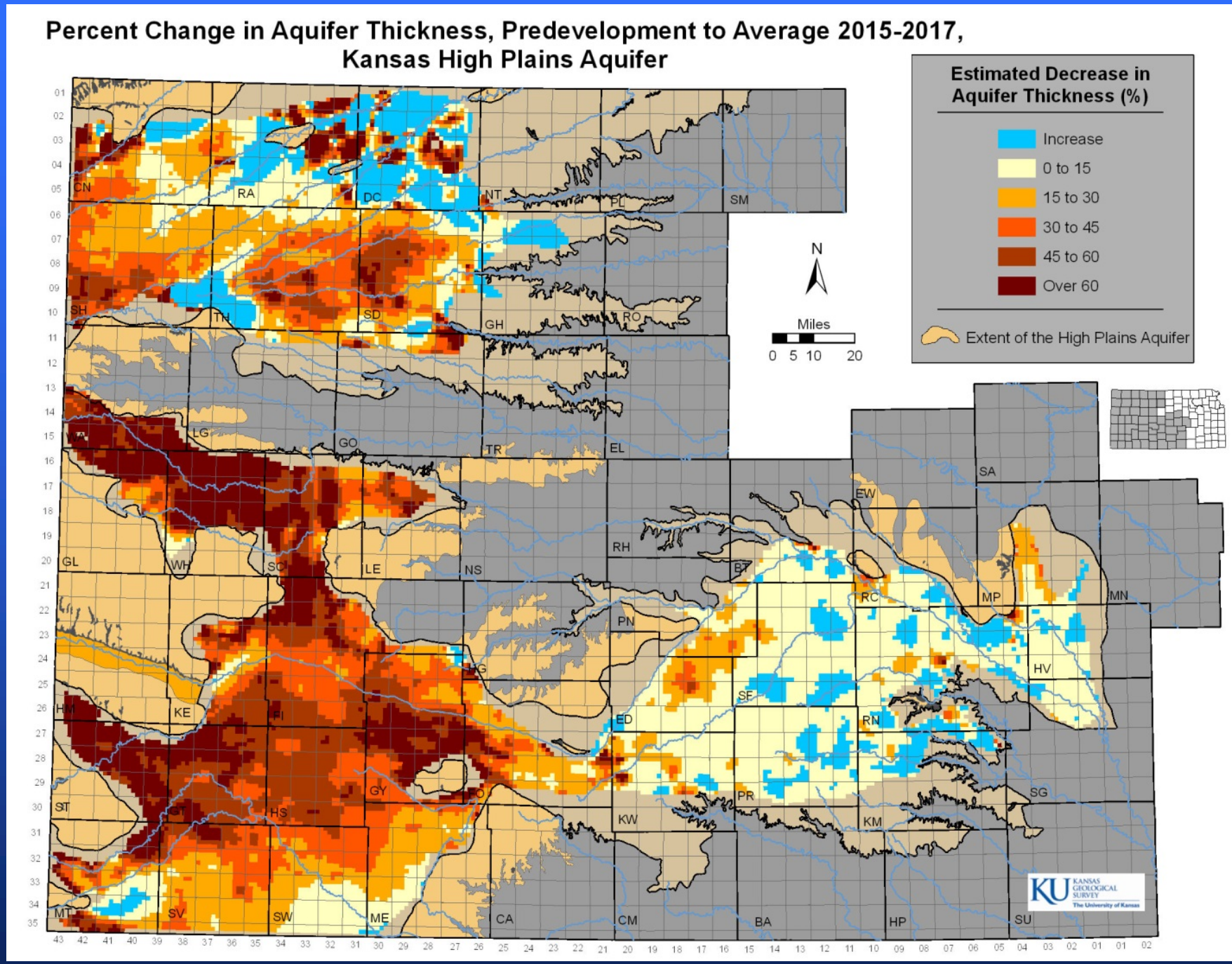
Dave Brauer, USDA-ARS

Jim Dobrowolski, USDA-NIFA

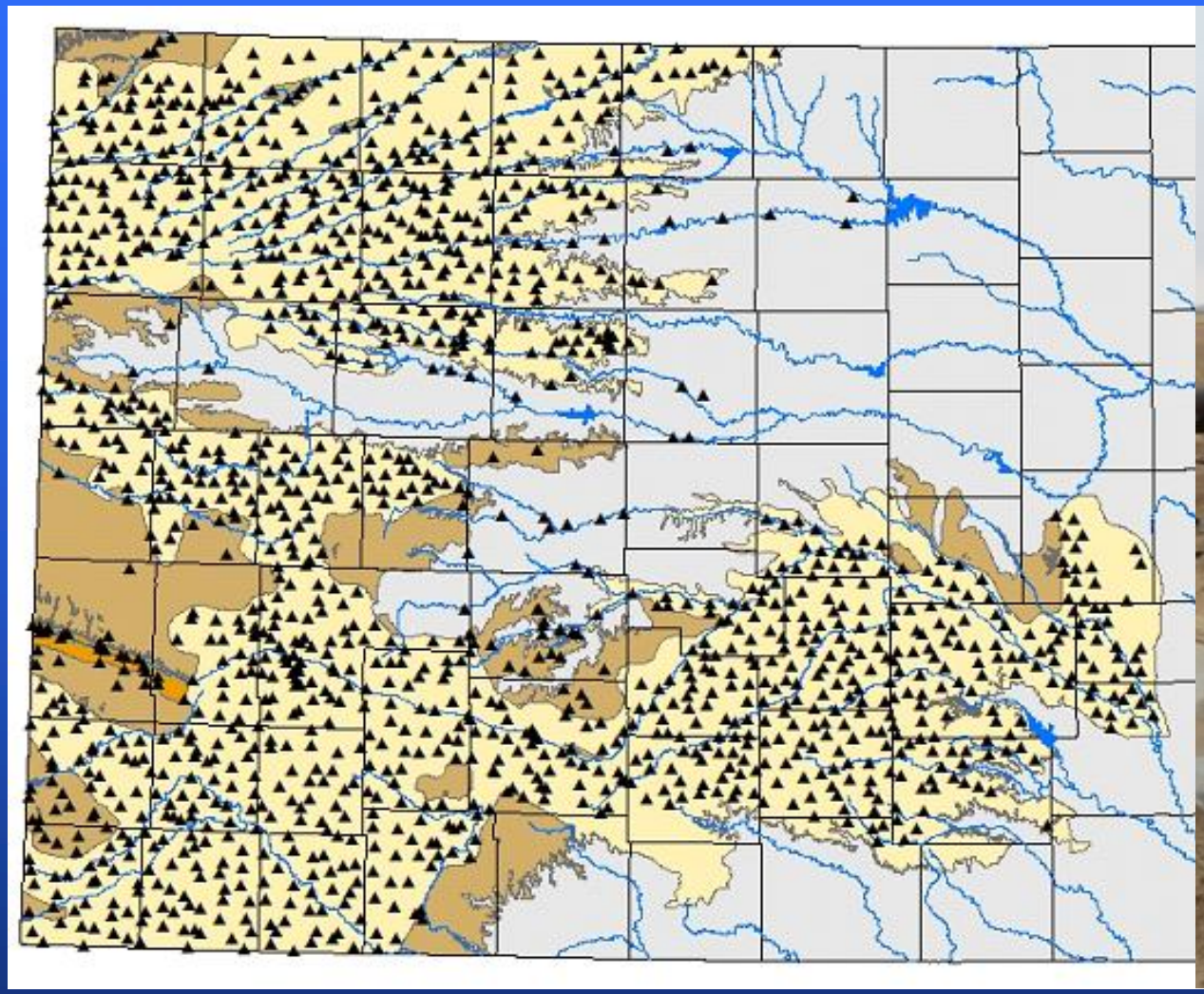
Moderator: Meagan Schipanski, Colorado State University

The High Plains Aquifer




Percent Change in Aquifer Thickness, Predevelopment to Average 2015-2017,
Kansas High Plains Aquifer
Estimated Decrease in Aquifer Thickness (%)
Increase
0 to 15
15 to 30
30 to 45
45 to 60
Over 60
Extent of the High Plains Aquifer
N
Miles
0 5 10 20
CN
RA
DC
NT
PL
SM
SH
TH
SD
GH
RO
LG
GO
TR
EL
SA
EW
RH
GL
WH
SC
LE
NS
BT
RC
MP
MN
PN
HG
HV
HM
KE
FI
SF
ED
RN
GY
SG
ST
CT
HS
PR
KW
KM
MT
SV
SW
ME
CA
CM
BA
HP
SU
KU
KANSAS GEOLOGICAL SURVEY
The University of Kansas

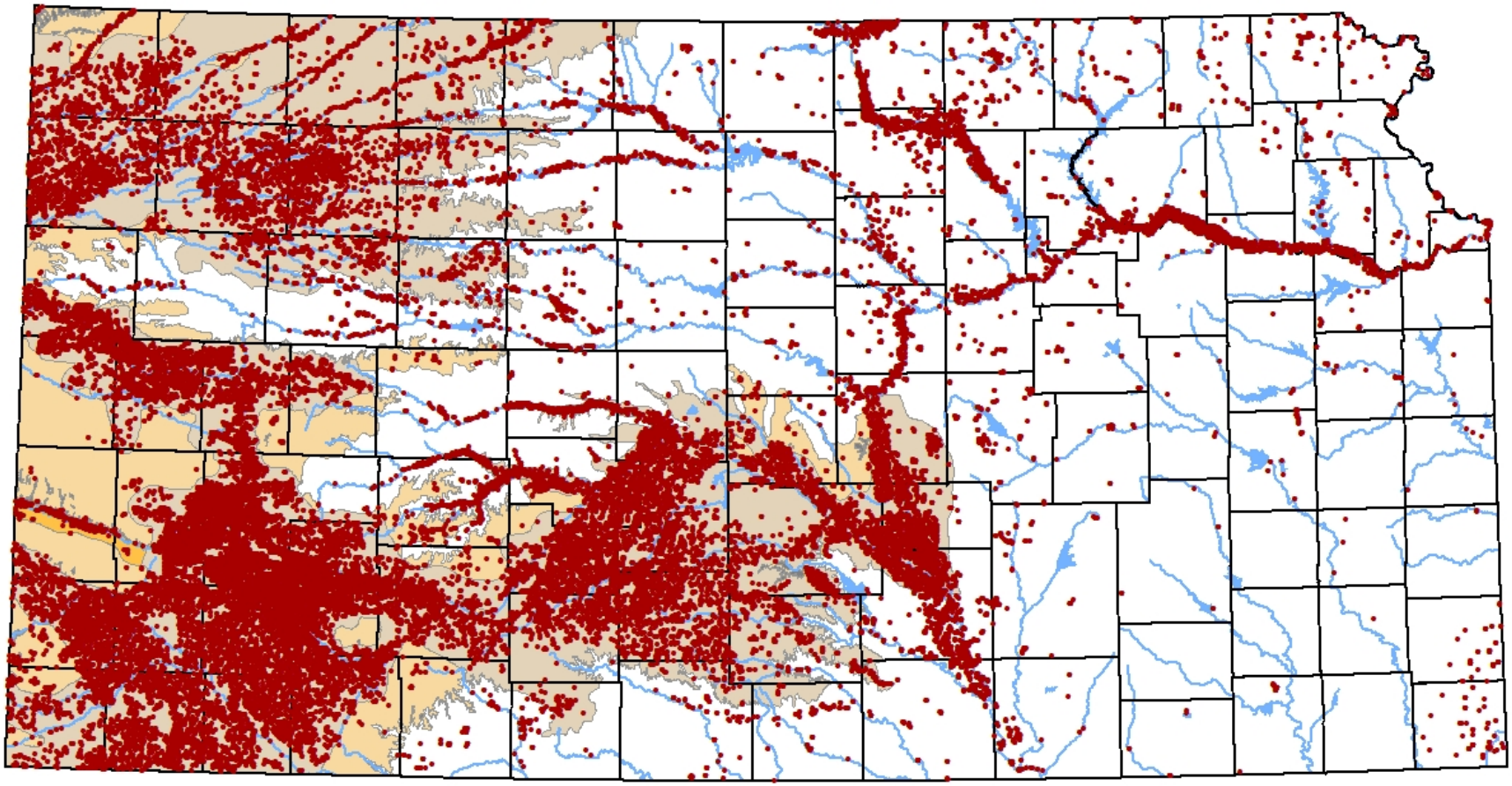
Annual Water Level Data



≈1400 wells measured in High Plains aquifer in 2018

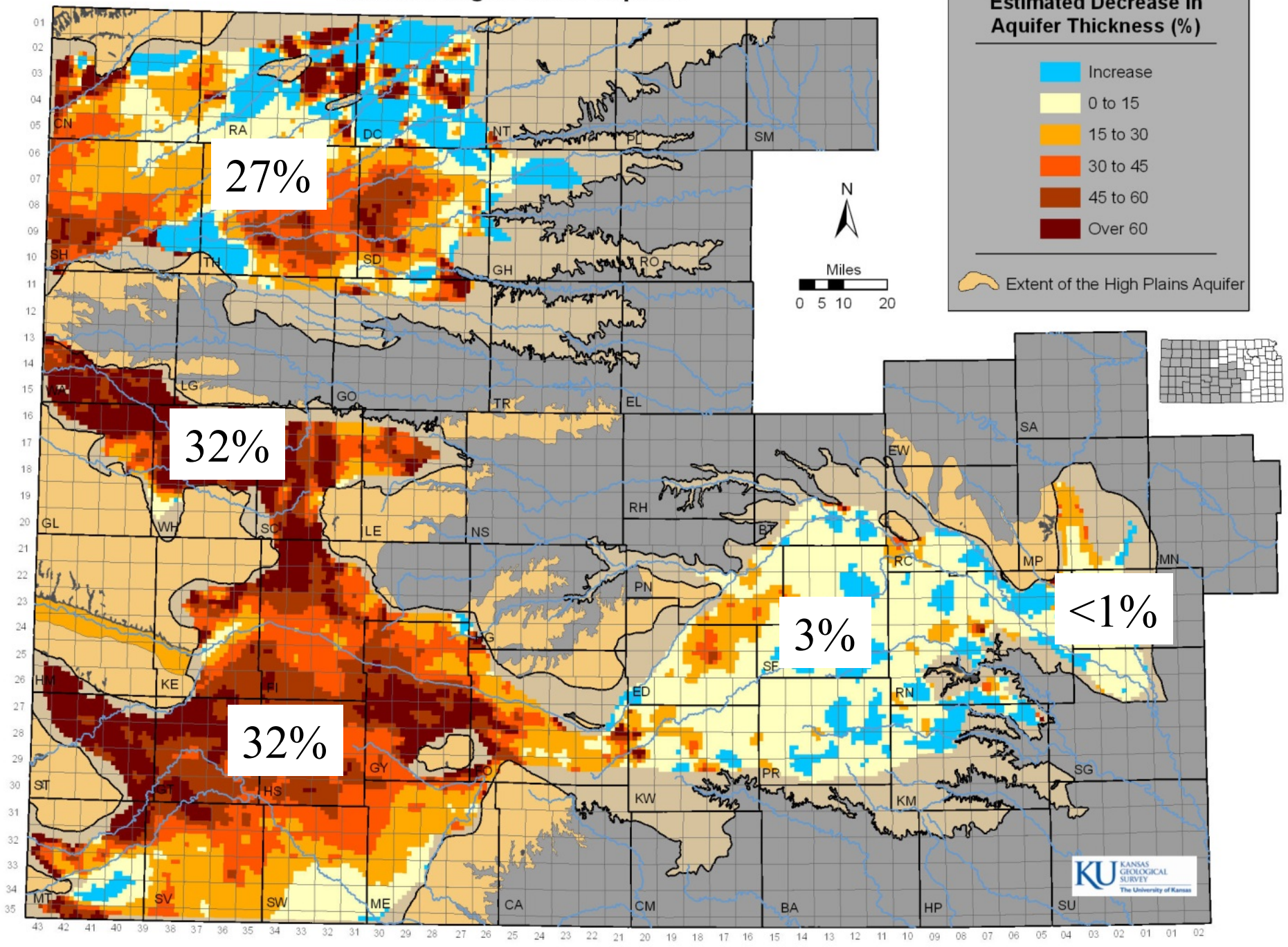
- http://www.kgs.ku.edu/HighPlains/HPA_Atlas/index.html

Annual Water Use Data



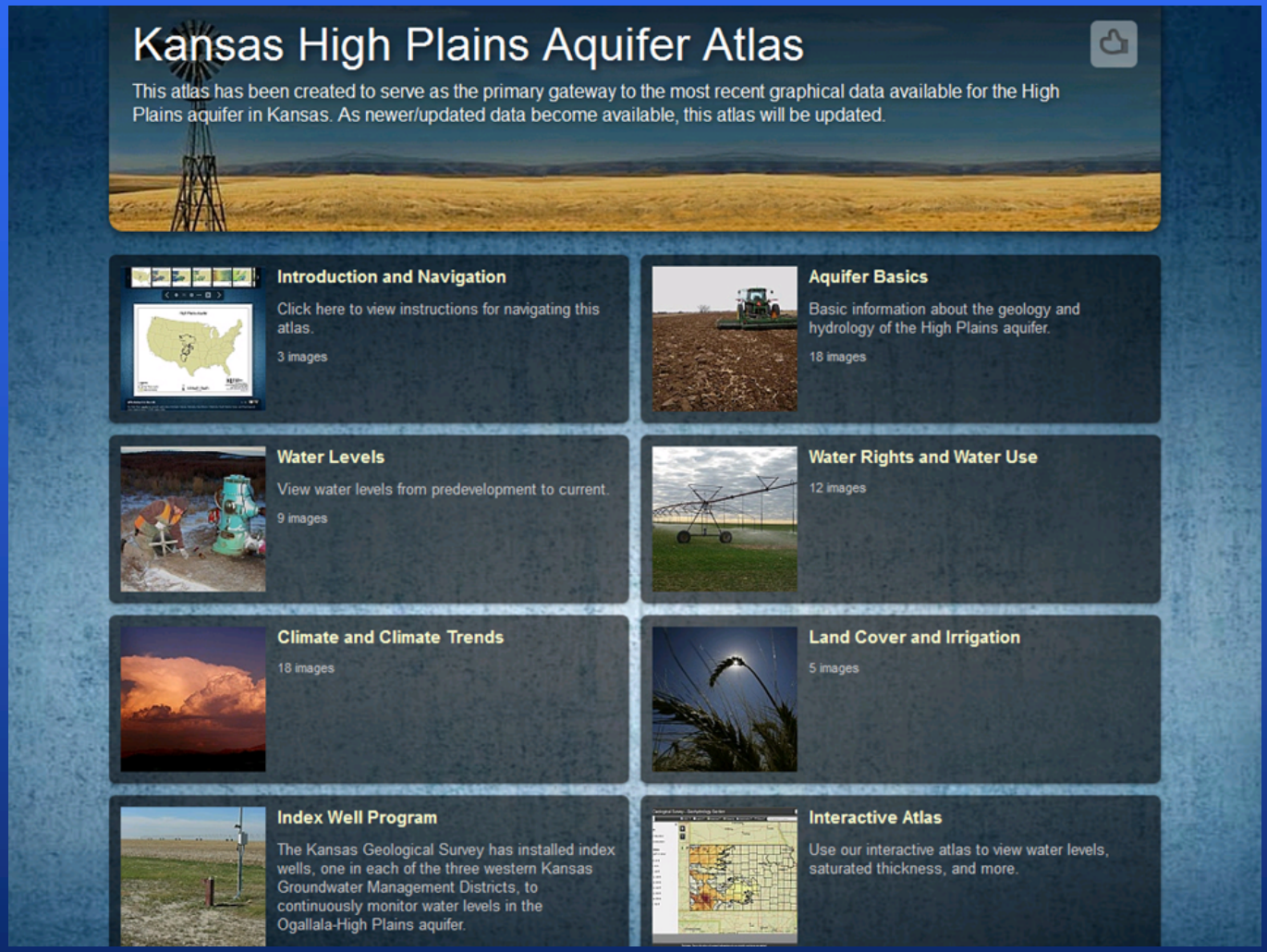
≈ 27,700 wells with totalizing flowmeters in High Plains aquifer
(over 95% of non-domestic pumping wells)

Percent Change in Aquifer Thickness, Predevelopment to Average 2015-2017, Kansas High Plains Aquifer



ACKNOWLEDGMENTS

This work was supported, in part, by funding from the Kansas Water Office, Kansas Water Plan (Ogallala Technical Support Program of the KGS), the National Science Foundation, and the U.S. Dept. of Agriculture.



http://www.kgs.ku.edu/HighPlains/HPA_Atlas/index.html

Science and data in action

Panelists

Jim Butler, Kansas Geological Survey

Daran Rudnick, University of Nebraska-Lincoln

Jourdan Bell, Texas A&M University

Saleh Taghvaeian, Oklahoma State University

Dave Brauer, USDA-ARS

Jim Dobrowolski, USDA-NIFA

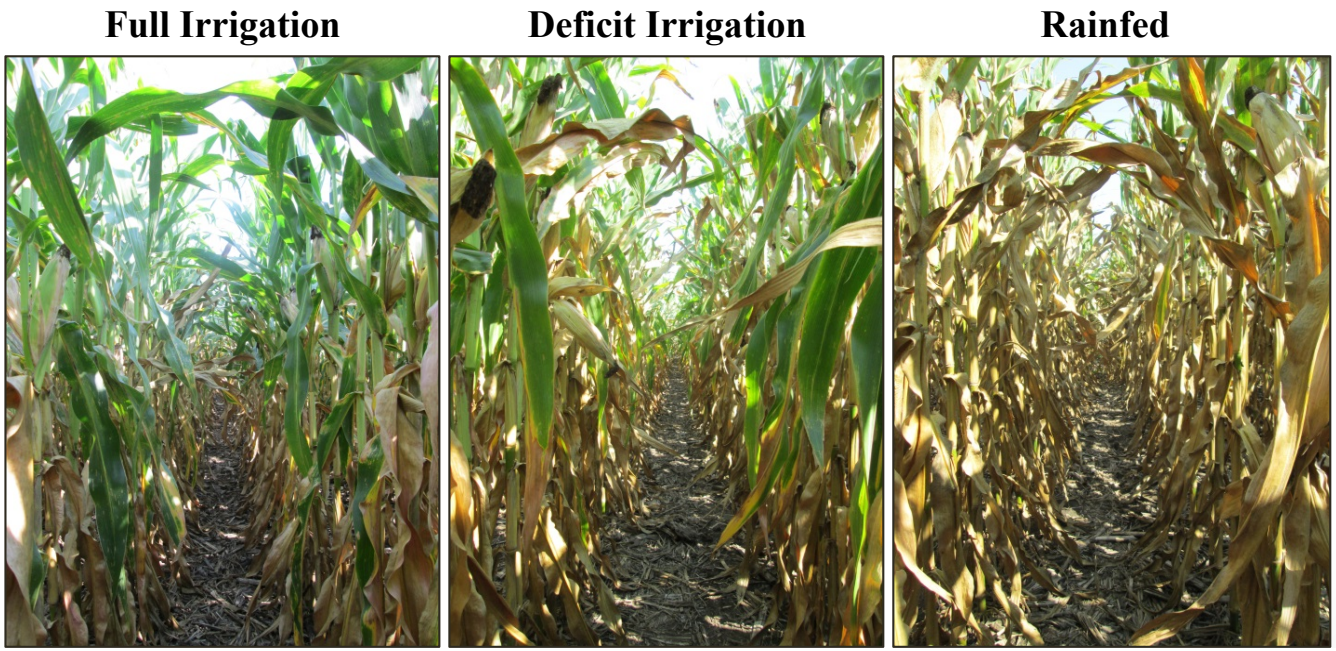
Moderator: Meagan Schipanski, Colorado State University

Deficit Irrigation

Definition: Applying less irrigation than what is required to meet crop water requirements.

Common Approaches:

- Withholding water at growth stages that are less sensitive to water stress as compared to others.
- Irrigating a percentage of crop evapotranspiration (ET) or full irrigation requirement throughout the growing season.



Research Case Studies

Nebraska:

- Clay Center
- North Platte
- Scottsbluff

Colorado:

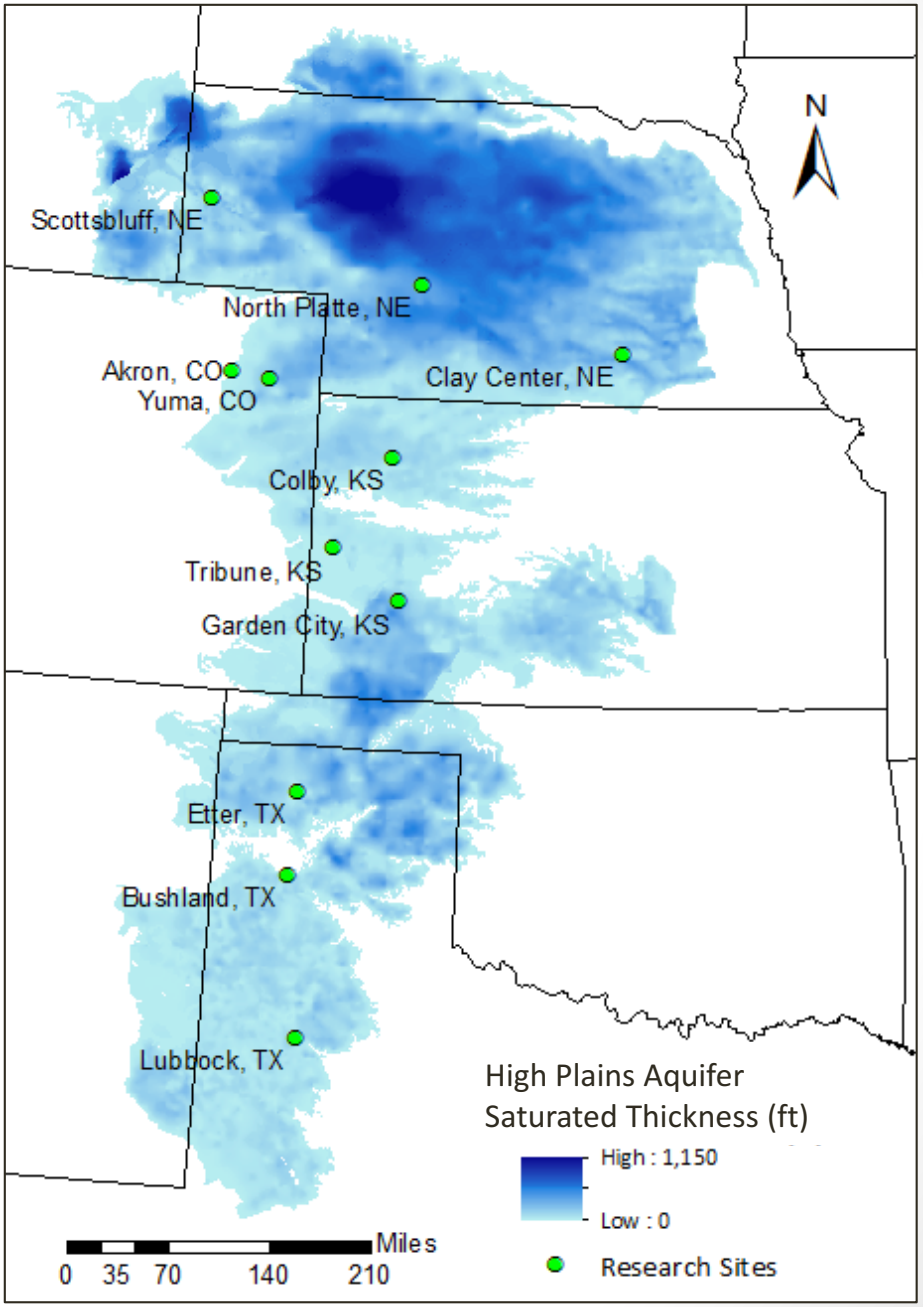
- Akron
- Yuma

Kansas:

- Colby
- Tribune
- Garden City

Texas:

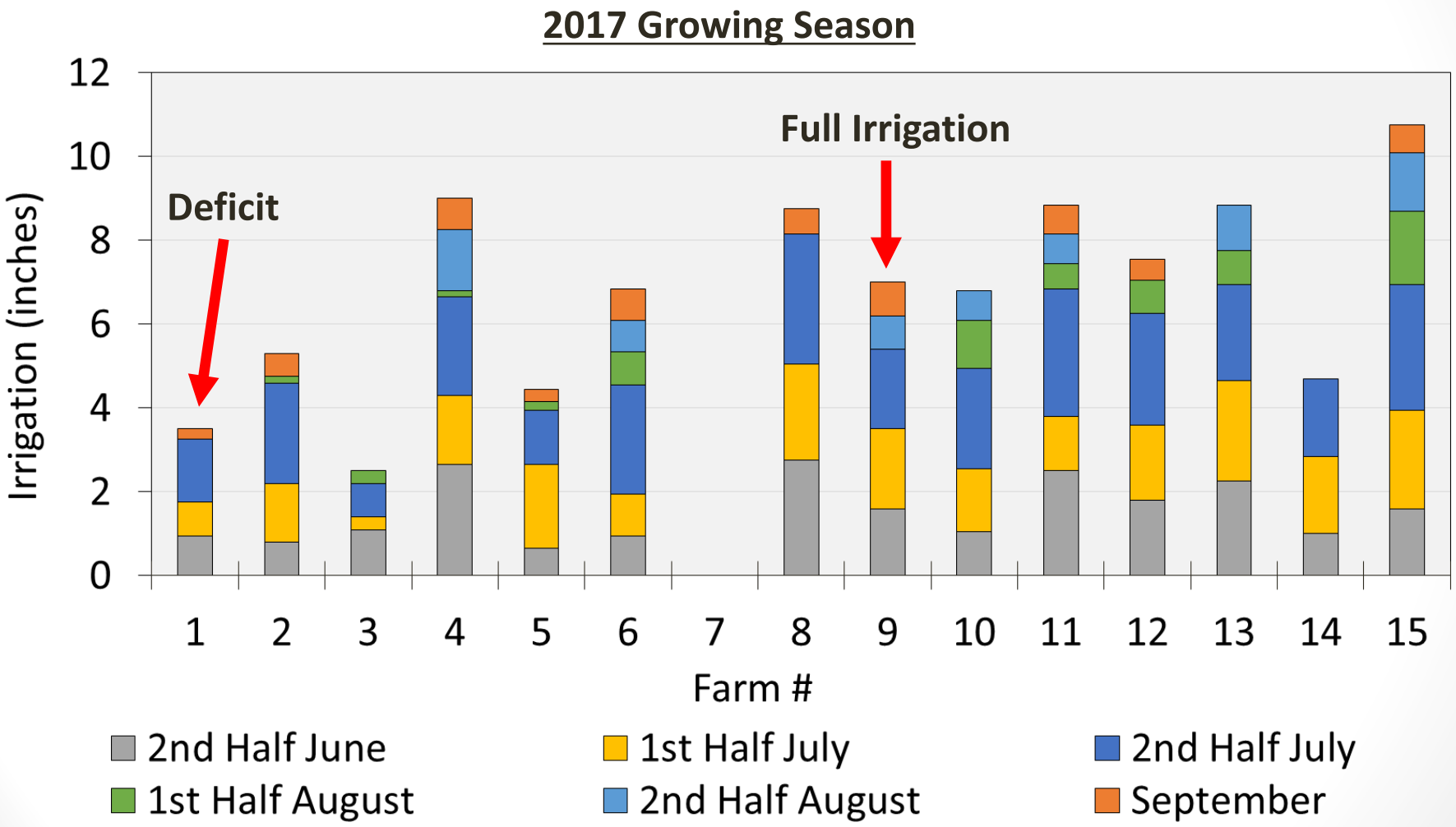
- Etter
- Lubbock
- Bushland



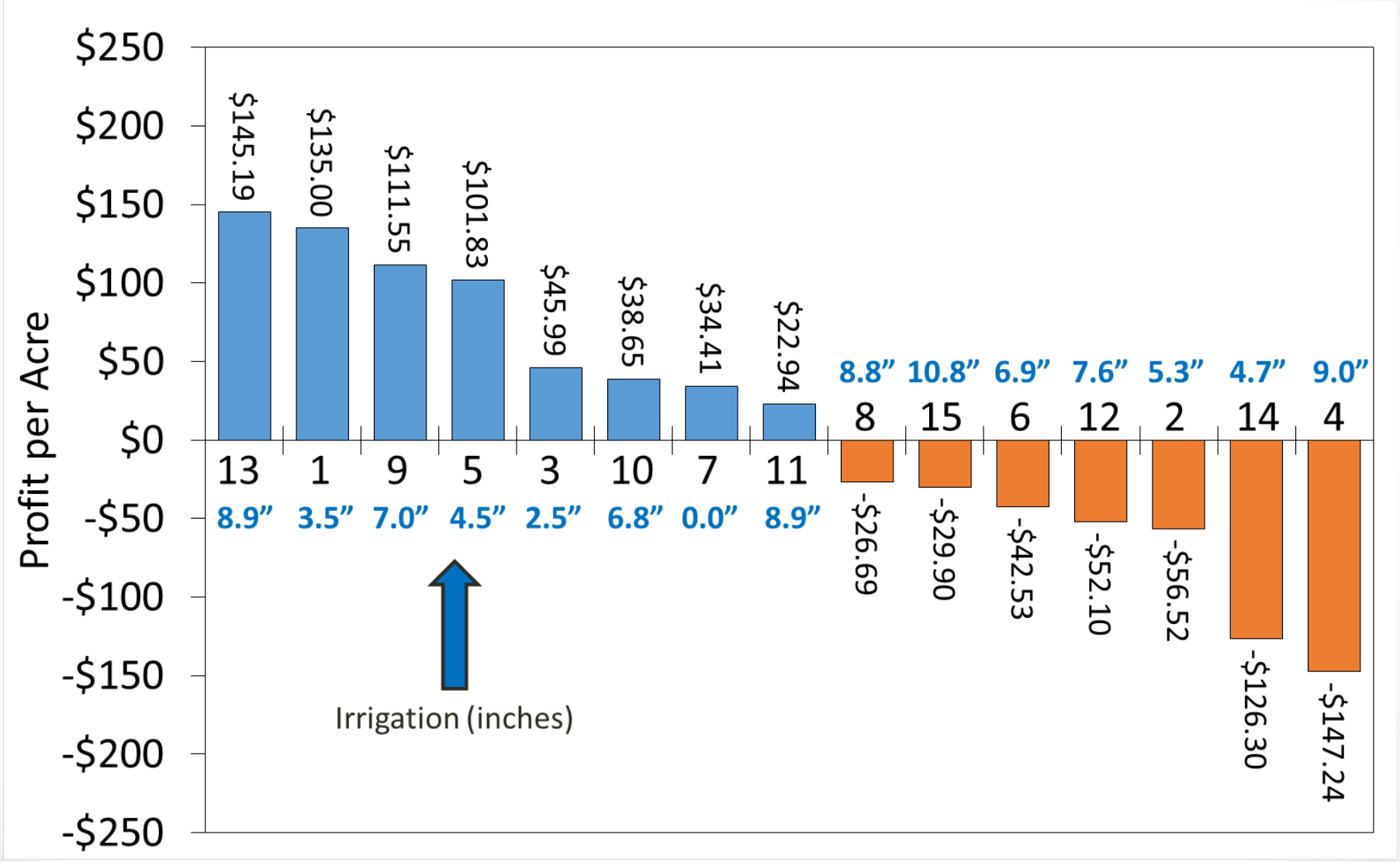
Overview and Broad Conclusions

- Grain yield increases with irrigation until it becomes excessive
  - Location specific and can vary from year to year
- Deficit irrigation can have residual impacts on subsequent crops
  - Depends on the amount of off season recharge
- Appropriate crop & land management practices can reduce irrigation requirements
  - Reduce unbeneficial water use
  - Soil available water can buffer between irrigation events
- Grain yield response to irrigation is affected by timing and amount of water
  - Minimize stressing the crop at critical growth stages
- Account for inter-annual variability of crop conditions
  - Static management may not respond to existing conditions and can lead to unintended consequences
- Yield variability increases as irrigation decreases
  - Increased risk associated with adopting deficit irrigation
- Deficit irrigation strategies are not universal
  - A strategy that works for one location may not work for another; should account for climate, soil type, crop type, residue & land management, etc.

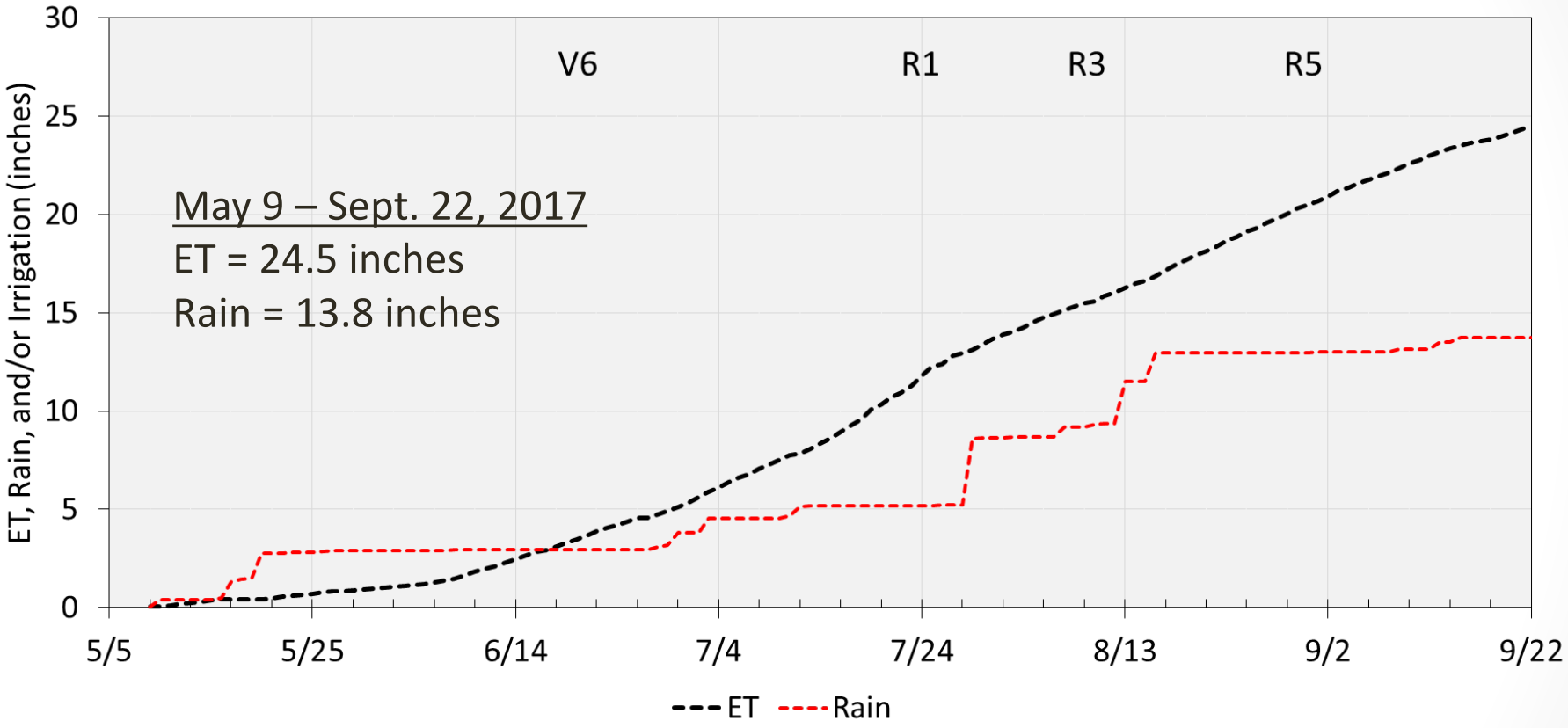
Producer Irrigation Decisions



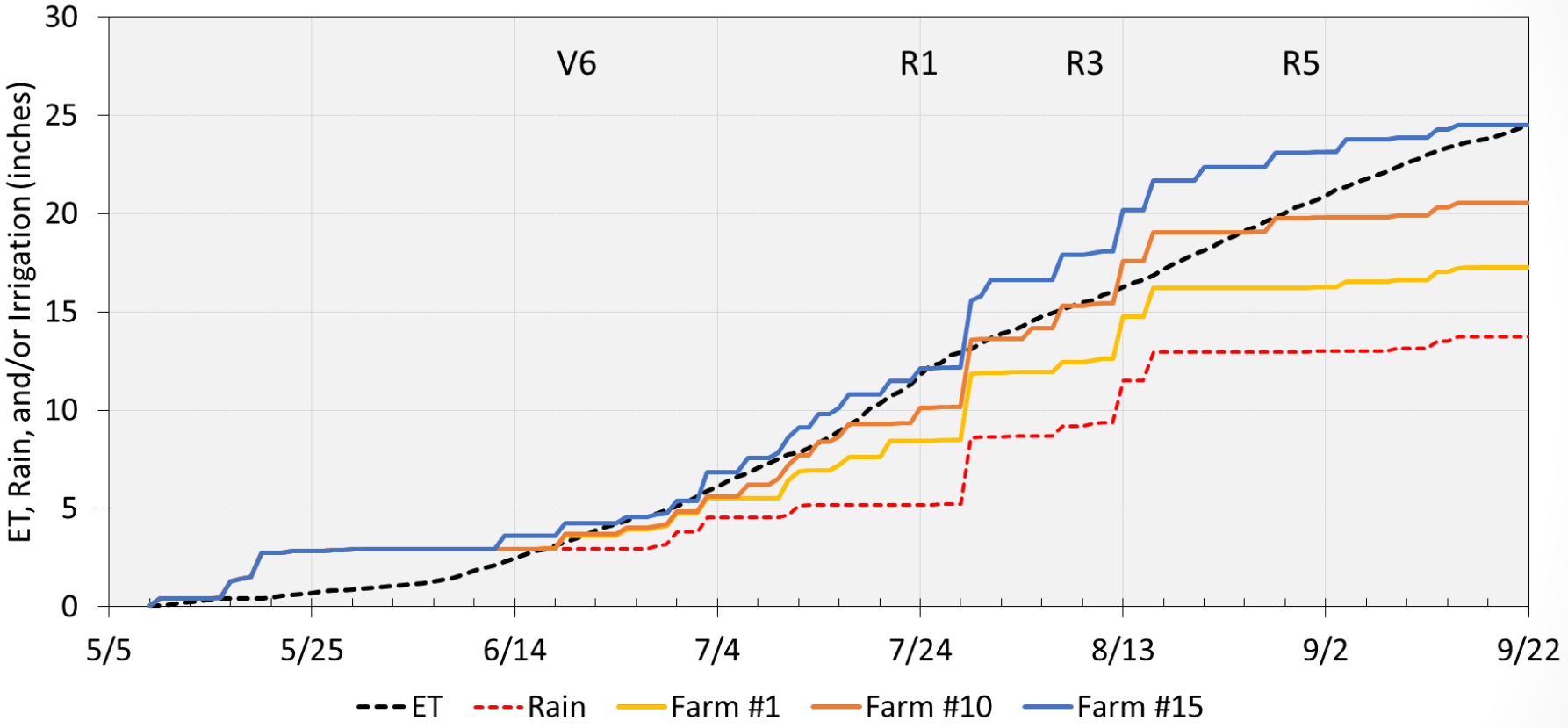
Farm Profitability



ET vs. Water Supply



ET vs. Water Supply



Irrigation

Farm 1: 3.5 inches

Farm 10: 6.8 inches

Farm 15: 10.75 inches

Grain Yield

Farm 1: 250 bu/ac

Farm 10: 261 bu/ac

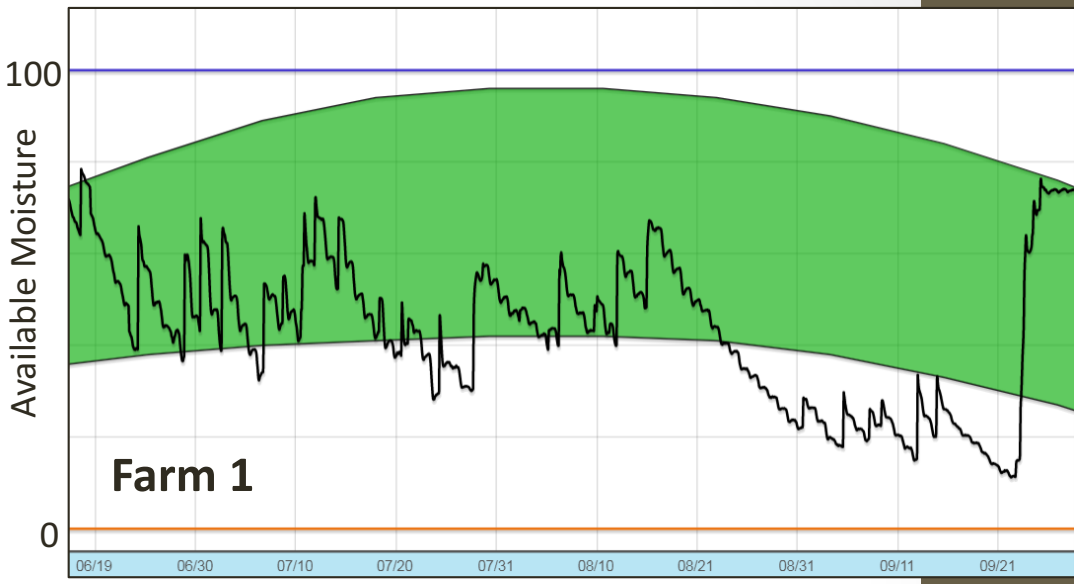
Farm 15: 247 bu/ac

Soil Water Status

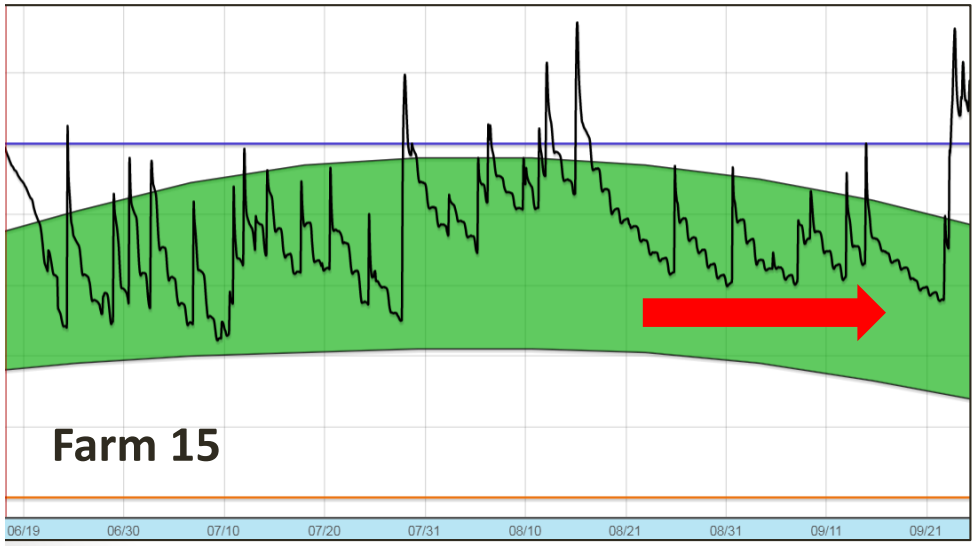
Farm 1: 3.5 inches

Farm 10: 6.8 inches

Farm 15: 10.75 inches



AquaSpy®



Acknowledgements

Nebraska Growers

Non-Profit Organizations

Nebraska Corn Board
The Nature Conservancy
Platte River
Nebraska Water Balance Alliance
OgallalaWater.org
AQUA MART

UNL TAPS
TESTING AG PERFORMANCE SOLUTIONS

Improving Input Use Efficiency & Farm Profitability

Regulatory Agencies

Twin Platte Natural Resources District
Central Nebraska Public Power and Irrigation District
Lower Republican Natural Resources District
Upper Republican NRD
Tri Basin Natural Resources District
Middle Republican Natural Resource District

Industry

SureFire Ag Systems
servi tech
Farm Credit Services of America
Plains Equipment Group
Ag Valley
Ward Laboratories, Inc. Ag Testing - Consulting
Agri-Inject
LI-COR
AirScout The Proactive Crop Management Tool
Martin Planter Attachments
The Climate Corporation
AquaSpy
FarmersEdge
divirod Measure · Manage · Thrive
Simplot
Iowa-Nebraska Equipment Dealers Association
Lindsay Corporation
Precision Planting

USDA United States Department of Agriculture
National Institute of Food and Agriculture

Water for Food
Daugherty Global Institute
at the University of Nebraska

Science and data in action

Panelists

Jim Butler, Kansas Geological Survey

Daran Rudnick, University of Nebraska-Lincoln

Jourdan Bell, Texas A&M University

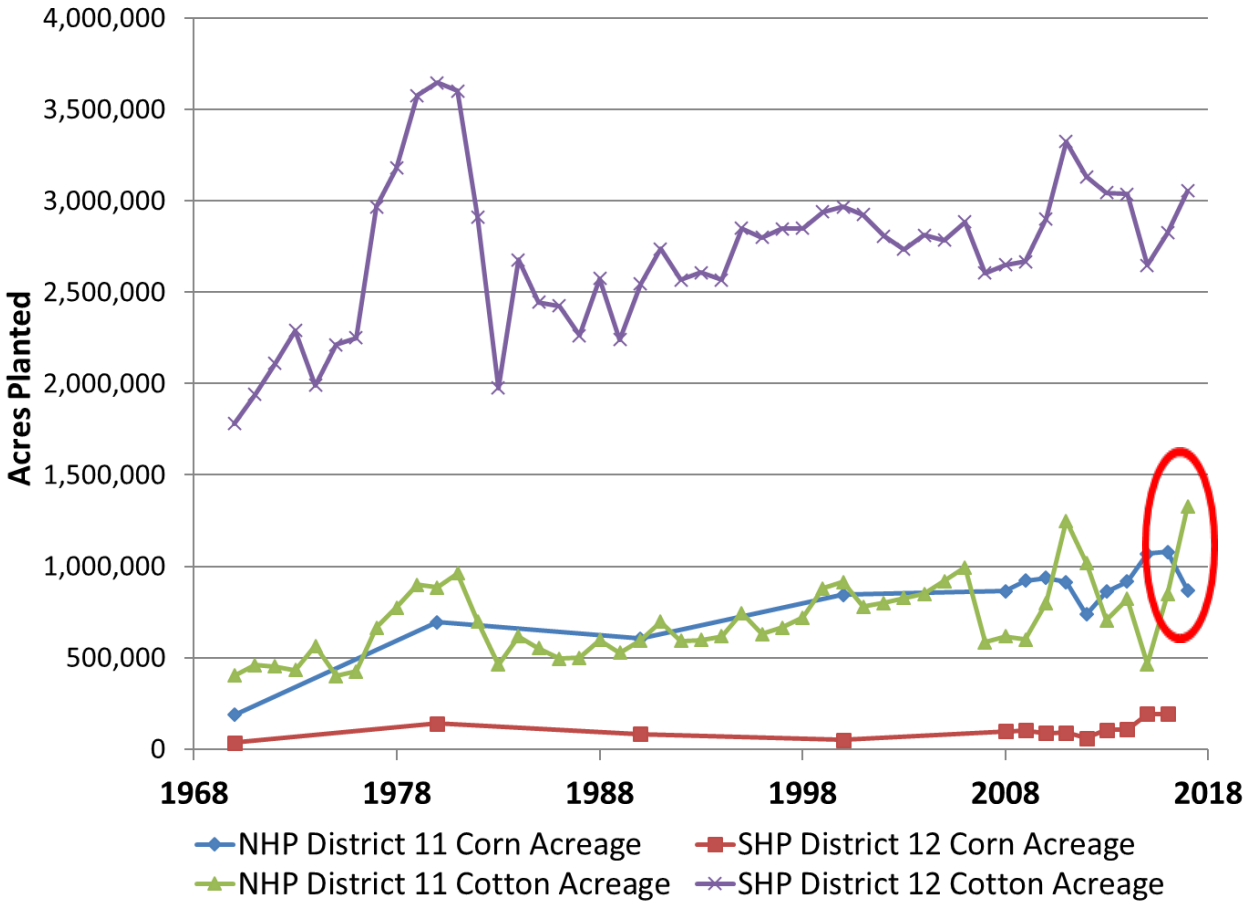
Saleh Taghvaeian, Oklahoma State University

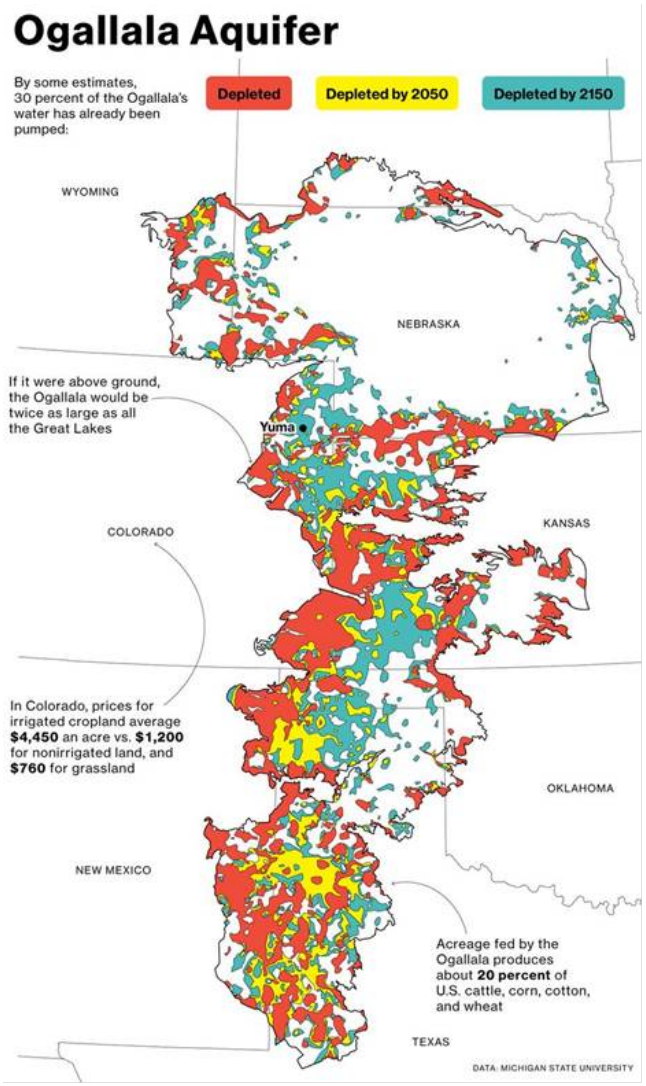
Dave Brauer, USDA-ARS

Jim Dobrowolski, USDA-NIFA

Moderator: Meagan Schipanski, Colorado State University

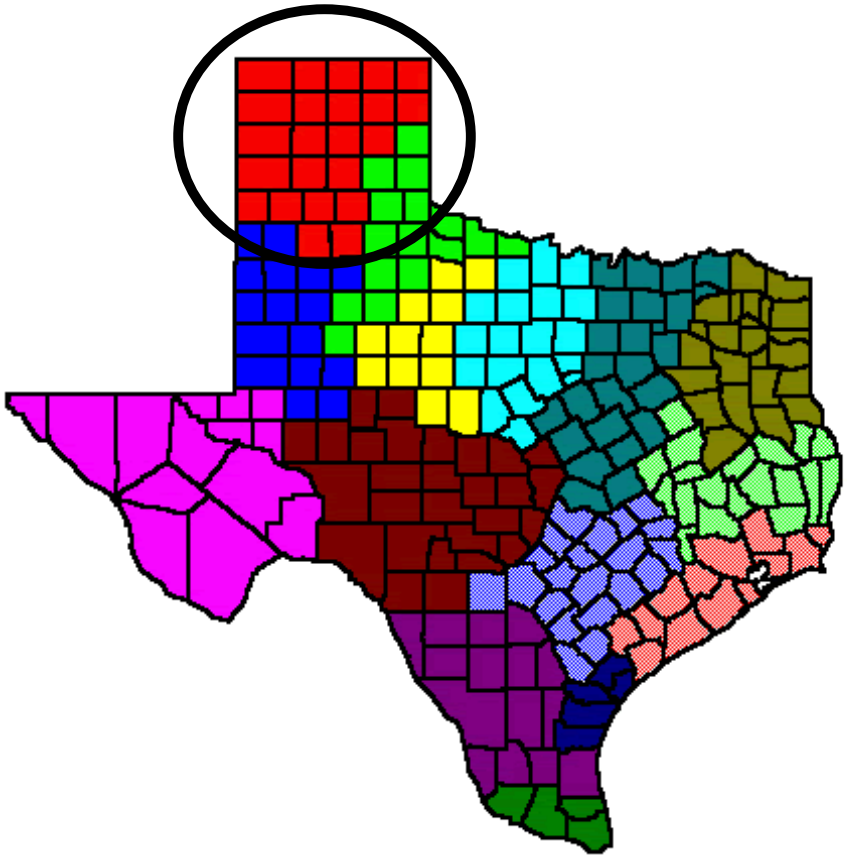
Transitioning Texas Acreage as Well Capacities Decline

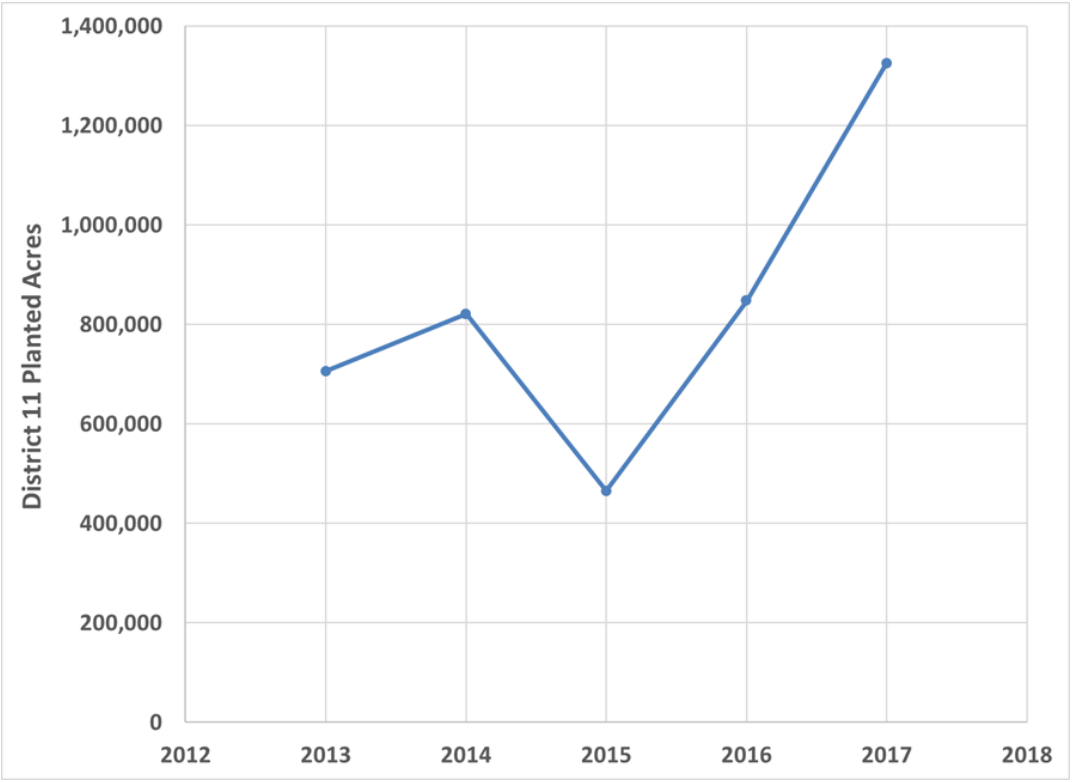




Texas A&M AgriLife Extension

Texas A&M AgriLife Research





Legend

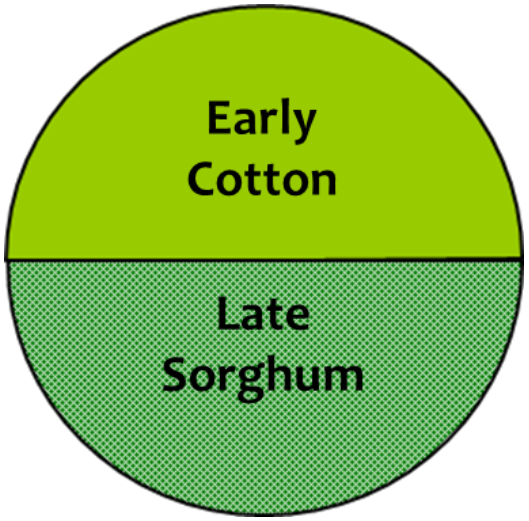
Color Key	Code	Numeric Name	Geographic Name
	11	District 1-North	Northern High Plains
	12	District 1-South	Southern High Plains

TEXAS A&M AGRILIFE EXTENSION

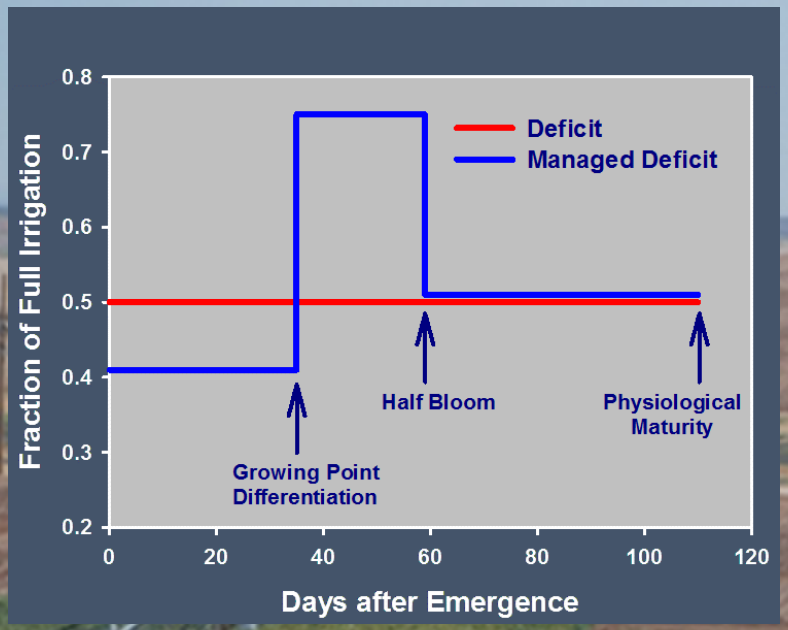
TEXAS A&M AGRILIFE RESEARCH

Split Pivot Scenarios…

- Splitting acreage with another crop provides the opportunity to:
  - Manage residue and minimize soil evaporation
  - Avoid overlap in peak irrigation demand
  - Incorporate a fallow period and bank water
- Example: splitting pivot acreage with cotton planted early May and sorghum planted late June
  - Peak cotton water use early July to mid-late August
  - Reduce irrigation after cutout if soil moisture is available
  - Half pivot with early to medium maturity sorghum
  - Plant around July 1
  - Flowering about September 1



Managed Deficit Irrigation in Grain Sorghum

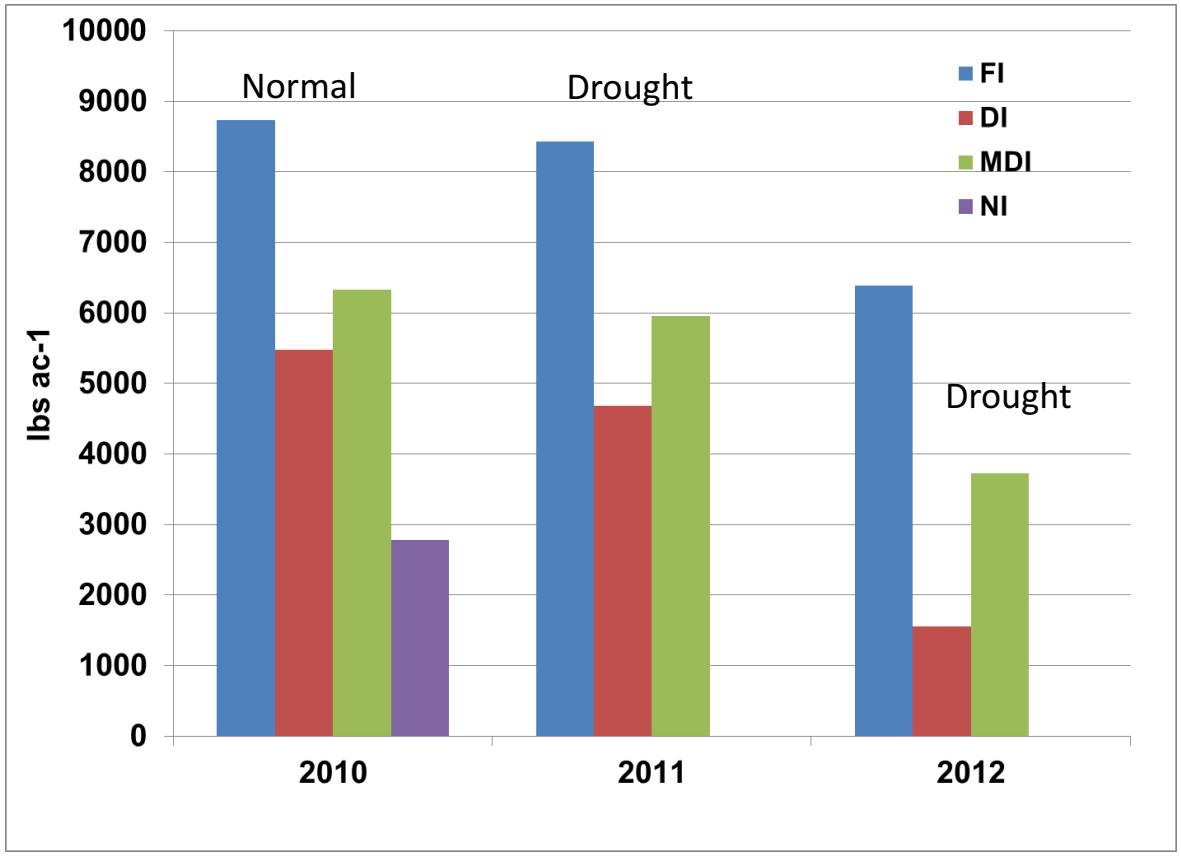


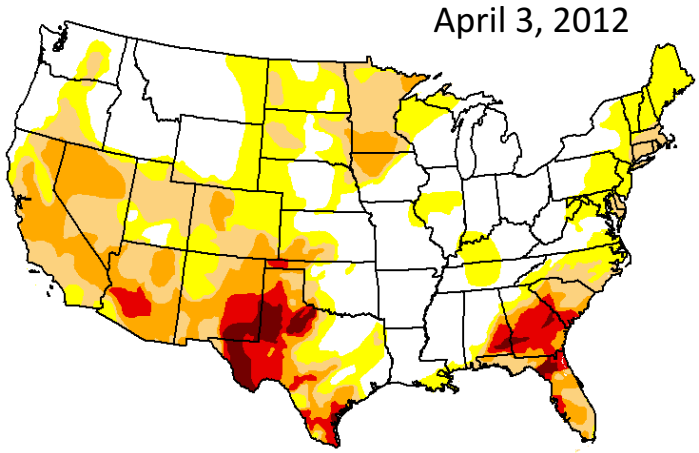
1. Eliminate 1-2 early season irrigation events compared with DI
2. Differentiation to half bloom, irrigation scheduled at 75% FI
3. Half bloom to maturity, irrigation scheduled at 50%FI
4. Must have the well capacity to apply greater depth during critical growth periods.

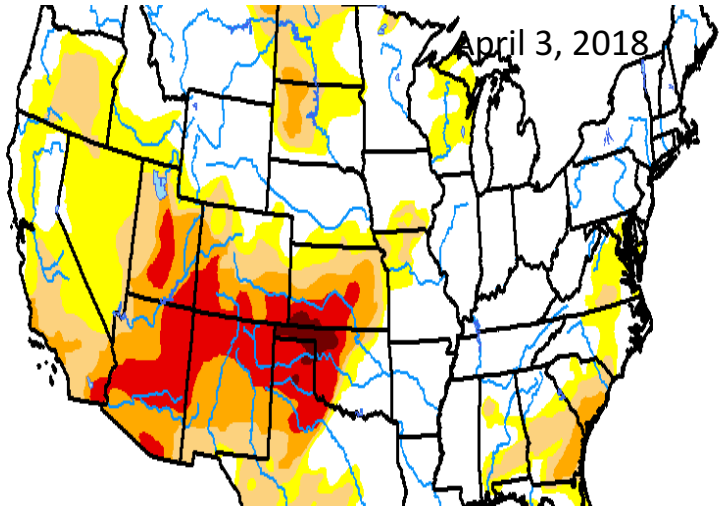
Texas A&M AgriLife Extension

Texas A&M AgriLife Research

Grain Yield Enhanced in Drought Years







TEXAS A&M AGRILIFE EXTENSION

TEXAS A&M AGRILIFE RESEARCH

Science and data in action

Panelists

Jim Butler, Kansas Geological Survey

Daran Rudnick, University of Nebraska-Lincoln

Jourdan Bell, Texas A&M University

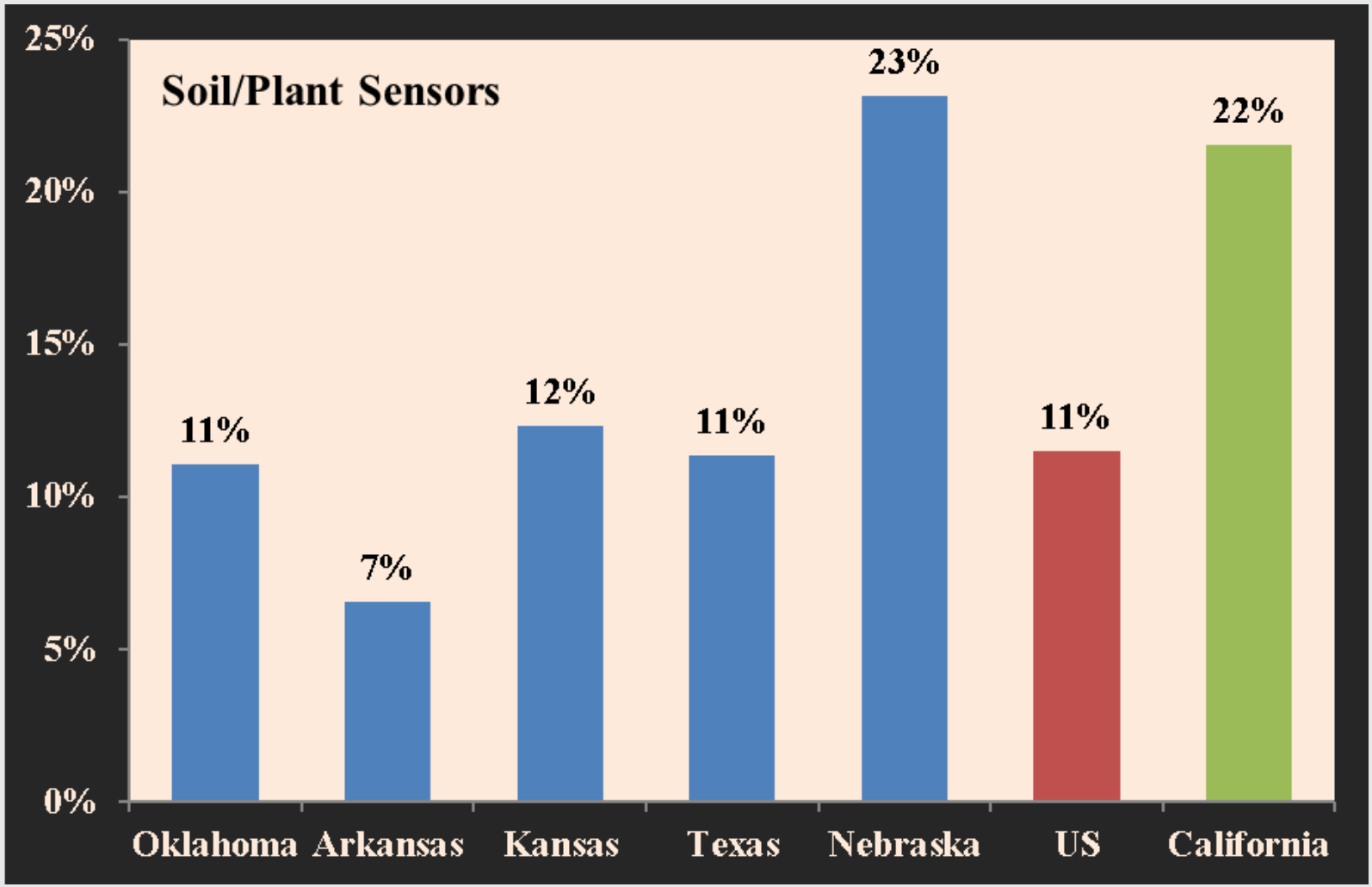
Saleh Taghvaeian, Oklahoma State University

Dave Brauer, USDA-ARS

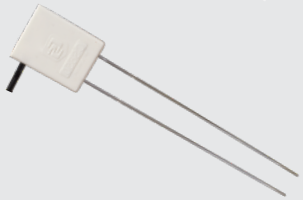
Jim Dobrowolski, USDA-NIFA

Moderator: Meagan Schipanski, Colorado State University

Sensor technologies for Irrigation Scheduling

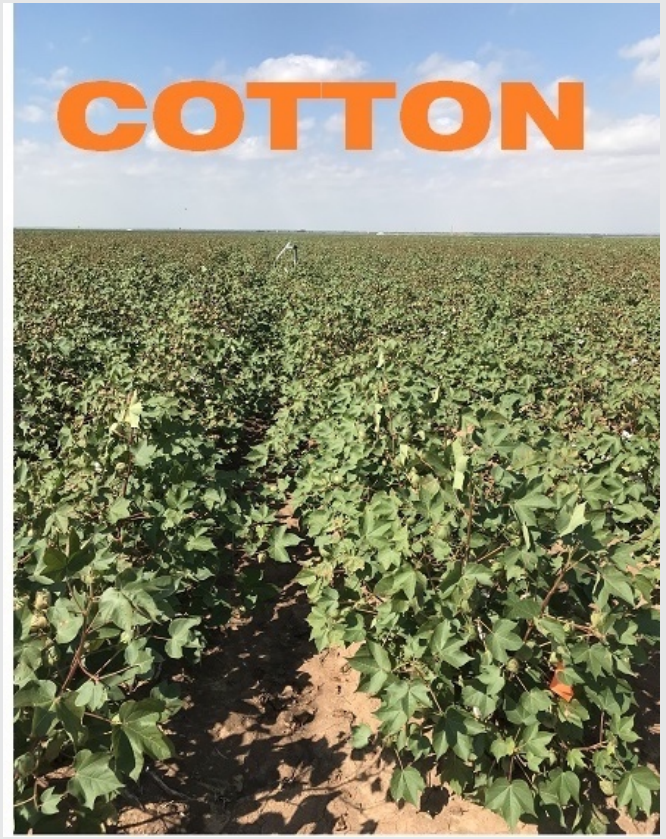


Sensor technologies for Irrigation Scheduling



Low Clay, Low Salt

High Clay, High Salt

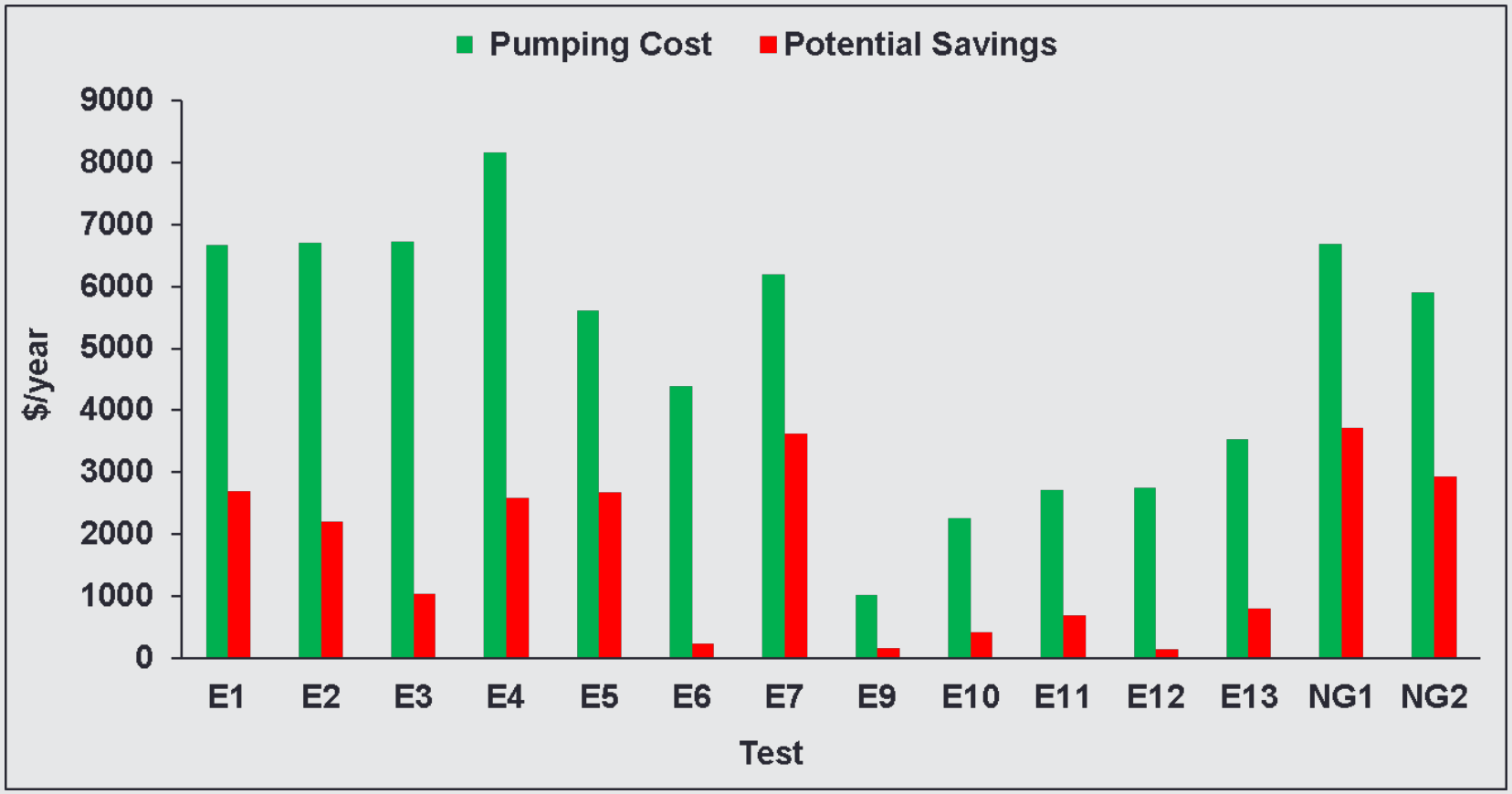


Center Pivot Energy/Water Audits

- Energy consumption efficiency in pumping plants
- Water application uniformity; conveyance efficiency
- Economic viability; water resources sustainability

Center Pivot Energy/Water Audits

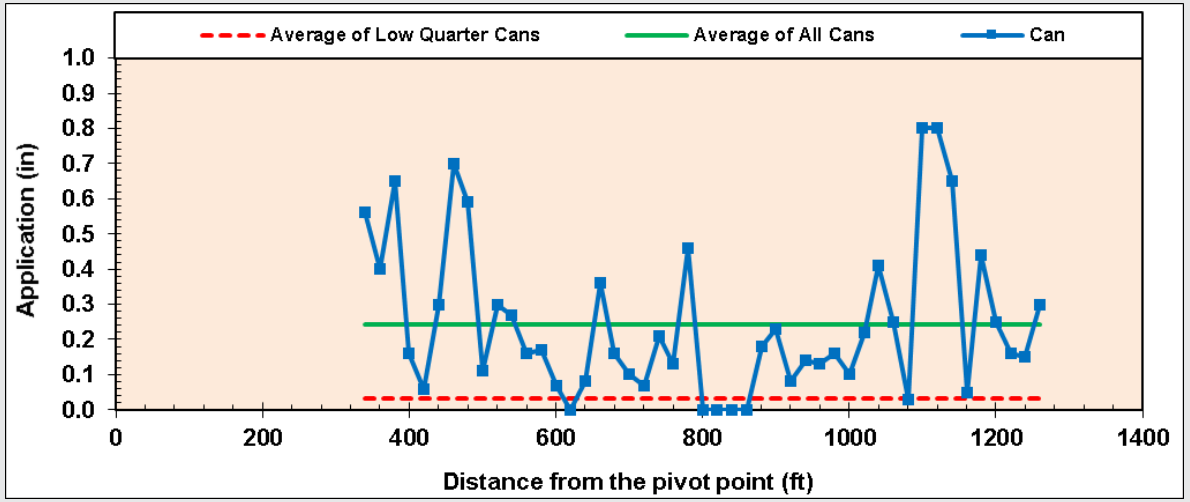
- Electric: 30% saving; Natural gas: 47% saving

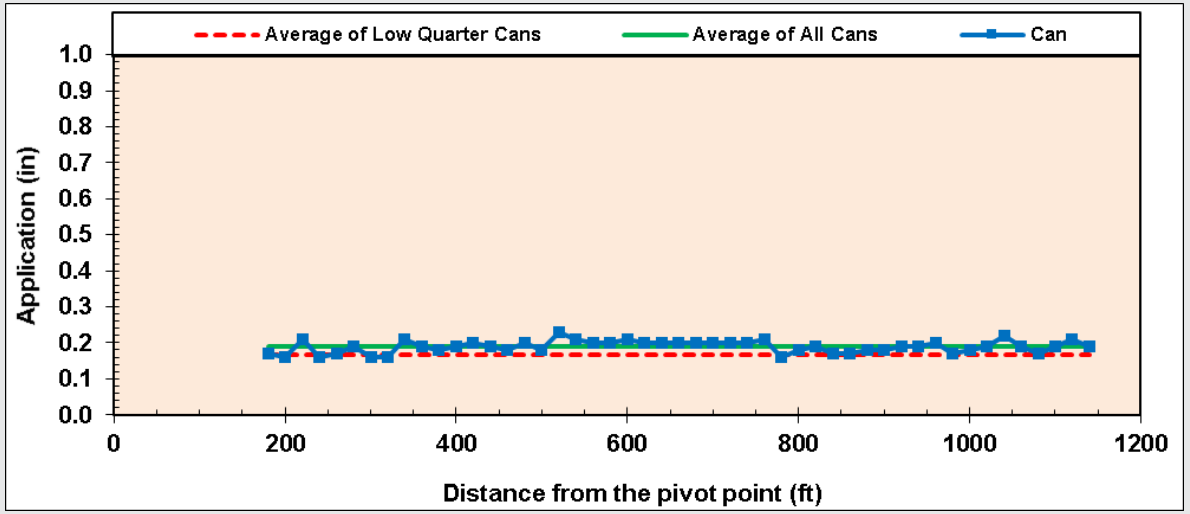


Center Pivot Energy/Water Audits

Water application uniformity:

14% to 88%





Center Pivot Energy/Water Audits

- Public-private partnership

Science and data in action

Panelists

Jim Butler, Kansas Geological Survey

Daran Rudnick, University of Nebraska-Lincoln

Jourdan Bell, Texas A&M University

Saleh Taghvaeian, Oklahoma State University

Dave Brauer, USDA-ARS

Jim Dobrowolski, USDA-NIFA

Moderator: Meagan Schipanski, Colorado State University

OGALLALA SUMMIT 2018

OGALLALA AQUIFER PROGRAM WAS RECEIPT OF U.S. SECRETARY OF AGRICULTURE EXCELLENCE AWARD (2013)

"FOR SUSTAINING RURAL PROSPERITY ACROSS THE DROUGHT PRONE SOUTHERN HIGH PLAINS BY FINDING SOLUTIONS TO PROBLEMS FROM DECLINING WATER AVAILABILITY FROM THE OGALLALA AQUIFER"

2003 AUTHORIZATION LANGUAGE

THE OVERALL GOALS OF THE COOPERATIVE EFFORT IS TO SEEK SOLUTIONS TO THE COMPLEX WATER PROBLEMS AND CHALLENGES BEING FACED IN WEST TEXAS AND WESTERN KANSAS.

THE BROAD OBJECTIVES FOR THE RESEARCH AND TECHNOLOGY TRANSFER ACTIVITIES ARE AS FOLLOWS:

1. DEVELOP, EVALUATE, AND DISSEMINATE INFORMATION AND TECHNOLOGIES FOR WATER USERS
2. PROVIDE SCIENTIFICALLY SOUND DATA AND KNOWLEDGE TO PLANNERS AND POLICYMAKERS TO ENABLE THEM TO DEVELOP EFFECTIVE WATER MANAGEMENT POLICIES

HIGHLIGHTS OF OGALLALA AQUIFER PROGRAM

- $40-50 MILLION CATALYSIS FOR AG. RESEARCH AND TECHNOLOGY TRANSFER FOR THE SOUTHERN HIGH PLAINS
  - ARS, KSU, TAMU, TTU AND WTAMU
- HIGHLY LEVERAGED FUNDING
- SEMI-COMPETITIVE PEER REVIEW PROCESS
- ANNUAL WORKSHOP

SUCCESSFUL OAP TEAMS

- ECONOMIC ASSESSMENT AND IMPACT TEAM
- IRRIGATION TECHNOLOGY TEAM
- TECHNOLOGY TRANSFER
- EMERGING TEAM: UAS/UAV/DRONES DATA COLLECTION AND PROCESSING

EXCITING OAP RESEARCH PROJECTS

- DATA BASES
  - 30 YEARS OF DETAILED CROP WATER USE DATA
  - 60+ YEARS OF DRYLAND CROP PRODUCTION DATA
  - 80+ YEARS OF CLIMATE DATA
- INTEGRATING SOIL AND PLANT SENSORS WITH VRI IRRIGATION TECHNOLOGY
- SPECIALTY CROPS

OAP ROLE IN OGALLALA GROUNDWATER WITHDRAWALS

- SOUTHERN HIGH PLAINS
  - AG BUSINESSES ASSESSMENTS AT REGIONAL/STATE SCALE
- KANSAS
  - DATA SUPPORTED STATE LAWS AND WATER VISION
  - ADAPTIVE MANAGEMENT FOR LEMA
  - DOCUMENTING LEMA SUCCESSES
- TEXAS
  - MANAGEMENT INSIGHTS INTO MANAGING WATER OVER TIME AND SPACE (RELATED TO GWD RULES)

Science and data in action

Panelists

Jim Butler, Kansas Geological Survey

Daran Rudnick, University of Nebraska-Lincoln

Jourdan Bell, Texas A&M University

Saleh Taghvaeian, Oklahoma State University

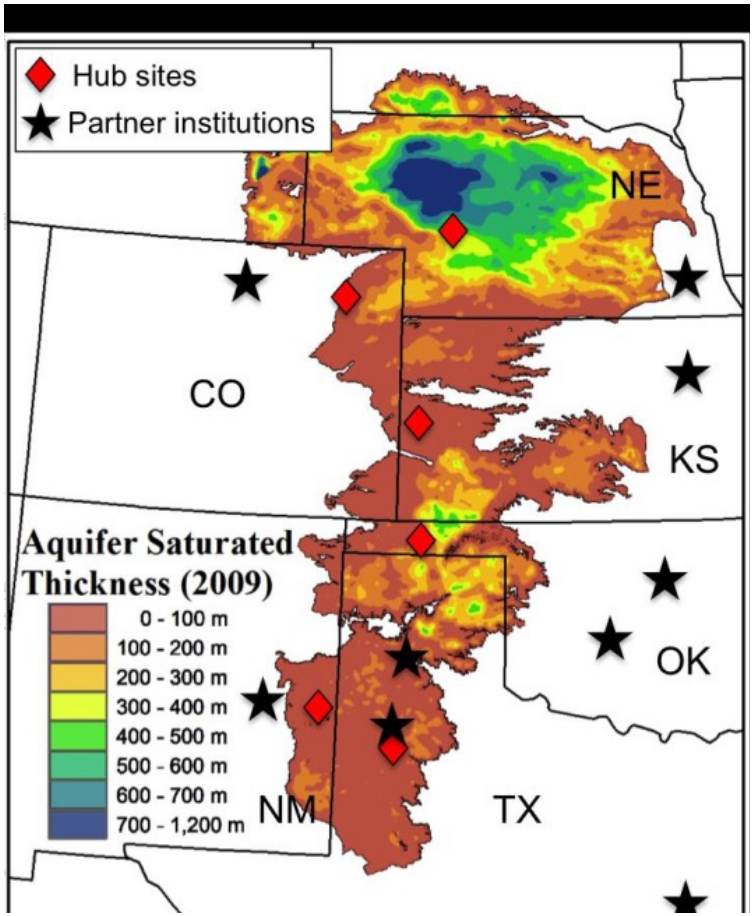
Dave Brauer, USDA-ARS

Jim Dobrowolski, USDA-NIFA

Moderator: Meagan Schipanski, Colorado State University

Public Sector Ag Research A Necessity?

- When I started in this job, only 20+ percent of the proposals submitted to NIFA were funded. Today, the funding rate for AFRI has dipped to barely 10 percent.
- I remember when Sonny Ramaswamy asked us to calculate the number of proposals addressing AFRI RFAs--Out of more than 3800 proposals delivered to NIFA, 1,600 were recommended for funding, and, unfortunately, we funded only 390 proposals with the resources available.
- In this highly competitive environment, many talented scientists and researchers leave agricultural sciences both frustrated and disappointed--at a time when the need for their innovation is greatest or taking their expertise to other countries that are more supportive of public sector research.



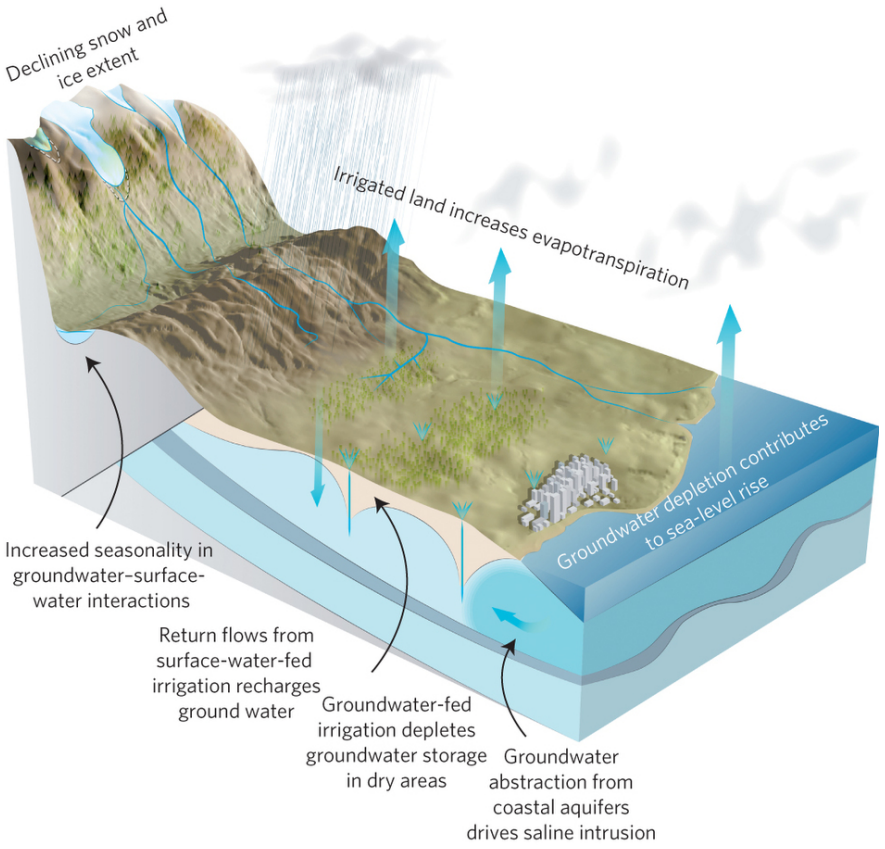
What does the future hold?

- A growing population, climate change, diminishing land and water resources, and the need to ensure food security are becoming ever more urgent.
- Funding shortfalls become even more daunting when one considers the urgency of new pests, pollinator health, water, carbon and nutrient footprints and the need for innovations for advanced manufacturing and economic enterprises.

WAG HAS ***ENDED***

Our research funding is focused on Ag sustainability

- Funding research to respond to these challenges should be considered as an investment in our Nation's future, an investment that will pay big dividends in the years to come.
- We focus funded research towards sustaining agriculture—new technologies, decision support, additional income streams



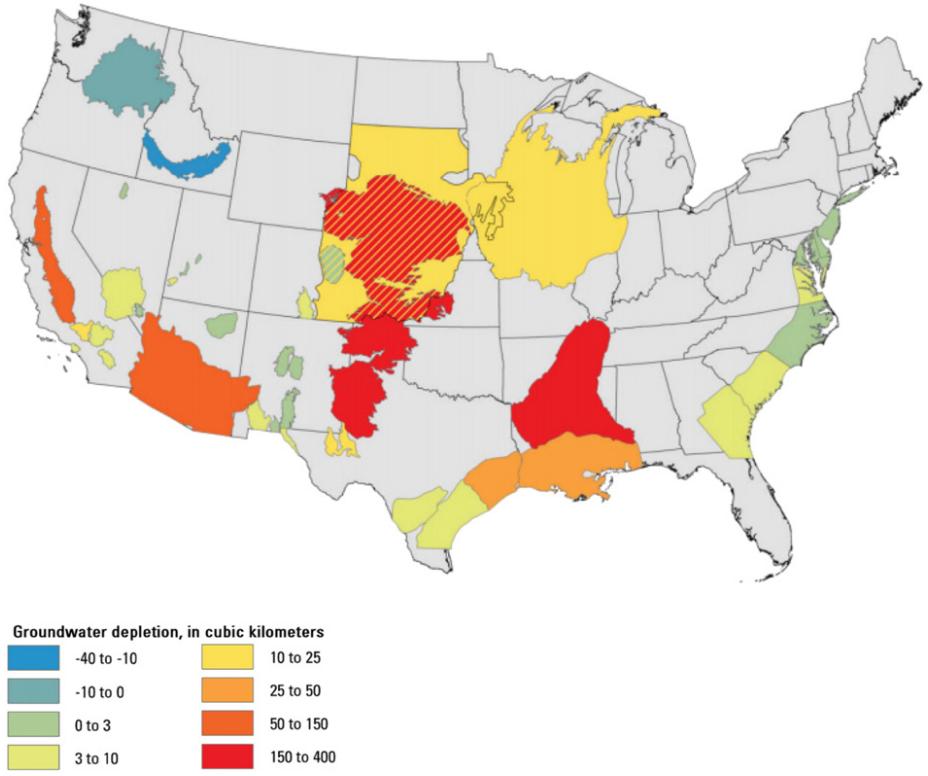
NIFA: Federal Assistance—A Small Agency with a big budget

- $1.5+ Billion
- Capacity programs
- Competitive grants
- Targeted programs
- Agreements with other Federal agencies

USDA-NIFA's MISSION

"Invest in and advance agricultural research, education, and extension to solve societal challenges."

Not an action agency; nor regulatory…

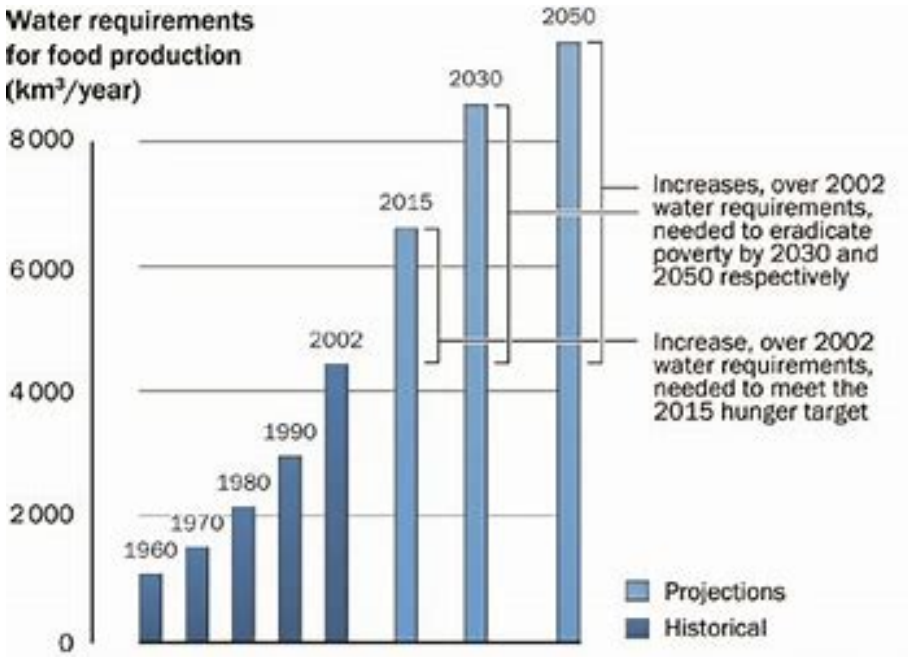


Strategically We Plan To:

- Catalyze exemplary and relevant research, education and extension programs
- Advance America's global partnerships in food and agricultural sciences

OK so how do we do that?

- We've already heard repeatedly that producers count on new technologies—and decision makers count on reliable data sources:
  - Agriculture and Food research initiative ("AFRI" Flagship funding line)
  - ***Water for Food Production Systems (WFPS) Challenge Area—current FY2017 RFA CLOSED AT $34 M (up from $21.7 M in 2016)***



OK so how do we do that?

- Agriculture and Food research initiative ("AFRI" Flagship funding line)
  - ***Sustainable agricultural systems (SAS) initiative—current FY2018 RFA unreleased AT $66 M @$10 M each***
- NIFA will invest $65,809,000 for new grants to catalyze transformative, integrated, and transdisciplinary systems-level approaches to ↑ agricultural production, productivity and profitability, ensure nutritional security and food safety, and foster the bioeconomy.
- NIFA will support initiatives such as the microbiome and Food and Ag Cyberinformatics and Tools (FACT).

OK so how do we do that?

- We leverage and partner:
- Innovation at the nexus of Food, Energy and water (INFEWS) partnership with NSF

You need to “see yourself” in our RFAs

- Part of SAS, AFRI Foundational BNRE, Ag systems, nano and others….INFEWS
- Take advantage of review panel membership
- You are an important stakeholder group

Jim Dobrowolski

jdobrowolski@nifa.usda.gov

202-401-5016

Thanks!

Ogallala Aquifer
SUMMIT

APRIL 9 - 10, 2018 | GARDEN CITY, KANSAS

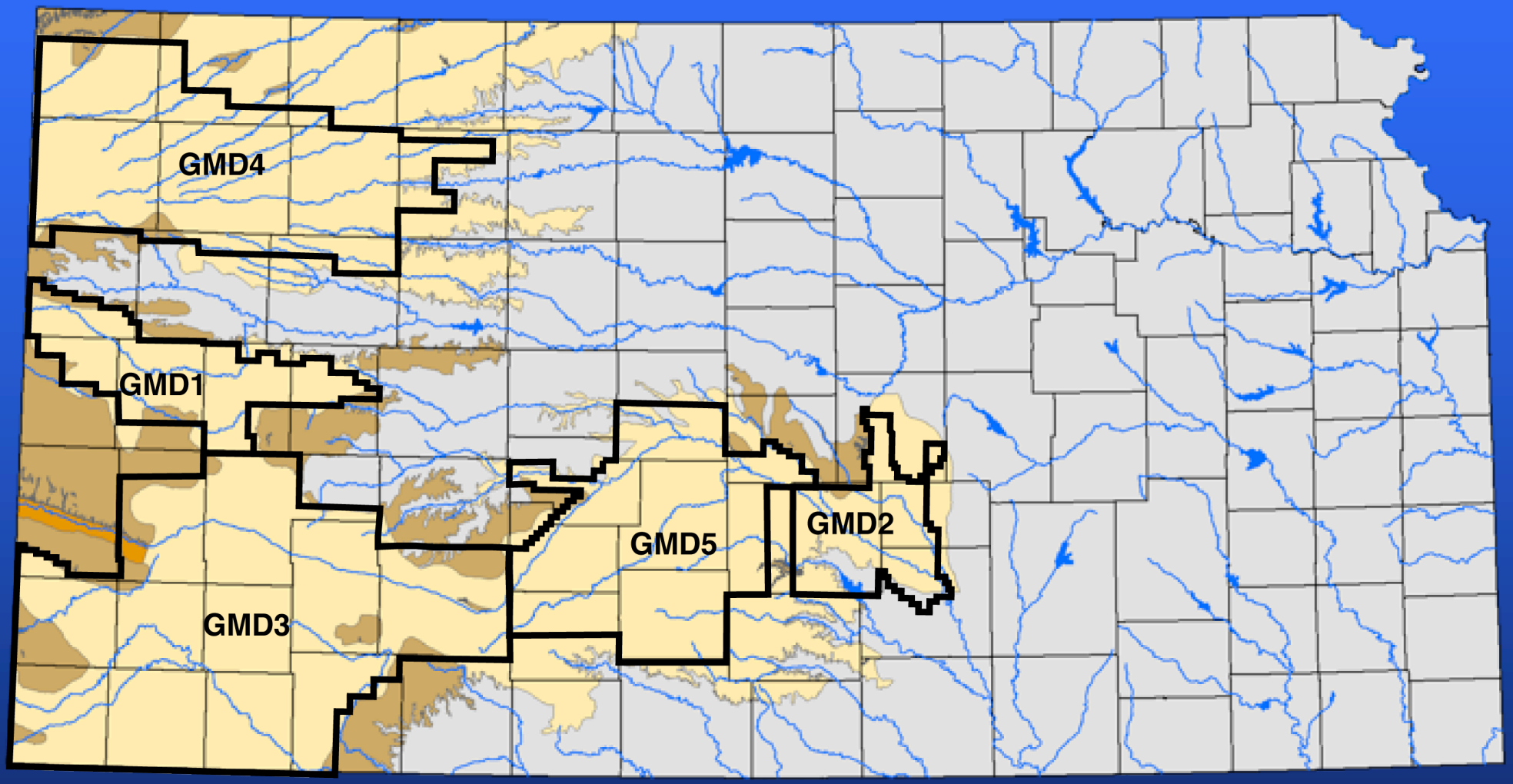
Up next:

9:00 Floor mic Q & A with science panelists

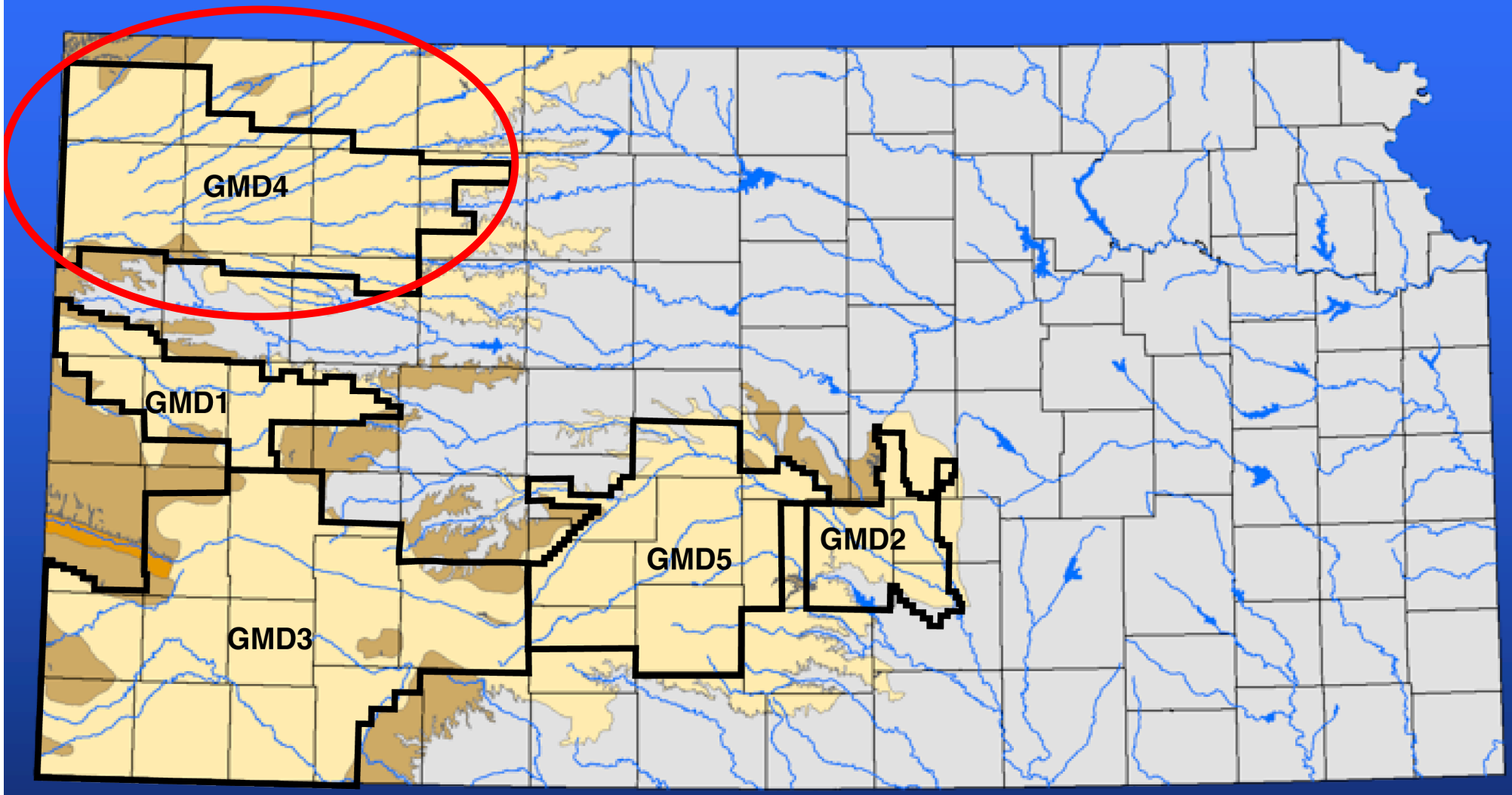
9:15 Key takeaway from science panel: table workshop

9:30 Break

The High Plains Aquifer in Kansas
- Groundwater Management Districts (GMDs)

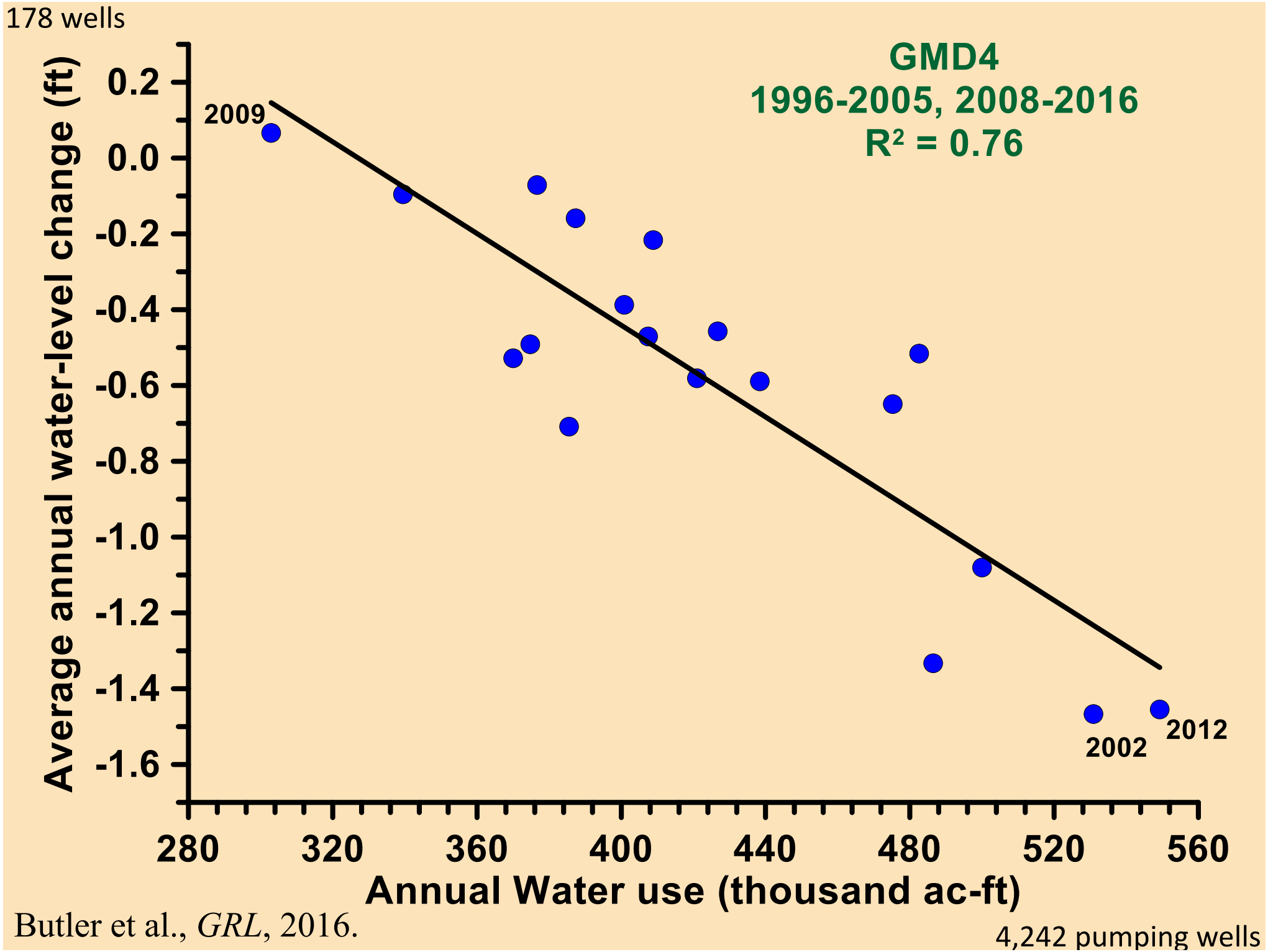


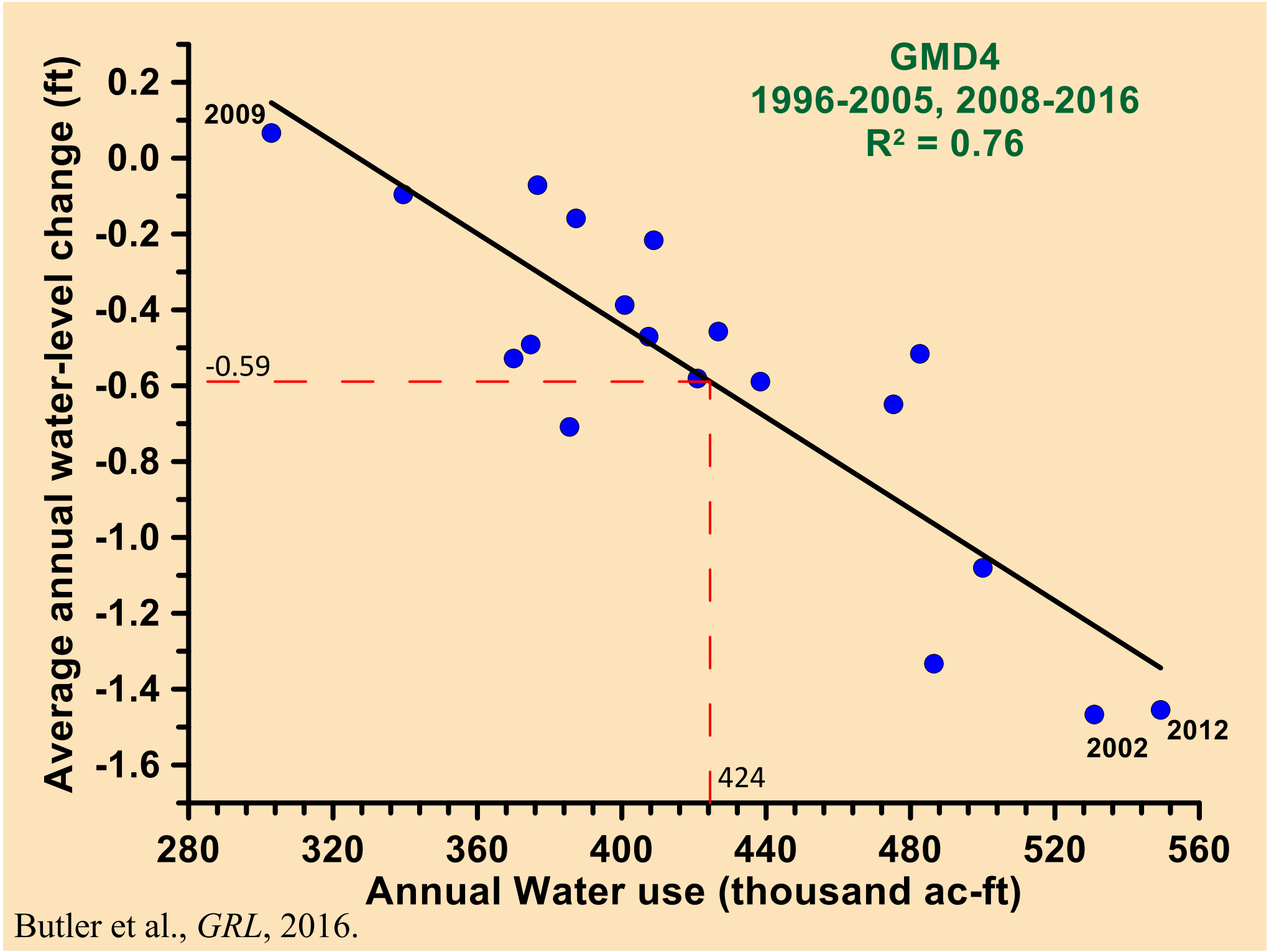
Aquifer Stability Assessment



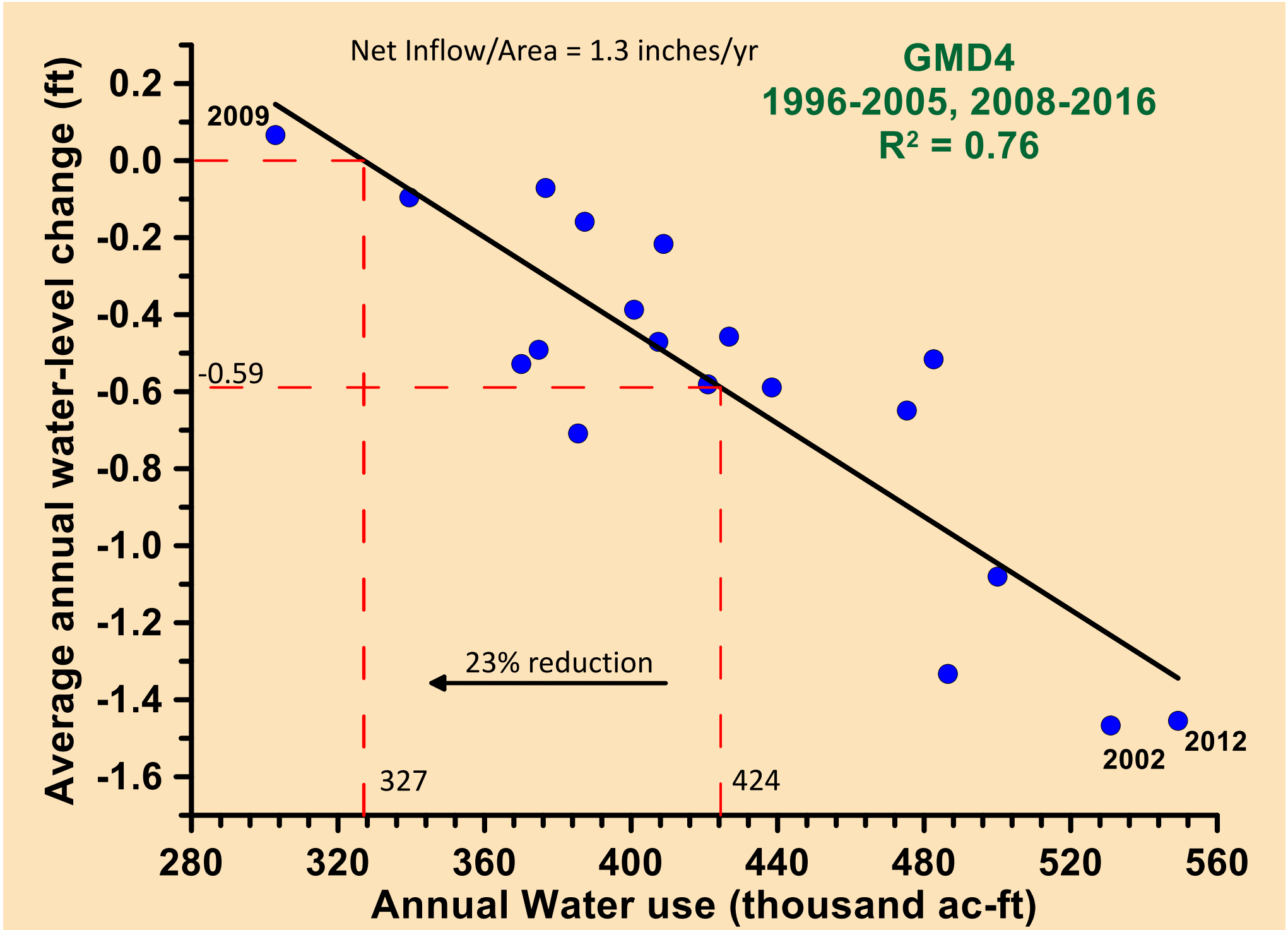
GMD4 area = 3.11 million acres (4,852 mi^2)

- 178 wells measured every year from 1996-2016
- 4,242 pumping wells with flowmeters


178 wells
GMD4
1996-2005, 2008-2016
R² = 0.76
2009
2002
2012
Average annual water-level change (ft)
0.2
0.0
-0.2
-0.4
-0.6
-0.8
-1.0
-1.2
-1.4
-1.6
280
320
360
400
440
480
520
560
Annual Water use (thousand ac-ft)
Butler et al., GRL, 2016.
4,242 pumping wells



Butler et al., *GRL*, 2016.



Butler et al., *GRL*, 2016.