WRRC Water Webinar

Empowering Arizona's Water Resource Management: Navigating Equity, Economic, and Ecological Challenges with Cutting-Edge Decision-Support Tools

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Presentation Outline

My story

1. About me
2. Examples of our work
3. Contribution to AZ water management frontiers

My childhood

Food

Supply source

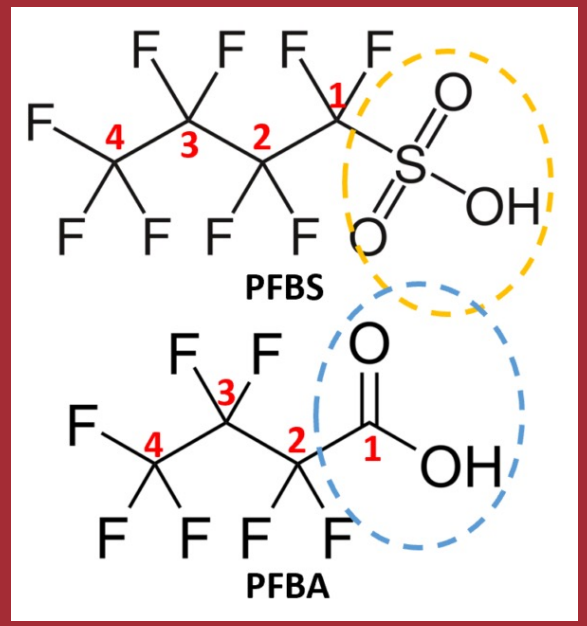
Conveyance

Recreation

Water Quality

My daily routine was centered around water

I went to school and got degrees



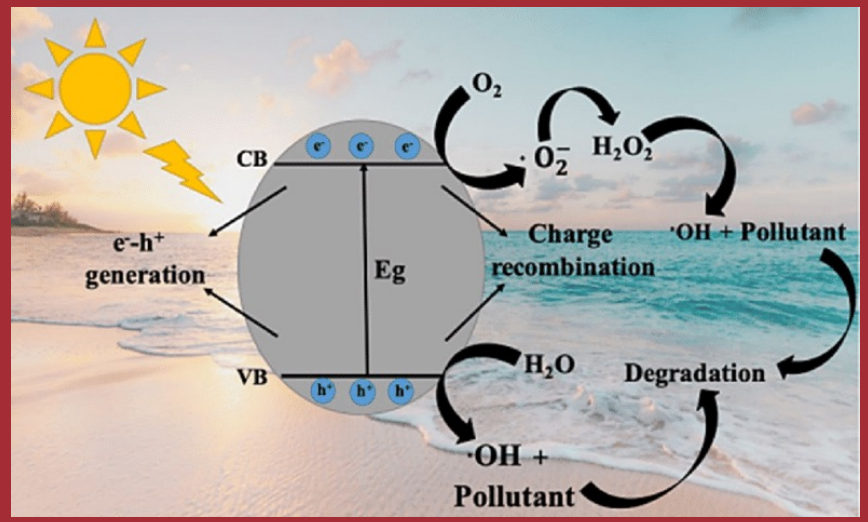
Why do I get sick from drinking water?

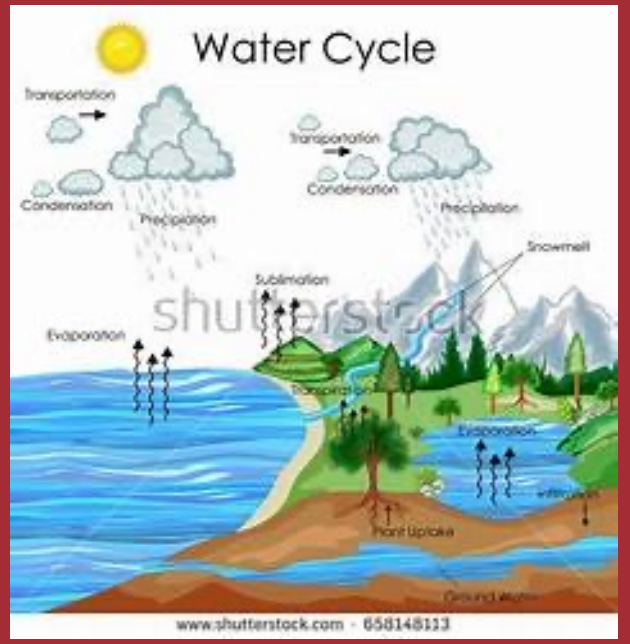
Where can we find water?

How much and how safe is the water?

Where does the rain go? Why is its pattern changing?

How can we model all of these?





And so, percentages like….

Colorado River - 36%
Groundwater - 41%
In-state rivers - 18%
Reclaimed water - 5%,

Reminds me of my days as a “child water manager”
Seen it, studied it, done it!

Source: https://news.asu.edu/

ABC news: Arizona commits $1 billion to boost water supply with alternative water projects

I became a water professional

Diversity of sources
(Supply mgt.)

Conveyance:
(Supply mgt.)

Non-consumptive:
(Demand mgt.)

Consumptive:
Food, Ag., etc.
(Demand mgt.)

Water Quality:
(supply mgt.)

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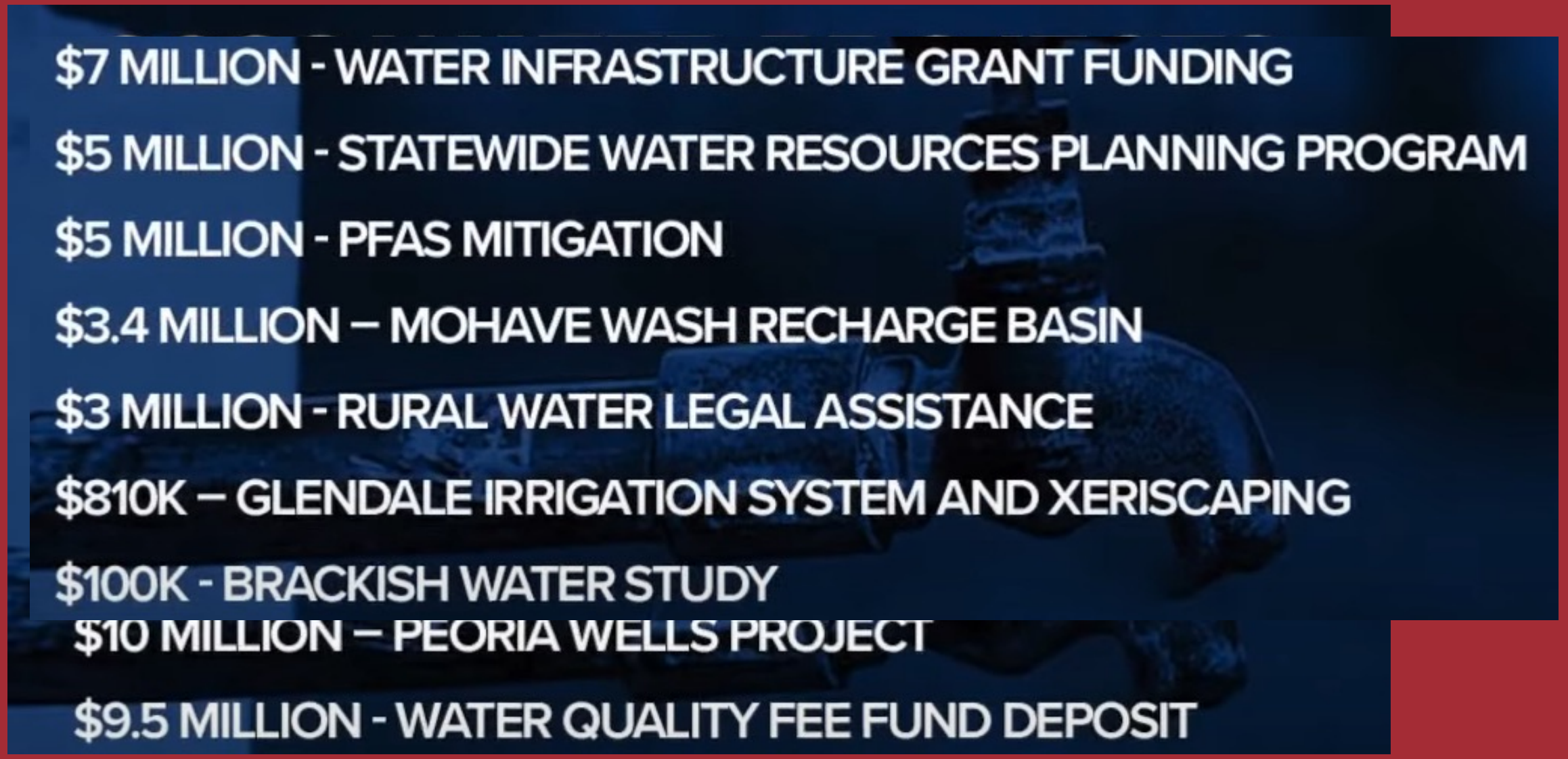

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AZ to end groundwater deal with Saudi Arabian company

OCT. 3

MORE FROM THIS SHOW

Arizona Governor Katie Hobbs' administration announced on Monday two steps to stop a controversial Saudi Arabian company from using groundwater beneath state land in western Arizona to grow and export alfalfa.

Hobbs said in a statement the Arizona State Land Department had canceled one of its leases to Fondomonte Arizona, and would not renew three others that are set to expire in February.

SPOTLIGHT

AIRS DEC. 3
See Trans-Siberian Orchestra at the Footprint Center, December

STAY IN TOUCH WITH AZPBS.ORG!
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FIRST
LAST

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(Supply mgt)

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(Demand mgt.)

Water Quality:
(supply mgt.)

Examples of our work: Remote Sensing of Water

- Integrating data from a suite of satellites into frameworks that support preparedness and response to water challenges.

- Example:

Satellite	Spatial Res	Temporal Res	Spectral Res	Cost	Coverage area
Landsat 8/9	30 m	8 days	11 bands √	Free √	Large √
Sentinel 2	10 m	5 days	13 bands √	Free √	Medium √
PlanetScope	3 m √	Daily √	8 bands	Commercial	Small

remote sensing

MDPI

Article

Comparing PlanetScope to Landsat-8 and Sentinel-2 for Sensing Water Quality in Reservoirs in Agricultural Watersheds

Abubakarr S. Mansaray [1,*], Andrew R. Dzialowski [2], Meghan E. Martin [3], Kevin L. Wagner [1], Hamed Gholizadeh [4] and Scott H. Stoodley [3]

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2 Department of Integrative Biology, Oklahoma State University, Stillwater, OK 74078, USA; andy.dzialowski@okstate.edu
3 Environmental Science Graduate Program, Oklahoma State University, Stillwater, OK 74078, USA; meghan.martin10@okstate.edu (M.E.M.); scott.stoodley@okstate.edu (S.H.S.)
4 Department of Geography, Oklahoma State University, Stillwater, OK 74078, USA; hamed.gholizadeh@okstate.edu
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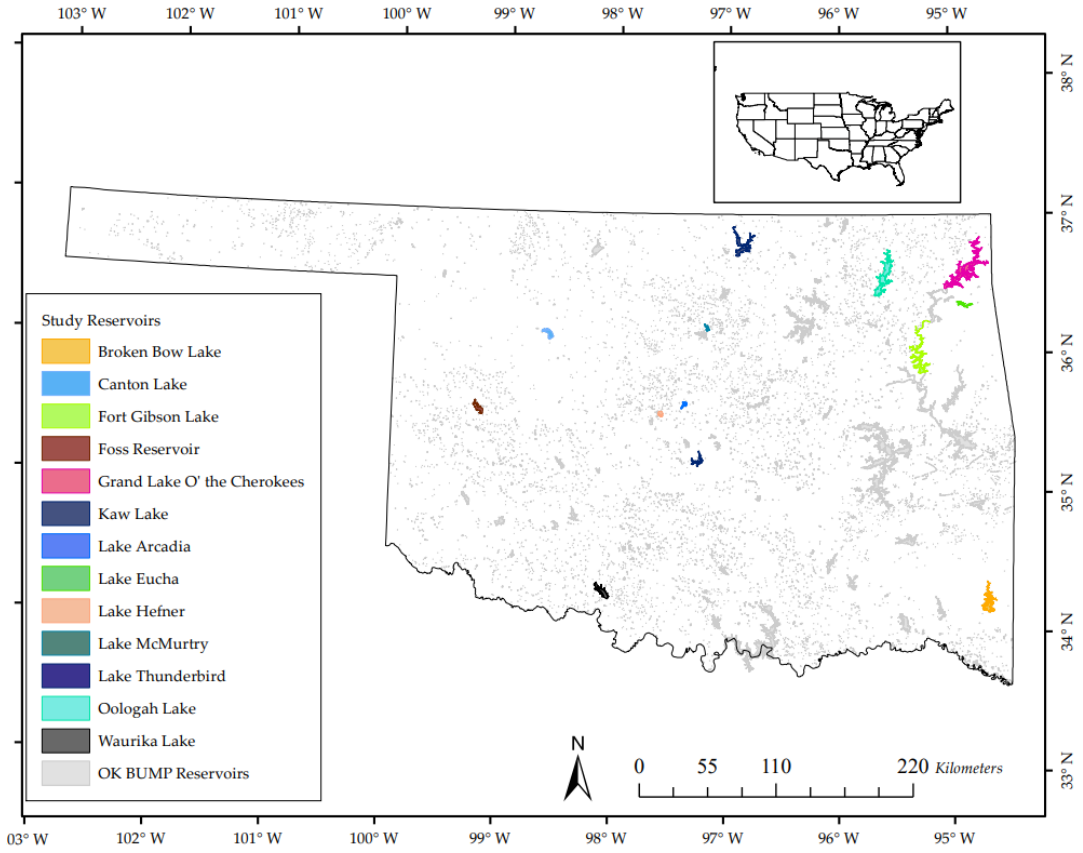
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102° W
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100° W
99° W
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96° W
95° W
38° N
37° N
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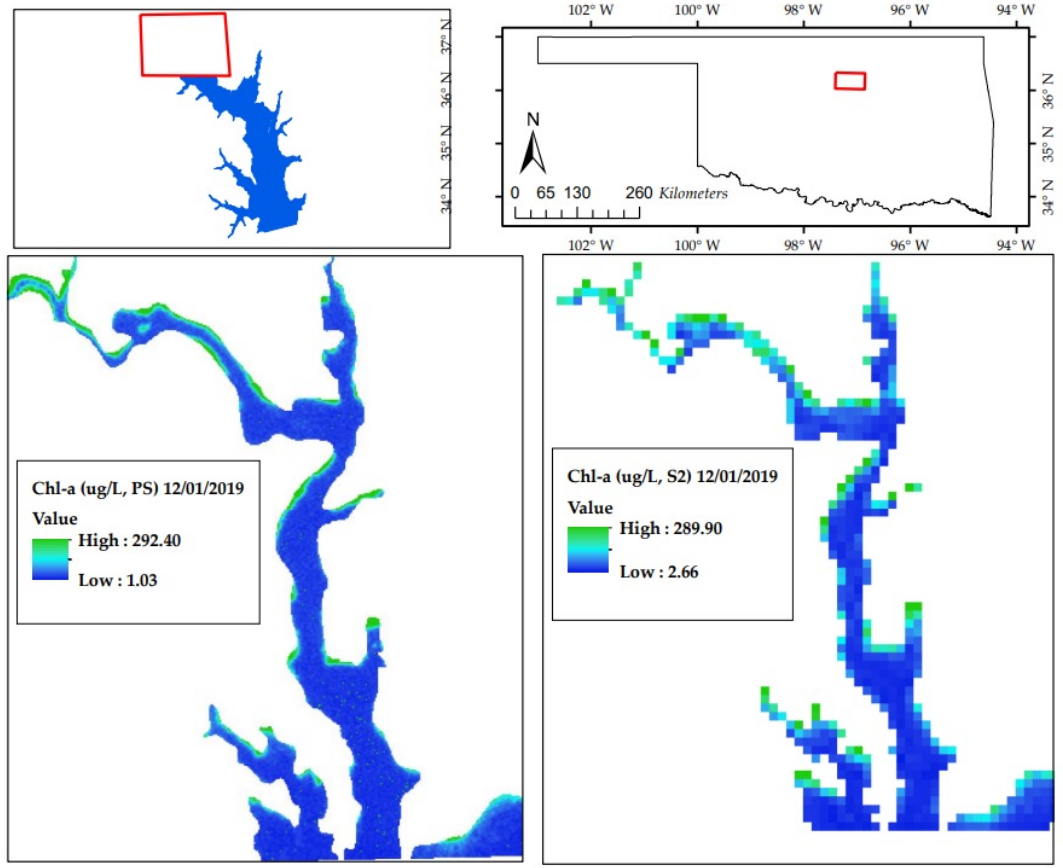
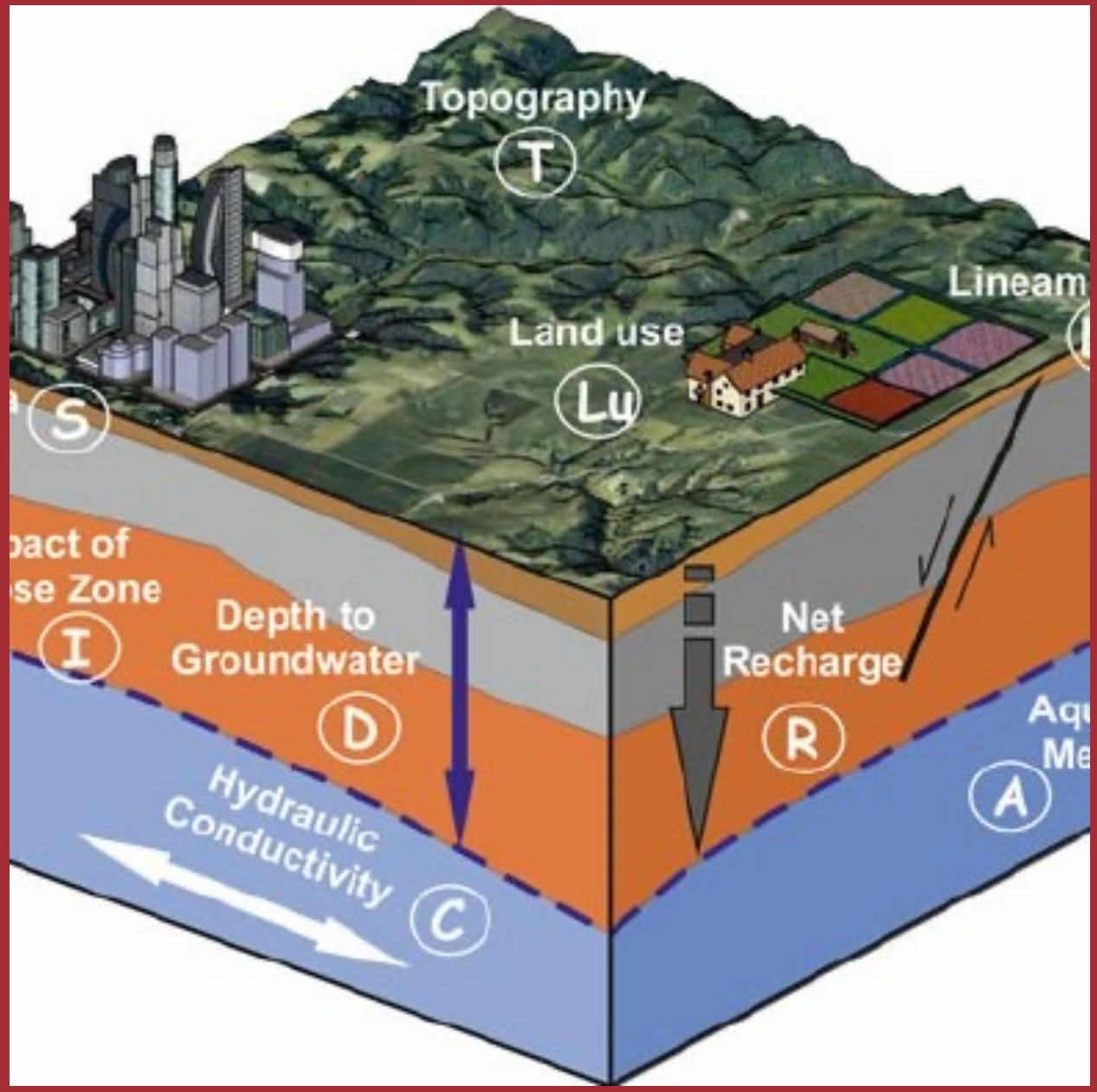
35° N
34° N
33° N
Study Reservoirs
Broken Bow Lake
Canton Lake
Fort Gibson Lake
Foss Reservoir
Grand Lake O' the Cherokees
Kaw Lake
Lake Arcadia
Lake Eucha
Lake Hefner
Lake McMurtry
Lake Thunderbird
Oologah Lake
Waurika Lake
OK BUMP Reservoirs
N
0 55 110 220 Kilometers


102° W
100° W
98° W
96° W
94° W
37° N
36° N
35° N
34° N
N
0 65 130 260 Kilometers
Chl-a (ug/L, PS) 12/01/2019
Value
High : 292.40
Low : 1.03
Chl-a (ug/L, S2) 12/01/2019
Value
High : 289.90
Low : 2.66

Examples of our work: GIS based modeling of groundwater vulnerability

- Vulnerability to groundwater depletion
- Vulnerability to anthropogenic groundwater contamination
- Overlayed in a GIS environment
- Analysis of vulnerability in that study area.



water

MDPI

Article

Vulnerability of a Tunisian Coastal Aquifer to Seawater Intrusion: Insights from the GALDIT Model

Adel Zghibi [1,*], Amira Merzougui [2], Abubakarr S. Mansaray [3], Ali Mirchi [4], Lahcen Zouhri [5], Anis Chekirbane [2], Mohamed Haythem Msaddek [1], Dhekra Souissi [1], Amina Mabrouk-El-Asmi [6] and Abdelmadjid Boufekane [7]

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2 National Institute of Agronomy, University of Carthage, Tunis 1082, Tunisia; amira_merzougui@yahoo.fr (A.M.); anischkirbene@gmail.com (A.C.)
3 Oklahoma Water Resources Center, Division of Agricultural Sconce and Natural Resources, Oklahoma State University, Stillwater, OK 74078, USA; abu.mansaray@okstate.edu
4 Department of Biosystems and Agricultural Engineering, Oklahoma State University, 111 Agricultural Hall, Stillwater, OK 74078, USA; amirchi@okstate.edu
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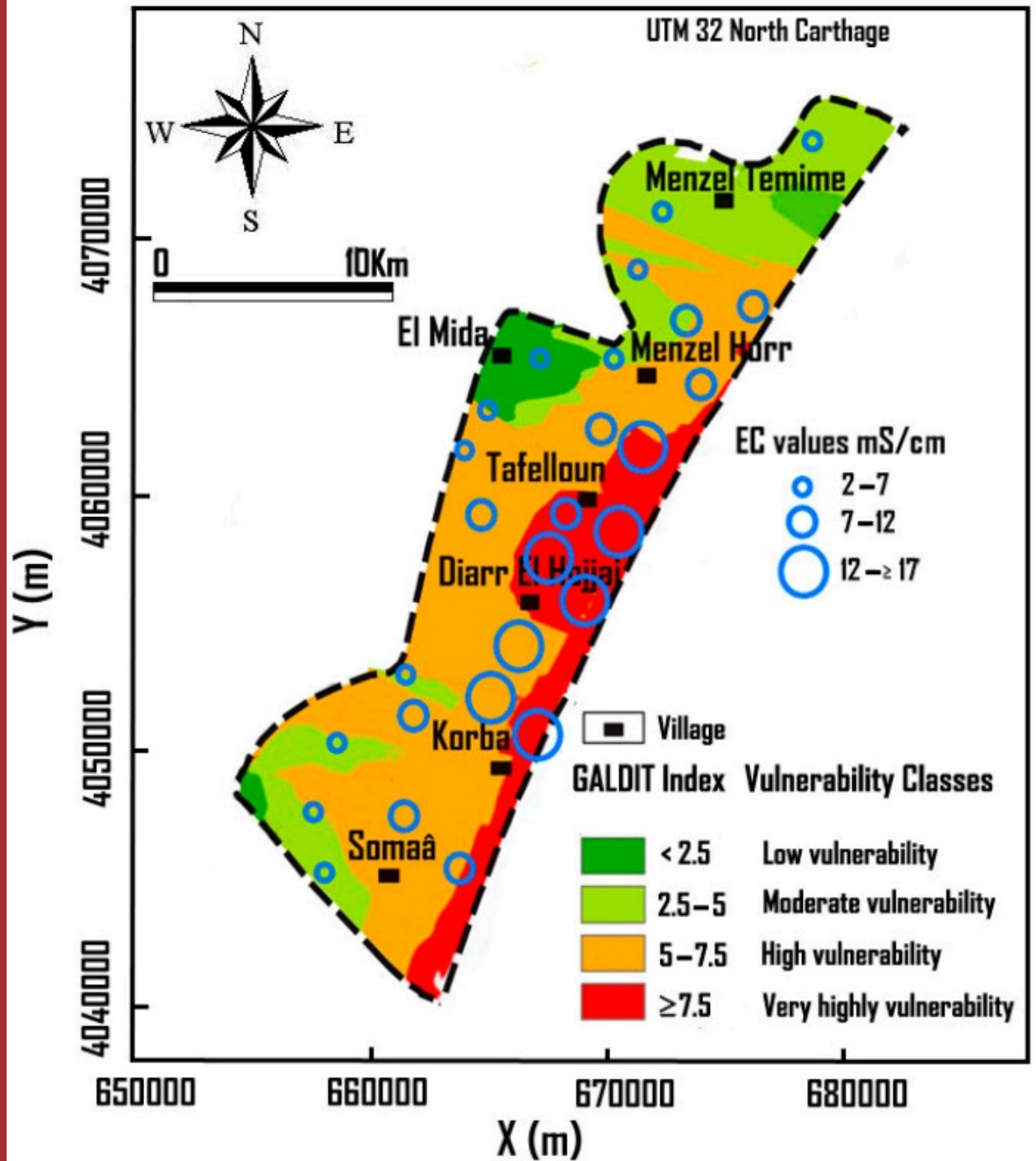
6 Laboratory of Sedimentary Basins and Petroleum Geology, Department of Geology, Faculty of Sciences of


UTM 32 North Carthage
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S
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10Km
Menzel Temime
El Mida
Menzel Horr
Tafelloun
Diarr El Hojjaj
Korba
Somaâ
EC values mS/cm
2–7
7–12
12–≥ 17
Village
GALDIT Index
Vulnerability Classes
< 2.5
Low vulnerability
2.5–5
Moderate vulnerability
5–7.5
High vulnerability
≥7.5
Very highly vulnerability
Y (m)
4070000
4060000
4050000
4040000
650000
660000
670000
680000
X (m)

Examples of our work: Climate impacts

- We use climate projections to build scenarios of dry spells, precipitation frequency and intensity, and temperature trends.
- We use the SC-CASC's Climate Projections Evaluation Project (C-PrEP)
  - Contains 27 projections per variable and emissions scenario
  - Uses three different global climate models (GCMs): Community Climate System Model (***CCSM4),*** Model for Interdisciplinary Research on Climate ***(MIROC5), and*** Max Planck Institute Earth System Model (***MPI-ESM-LR)***
  - Created with three different statistical downscaling techniques: Delta method (**DeltaSD**), Equidistant Quantile Mapping Method (**EDQM**), and a Piecewise Asynchronous Regression Method (**PARM**).
  - Uses three observational datasets to provide training data for statistical downscaling: ***Daymet, Livneh, and*** Parameter-elevation Relationships on Independent Slopes Model (***PRISM).***
  - Utilizes historical and three futuristic representative concentration pathways (RCPs): ***rcp26, rcp45, and rcp85***

Theoretical and Applied Climatology
https://doi.org/10.1007/s00704-023-04581-3

RESEARCH

Analysis of climatic trends in climate divisions of Oklahoma, USA

Aseem Singh[1] · Ali Mirchi[1] · Saleh Taghvaeian[2] · Abubakarr Mansaray[3] · Phillip D. Alderman[4] · Daniel Moriasi[5]

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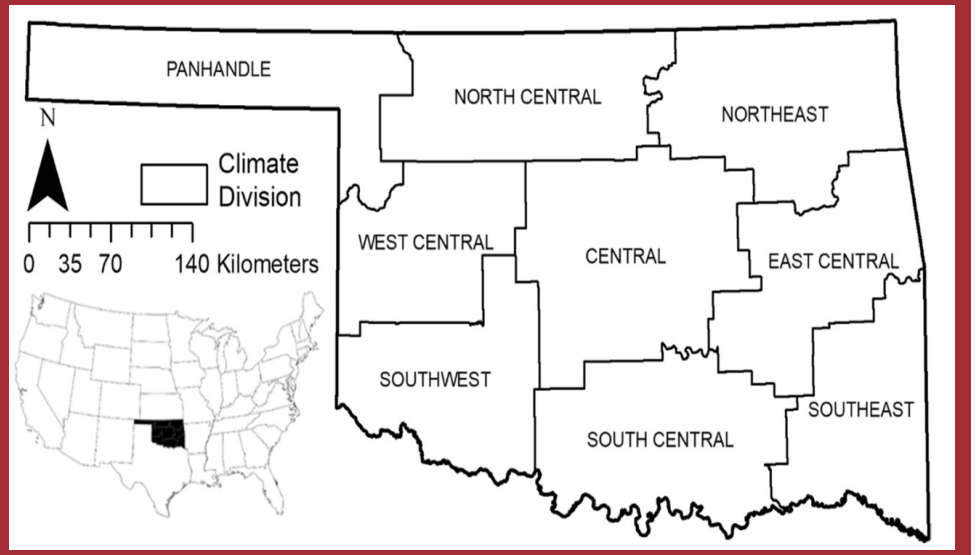
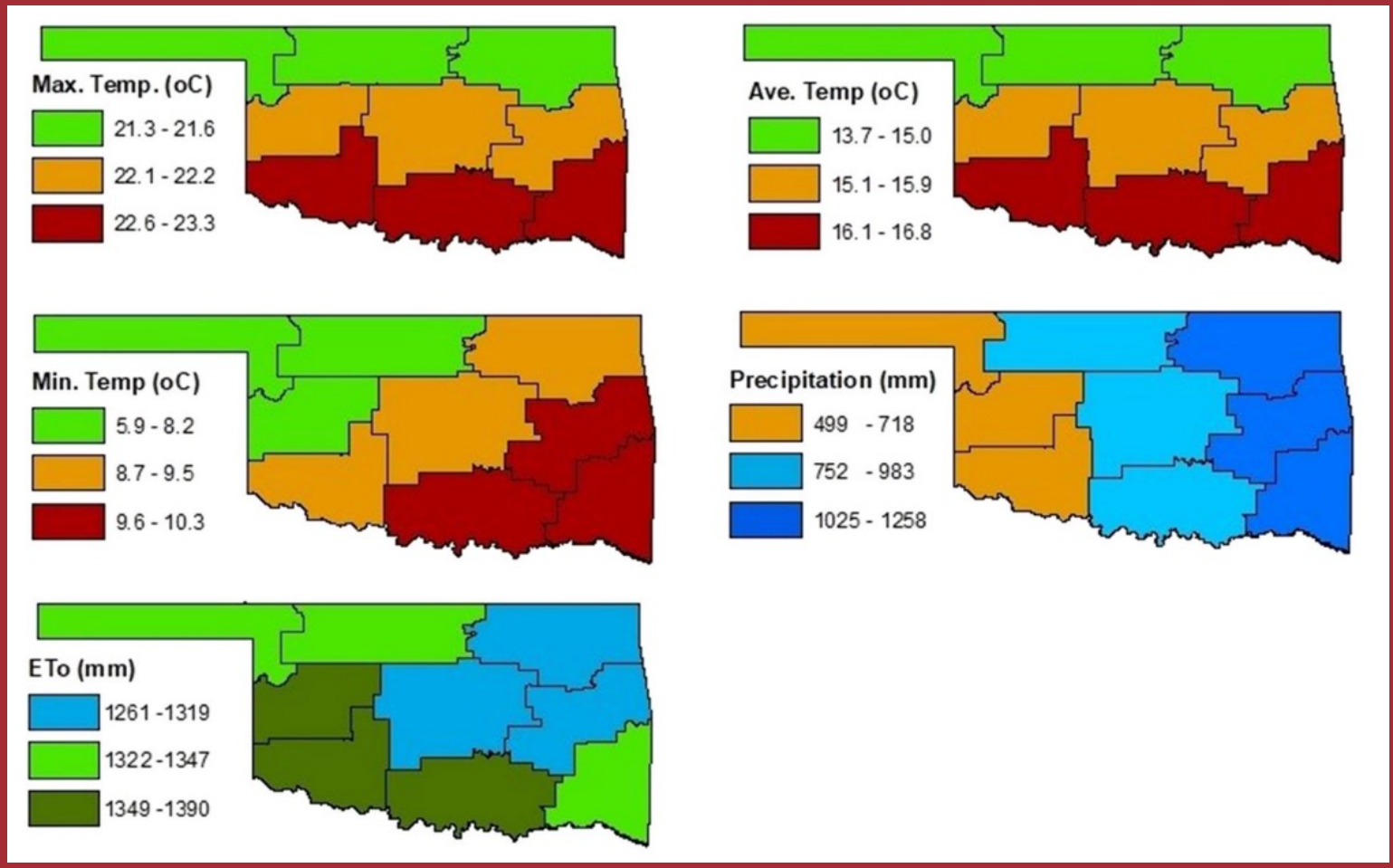
Abstract

We used monthly climatological datasets from the NOAA US Climate Divisional Database to detect long-term trends (1951–2021) in the nine climate divisions of Oklahoma, USA. We applied Hargreaves-Samani method to calculate reference evapotranspiration (ET_o) and used 12-month standardized precipitation index to characterize meteorological droughts.


PANHANDLE
NORTH CENTRAL
NORTHEAST
N
Climate Division
0 35 70 140 Kilometers
WEST CENTRAL
CENTRAL
EAST CENTRAL
SOUTHWEST
SOUTHEAST
SOUTH CENTRAL


Max. Temp. (oC)
21.3 - 21.6
22.1 - 22.2
22.6 - 23.3
Ave. Temp (oC)
13.7 - 15.0
15.1 - 15.9
16.1 - 16.8
Min. Temp (oC)
5.9 - 8.2
8.7 - 9.5
9.6 - 10.3
Precipitation (mm)
499 - 718
752 - 983
1025 - 1258
ETo (mm)
1261 -1319
1322 -1347
1349 -1390

Honorable mentions:

- Using downscaled GRACE data to delineate changes in groundwater storage.
- International transboundary water management - a good fit for the AZ-Mexico border (both surface and groundwater)
- Hydrologic and Water Quality System for Oklahoma (OK-HAWQS):
  - Support BMP selection, design, and evaluation
  - Support tracking of TMDL plans
  - Support preparedness and response to extreme water quality problems
- Oklahoma Well Owner Network
  - Free well water quality screening and education for private well owners across the state
- Virtual Fencing in grazing lands
  - Promote conservation practices (rotational grazing)
  - Protect stream ecosystems (quarterly stream health assessment)
  - Maximize food production

- My job: Lead grant writing efforts, help recruit students, coordinate implementation, manuscript preparation (reports, journal articles, newsletters, extension factsheets, etc.), provide training, attending meetings, **building relationships**

Contribution to the ongoing efforts of the Arizona Water Resources Research Center

University experts (within UA and from other universities in the state), water related agencies, policy makers, tribal nations, local communities, and regional, federal, and international partners

Channeled into the University's Land Grant mission: Teaching, Research & Extension

Secure extramural funding to:

a) Train the next generation of water professionals
b) Conduct research to find answers to critical questions about water sustainability
c) Utilize WRRC's extension and outreach system to work with AZ communities of practice in coproduction of knowledge, tools, and advancement of sustainable water solutions.

Env. Pillar

Climate variability
Biodiversity
Vegetation cover
Soil health
Soil properties
Pollutant load, etc.

All affect water availability and water quality

Economic pillar

Water Demand vs. Water Supply
Expanding Infrastructure
Food Security (Grazing, farming, poultry, etc.)
Technology
Public Health

Equity

Rural vs. urban water supply
Interested parties (Ag., cities, manufacturing, mining, etc.)
Private vs. public
Affluent vs. marginalized communities
Water urbanization: expansion of cities transforming rural waters to urban waters

Allocation - Environmental flows, common interest, economic growth = sustainable water resource management

Conclusions

- When it comes to water, the centrality of the Water Center both within the university, across the state and beyond requires someone with the requisite breadth and depth of transdisciplinary water/environmental background that allows actionable engagement and leadership

- What am I bringing?

Thank you!