



Sandia National Laboratories



Water and economic development: thinking across sectors

Nicole D. Jackson, Ph.D.

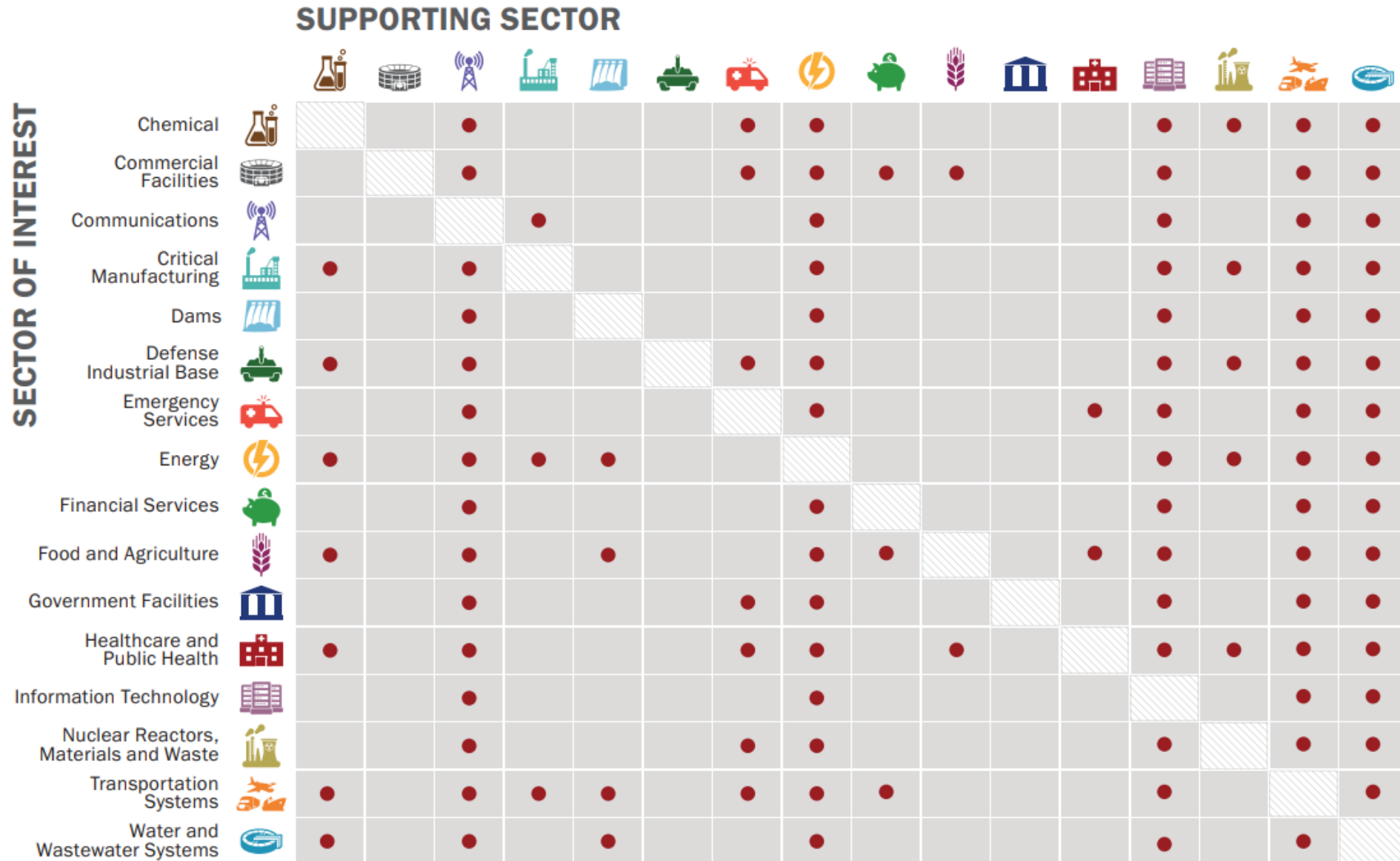
2026 Water Leaders Workshop

22 April 2026

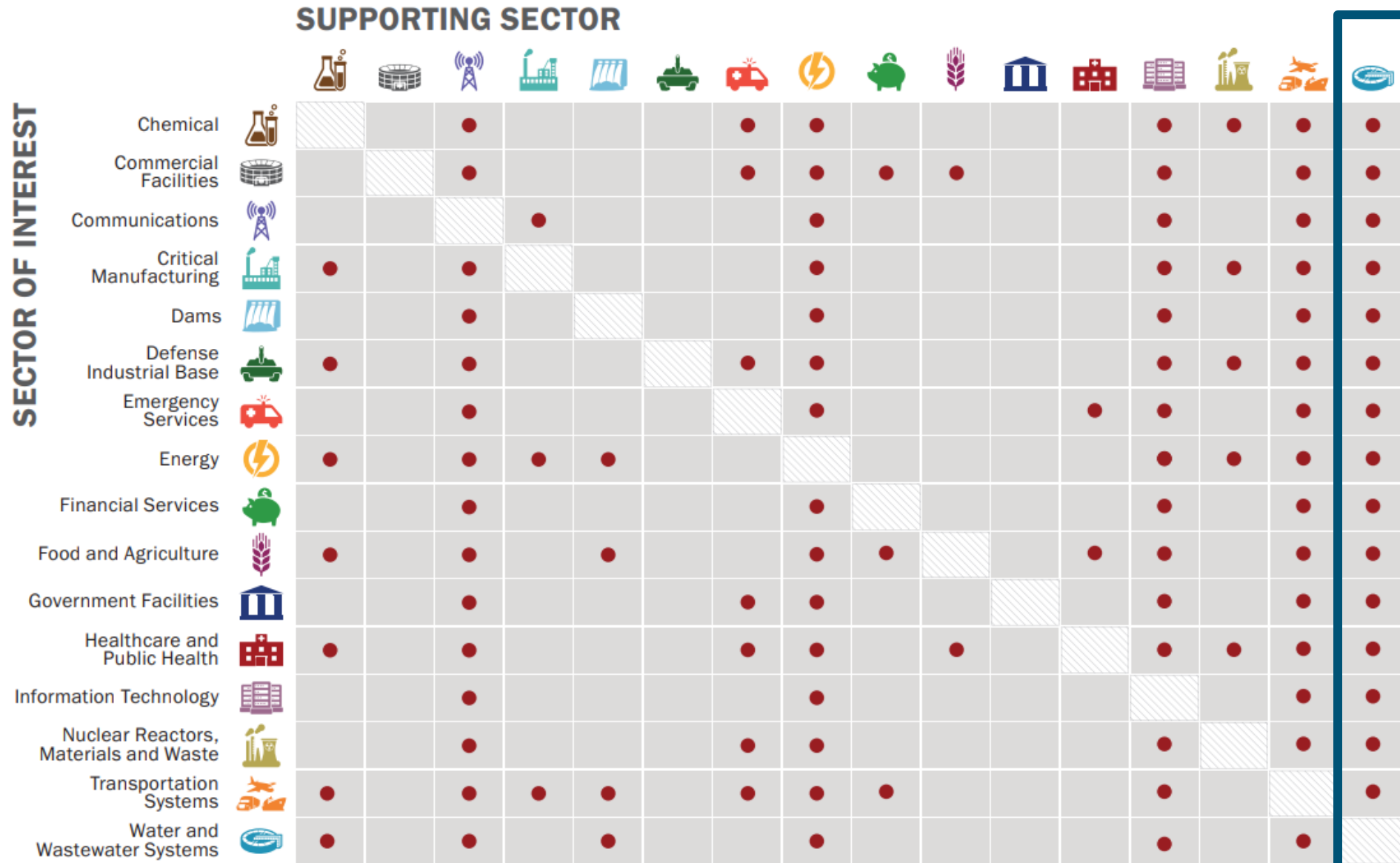


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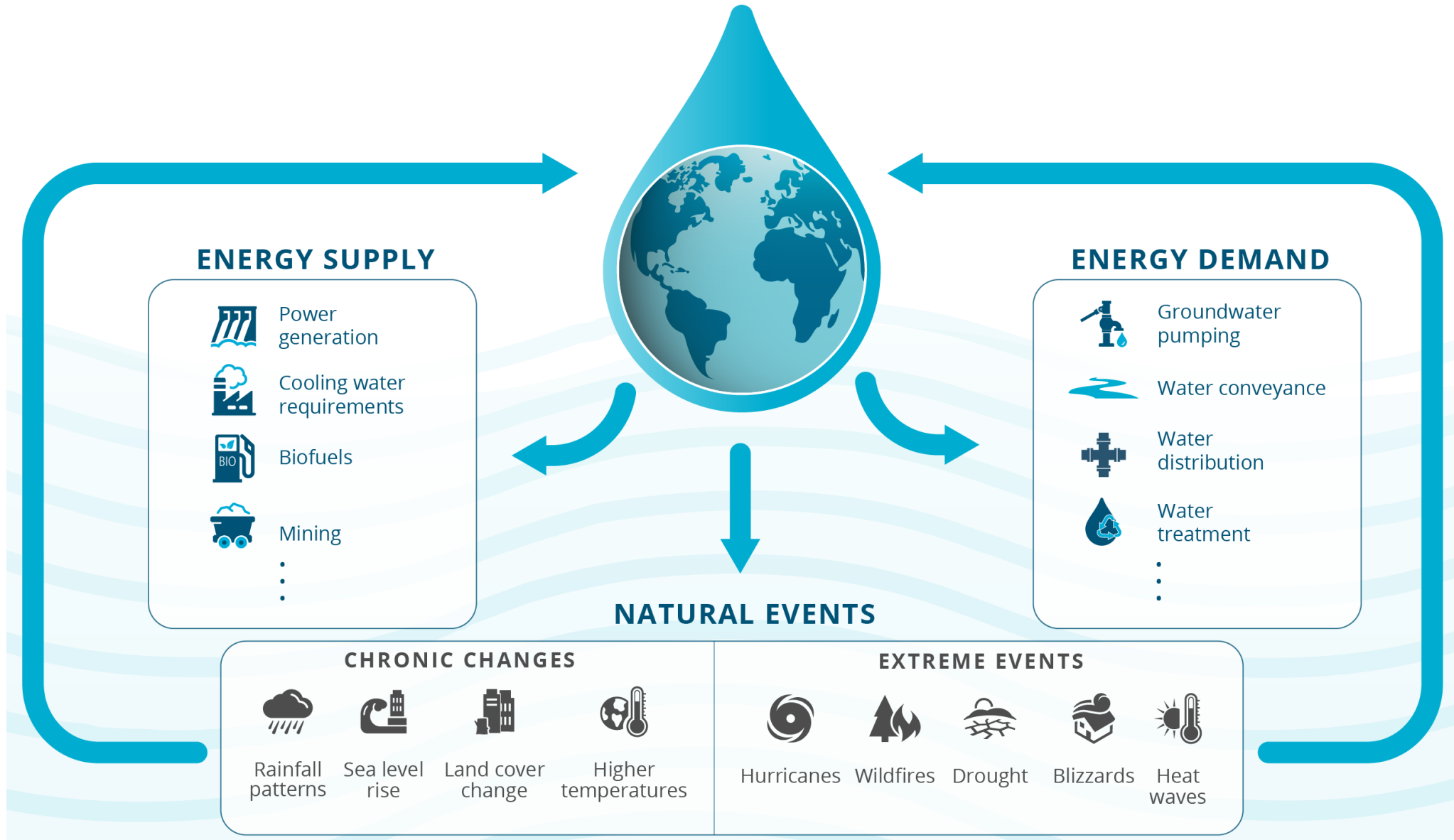
Central role of water for critical infrastructures



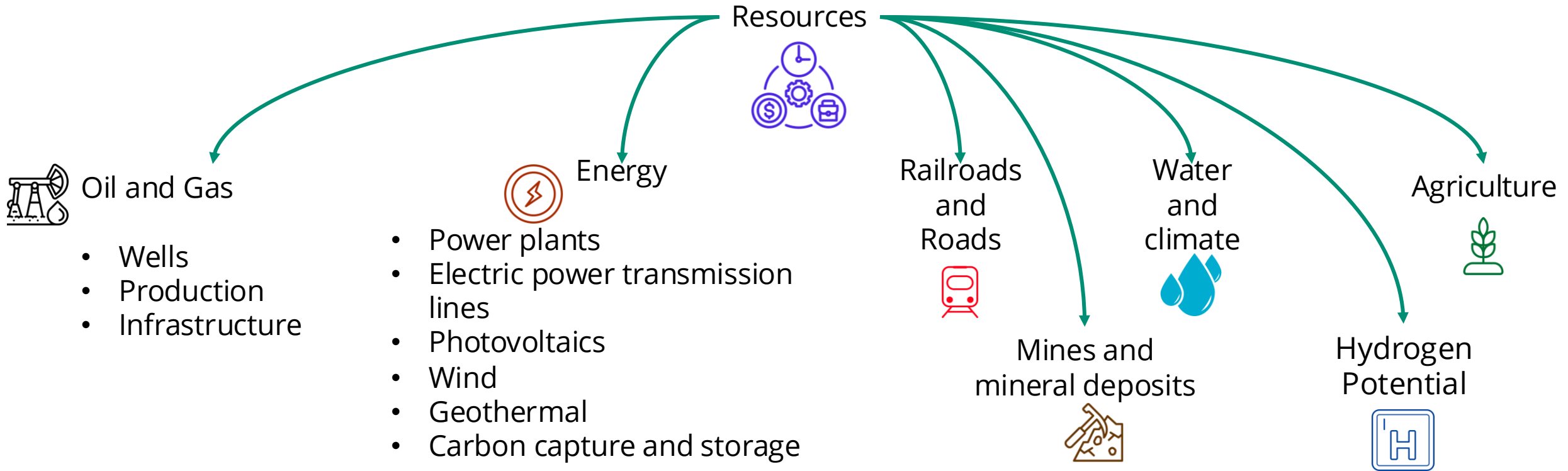
Central role of water for critical infrastructures



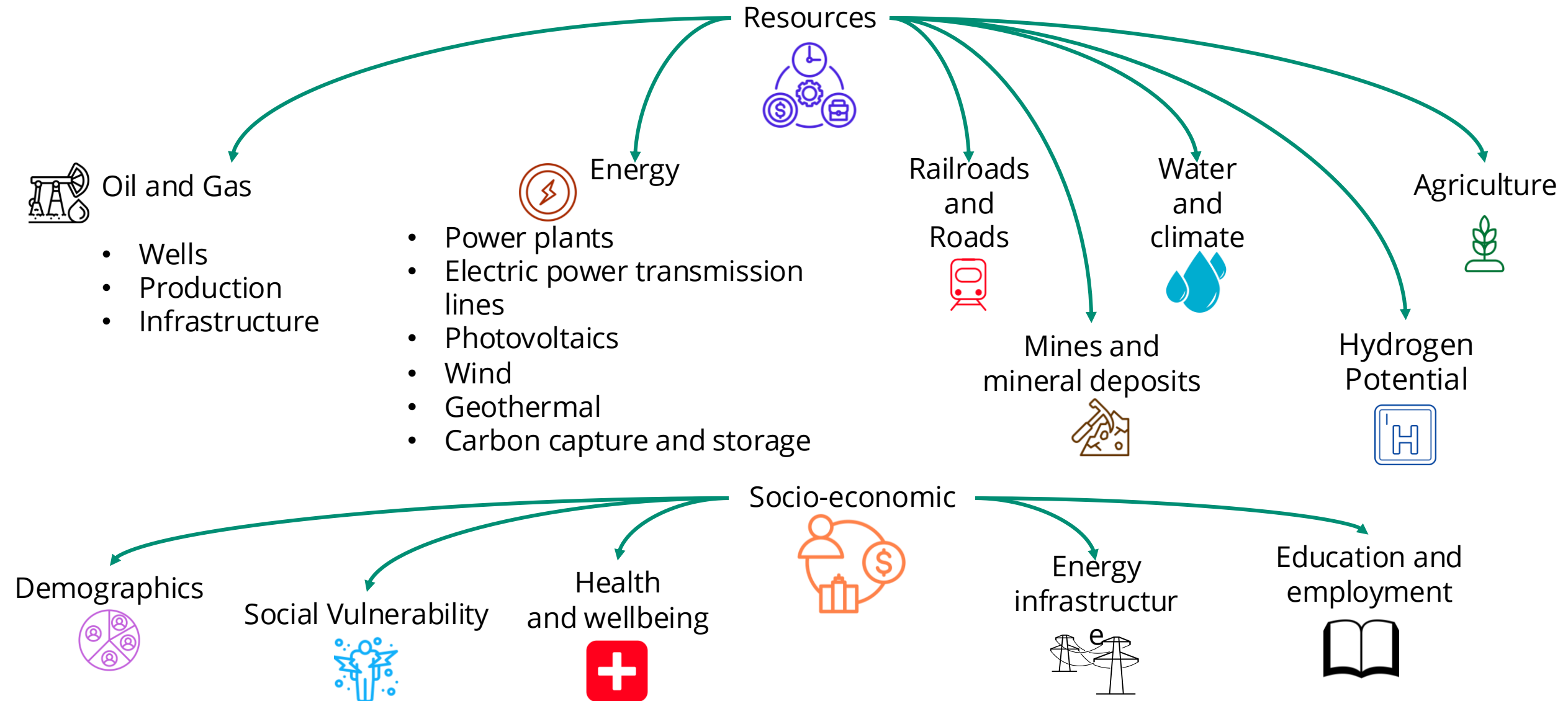
Water has touchpoints across energy and natural events.



Resource and socio-economic variables provide additional insights into the complex regional system dynamics



Resource and socio-economic variables provide additional insights into the complex regional system dynamics



Water management model emulator for the Texas Colorado River Basin is a limited coupled human-natural system representation



Naturalized
flows



Water management model emulator for the Texas Colorado River Basin is a limited coupled human-natural system representation



Naturalized
flows



Water
Rights



Water management model emulator for the Texas Colorado River Basin is a limited coupled human-natural system representation



Naturalized flows



Water Rights

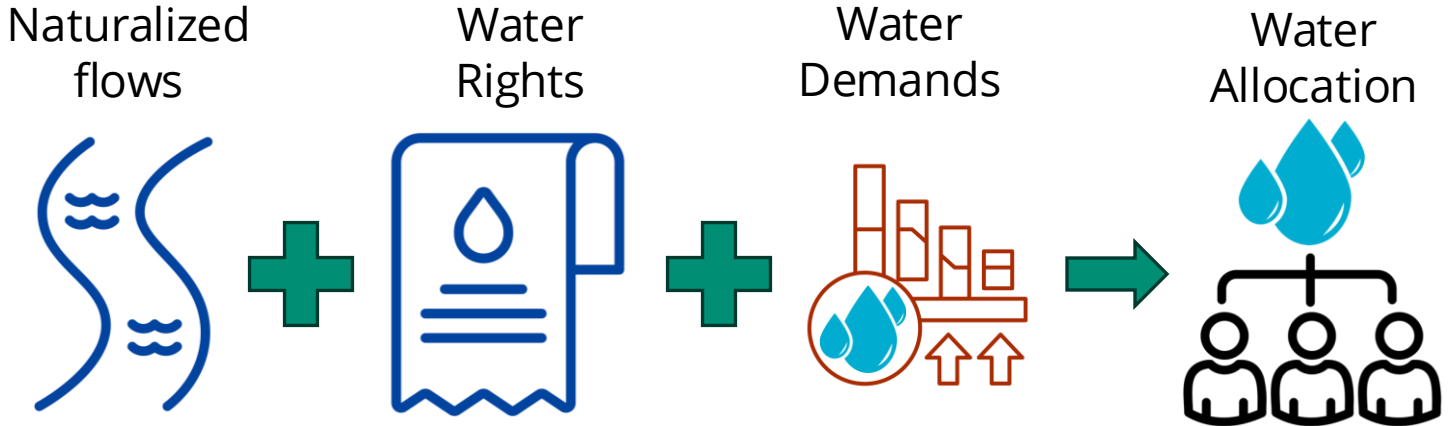


Water Demands



Concept from Bonney, Gunda, Ferencz, and Jackson (in press)

Water management model emulator for the Texas Colorado River Basin is a limited coupled human-natural system representation



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Naturalized flows



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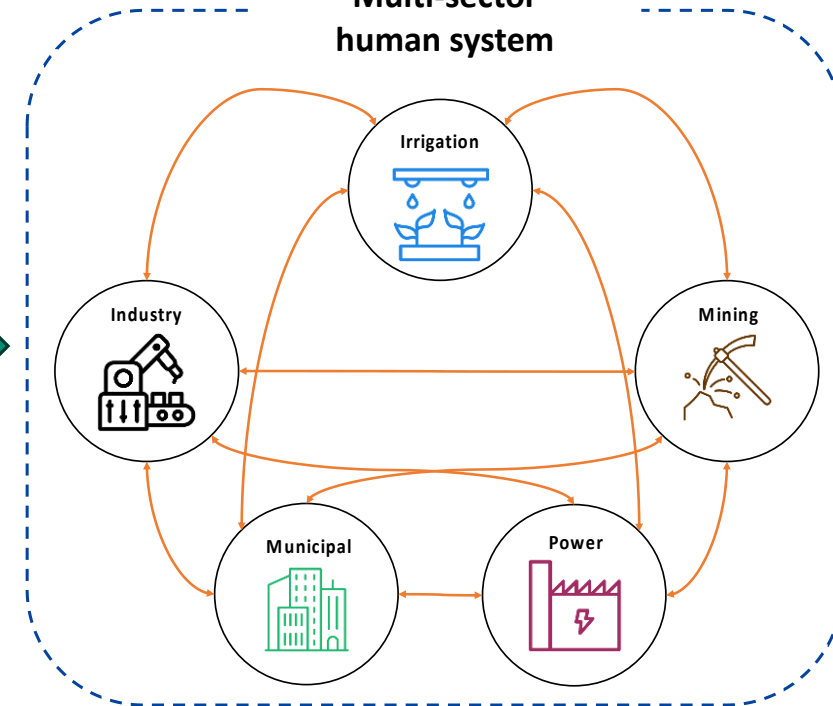
Water Demands



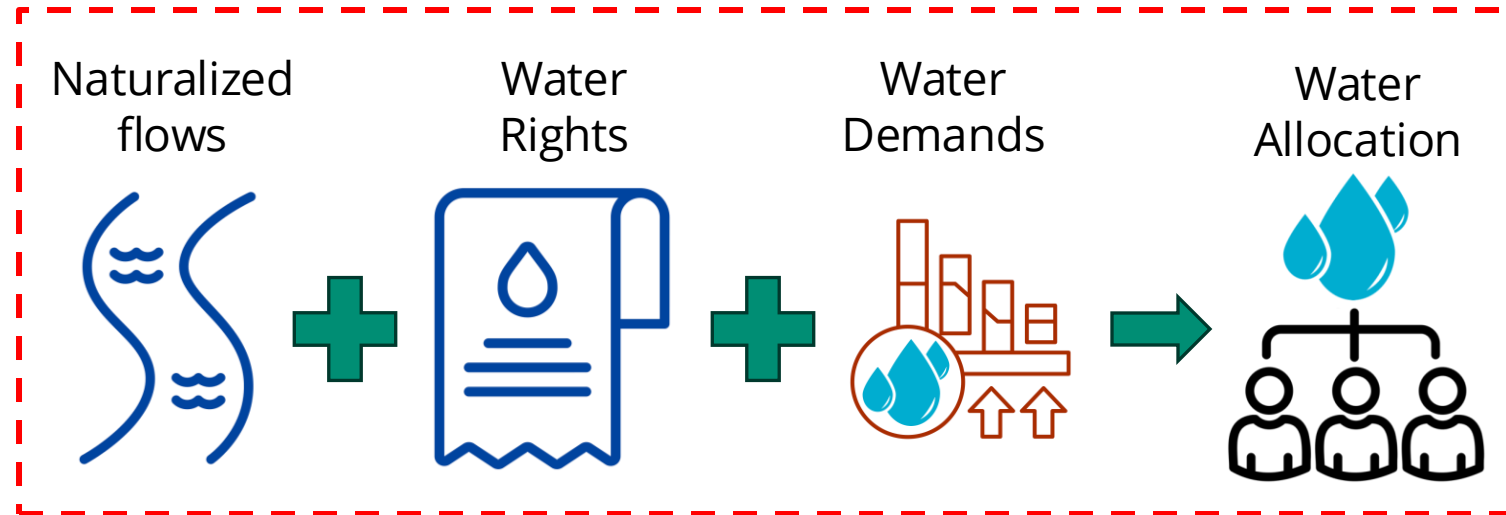
Water Allocation



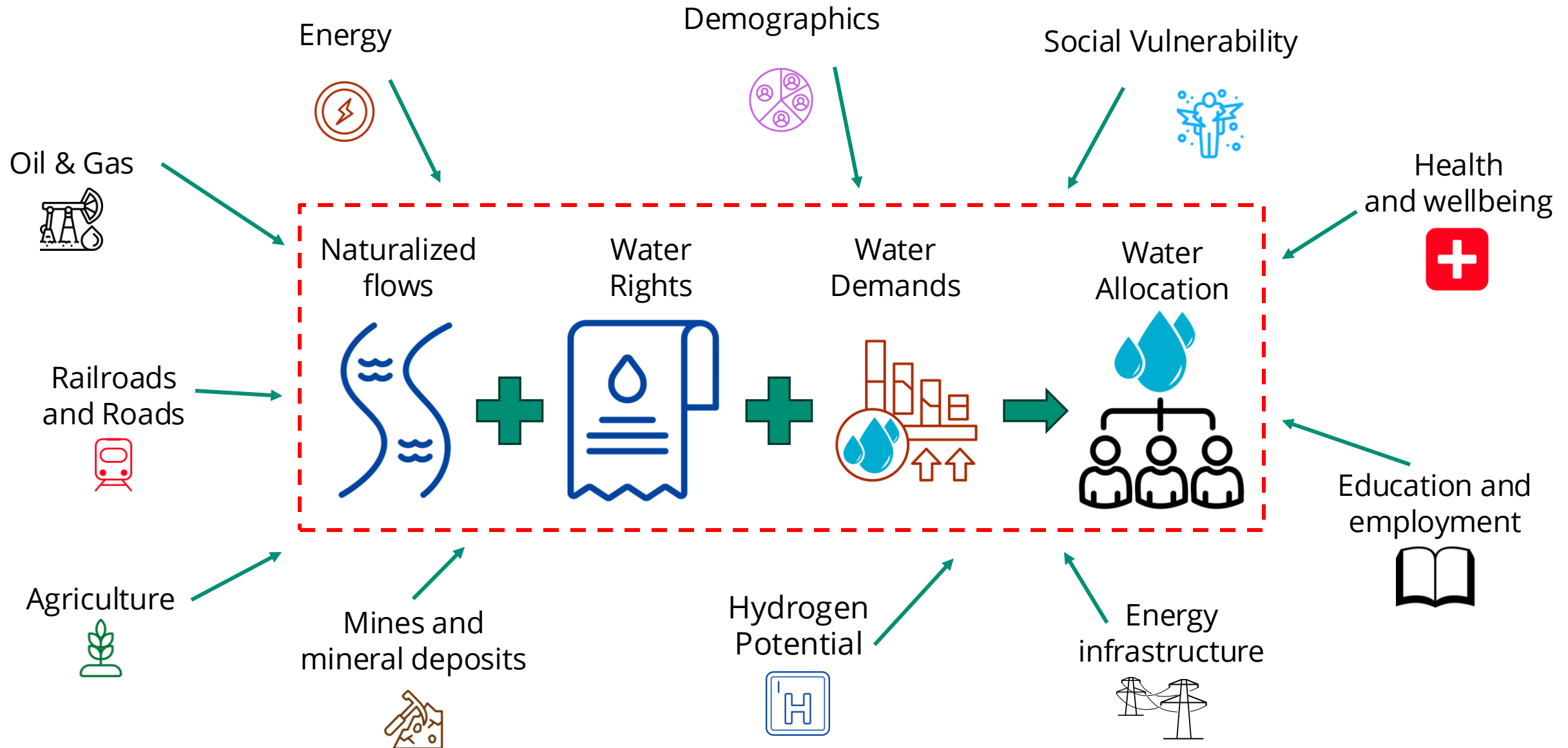
Multi-sector human system



Resource and socio-economic variables are important for understanding water's impact on multiple sectors.



Resource and socio-economic variables are important for understanding water's impact on multiple sectors.



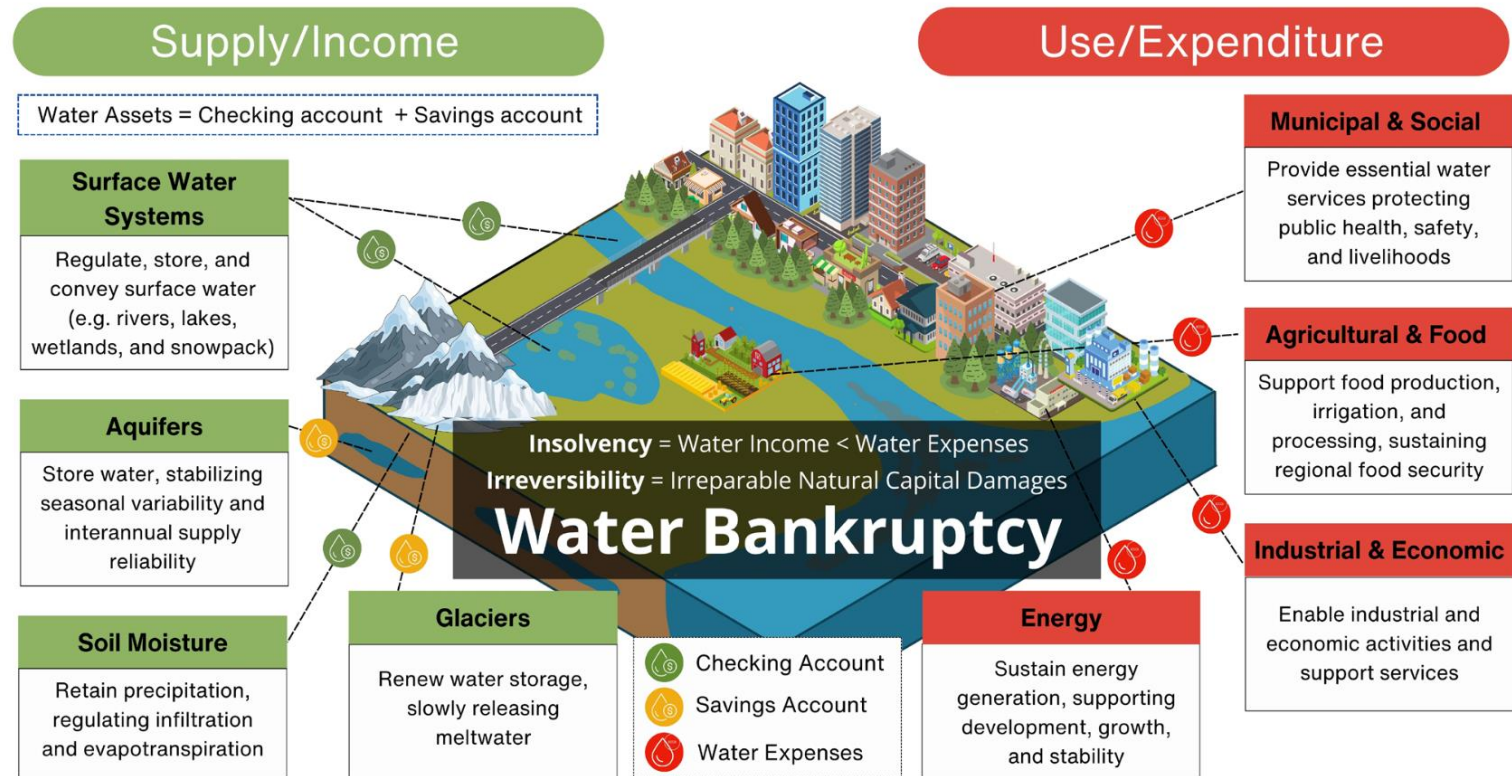
Water can be thought of in terms of “income” and multi-sectoral “expenses” with a trend towards deficits.



United Nations University
Institute for Water, Environment and Health

GLOBAL WATER BANKRUPTCY

Living Beyond Our Hydrological Means in the Post-Crisis Era



Water scarcity is now constraining industrial operations and reshaping where facilities can be built.



How Water Scarcity Is Reshaping Site Selection in 2026

The companies still treating water as a utility are discovering—too late—that it's become a strategy.



Photo Credit: Canva Teams

Posted Tuesday, April 7, 2026 8:00 am

Source: [F+ELeader \(2026\)](#)

Water scarcity is now constraining industrial operations and reshaping where facilities can be built or expanded.



How Water Scarcity Is Reshaping Site Selection in 2026

The companies still treating water as a utility are discovering—too late—that it's become a strategy.



Photo Credit: Canva Teams

Posted Tuesday, April 7, 2026 8:00 am

Source: [E+Leader \(2026\)](#)

Water Constraints and North American Industrial Operations



Photo Credit: Canva Teams

Posted Monday, April 6, 2026 8:00 am

Source: [E+Leader \(2026\)](#)

Water risk now shapes corporate exposure.



What Buyers Are Now Requiring From Suppliers on Water Risk



Photo Credit: Canva Teams

Posted Wednesday, March 18, 2026 10:00 am

Marybeth Collins

Source: [E+Leader \(2026\)](#)

Water risk now shapes corporate exposure and market access via permitting scrutiny.



What Buyers Are Now Requiring From Suppliers on Water Risk



Photo Credit: Canva Teams
Posted Wednesday, March 18, 2026 10:00 am

Marybeth Collins

Source: [E+Leader \(2026\)](#)

Your Water Record Is Now Blocking More Than Water Permit



Photo Credit: AI Generated Image
Posted Friday, April 3, 2026 10:00 am

Marybeth Collins

Source: [E+Leader \(2026\)](#)

Water risk now shapes corporate exposure and market access via permitting scrutiny and buyer demands.



What Buyers Are Now Requiring From Suppliers on Water Risk



Photo Credit: Canva Teams

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Your Water Record Is Now Blocking More Than Water Permit



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Source: [E+Leader \(2026\)](#)

When Corporate Structure Becomes a Water Liability Strategy



Photo Credit: Evan Budrovich

Posted Wednesday, April 8, 2026 8:00 am

Marybeth Collins

Existing water stresses are motivating considerations of alternate water sources



Water scarcity and clean energy collide in South Texas

A high-tech chemical company has purchased the last available water in the Nueces River to make hydrogen and ammonia for export.

BY DYLAN BADDOUR, **INSIDE CLIMATE NEWS** APRIL 12, 2024 5 AM CENTRAL

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The sun sets over the Port of Corpus Christi in March 2018. © Eddie Seal for The Texas Tribune

Source: [Baddour \(2024\)](#)

New Mexico governor wants \$500m to convert fracking wastewater into a new source of recycled water for industrial use

BY **THE ASSOCIATED PRESS**
January 23, 2024 at 3:25 AM MST



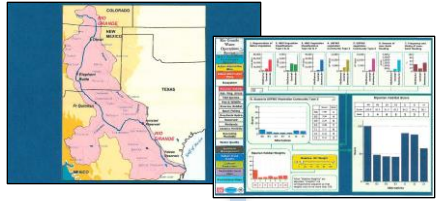
Julia Bernal, with Pueblo Action Alliance, speaks at a protest against an initiative by Gov. Michelle Lujan Grisham to develop a strategic new source of water, buying treated water that is the byproduct of oil and natural gas drilling, then treating it and selling it back to industry, on Jan. 22, 2024. EDDIE MOORE—THE ALBUQUERQUE JOURNAL/AP

Source: [AP \(2024\)](#)

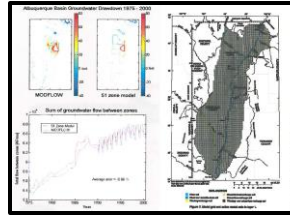
Sandia has a long history towards improving our understanding of the energy-water nexus



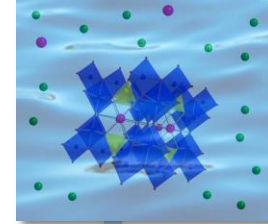
Rio Grande Analysis and Support



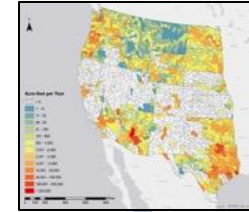
Water Management Toolbox



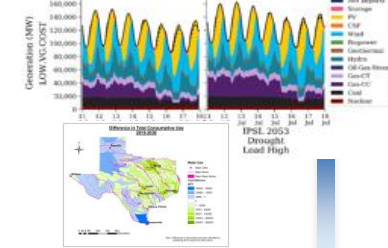
Fukushima CS+ clean-up using SNL tech



U.S. Water Atlas



Energy-Water Planning in the Western and Texas Interconnections



R&D 100 Green Tech REE extraction



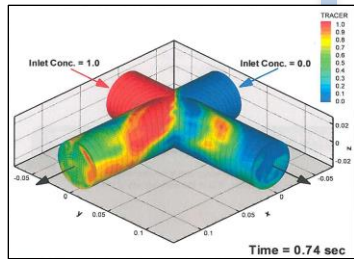
2000

2005

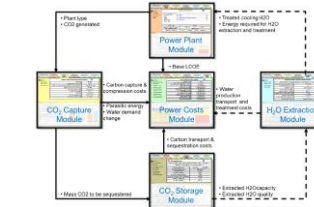
2010

2015

2020



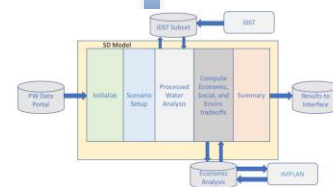
Contaminant Transport Analysis



WECSSim Model



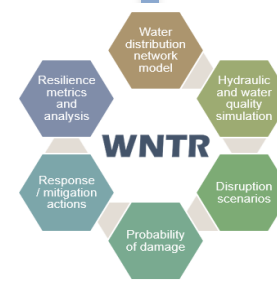
Water Sustainability in the Permian Basin Region of New Mexico



Produced H₂O-Economic, Socio, Env. Simulation model (PW-ESESim)



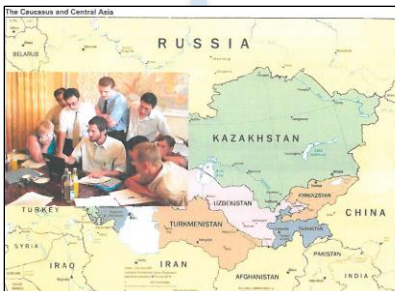
Model for Iraqi Water Planners



Water Network Tool for Resilience



Palo Verde, SNL team evaluated water use



Water Quality Monitoring in Central Asia

Synthetic data for naturalized flows can be used to stress test water allocations and shortages



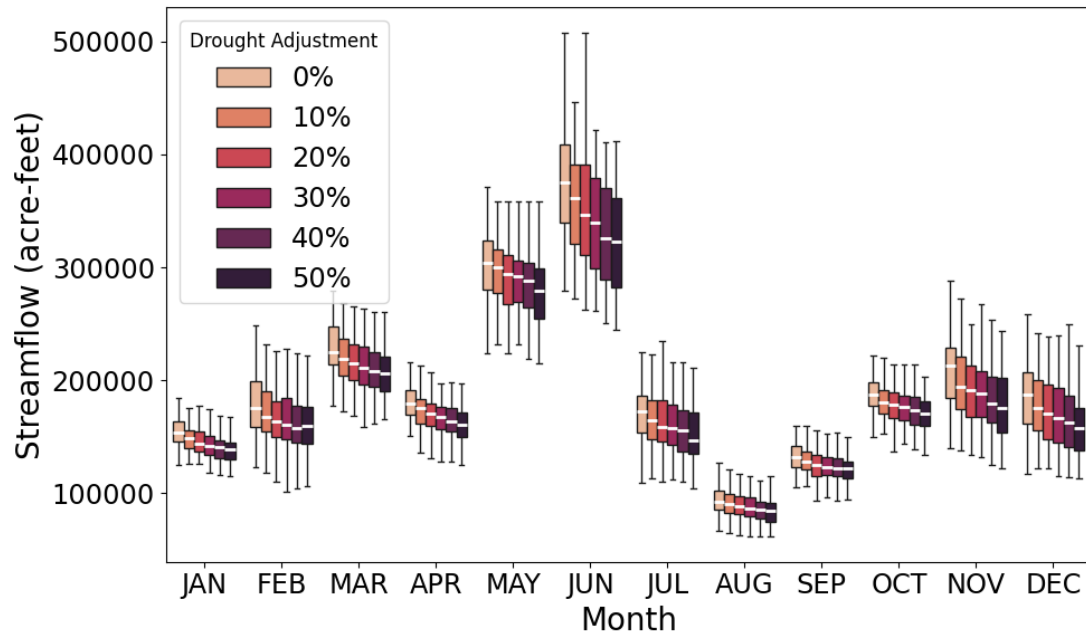
Naturalized
flows



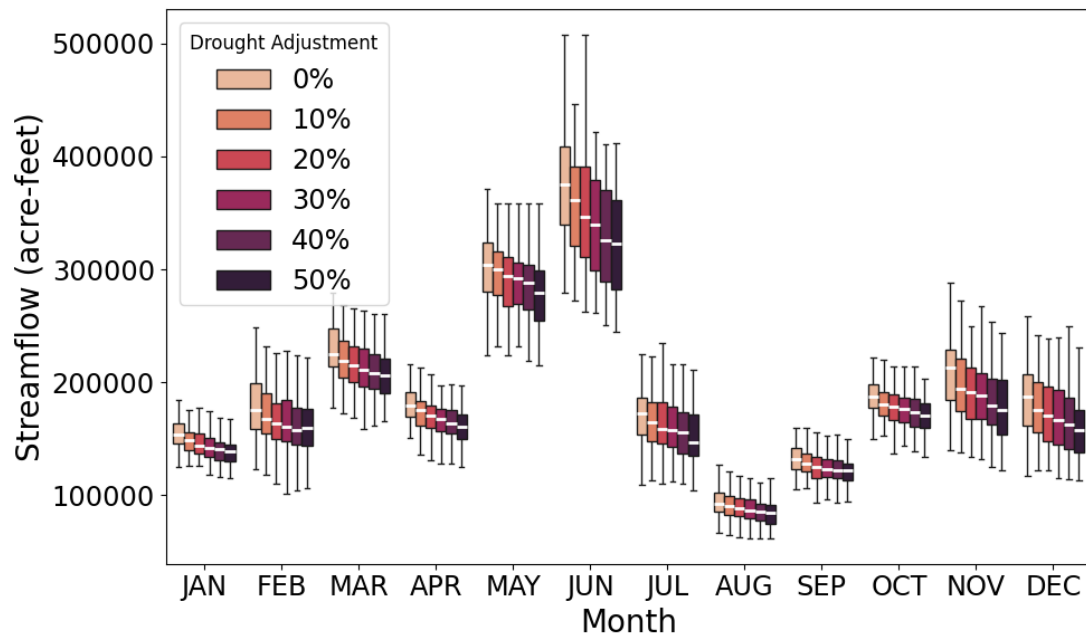
Synthetic data for naturalized flows can be used to stress test water allocations and shortages



Naturalized flows



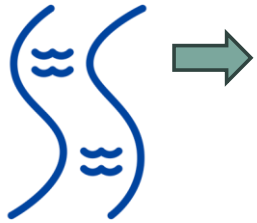
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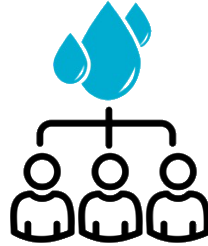
Synthetic data for naturalized flows can be used to stress test water allocations and shortages



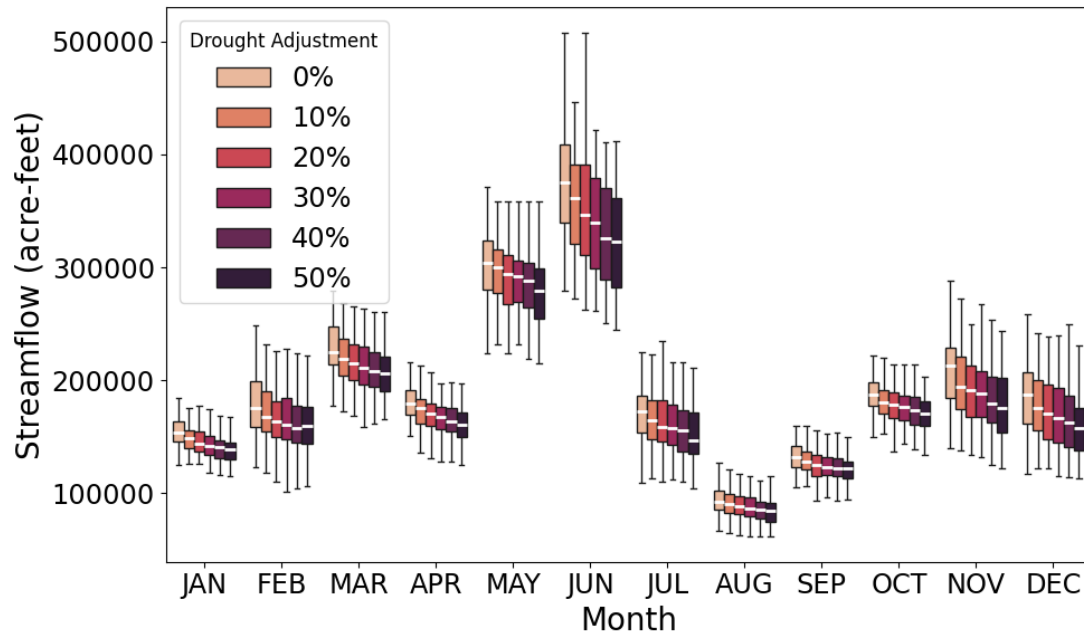
Naturalized flows



Water Allocation



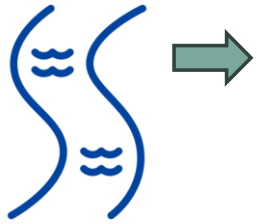
$$\text{shortage ratio} = \frac{\text{allocation shortage}}{\text{allocation target}}$$



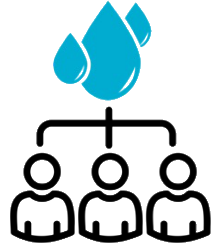
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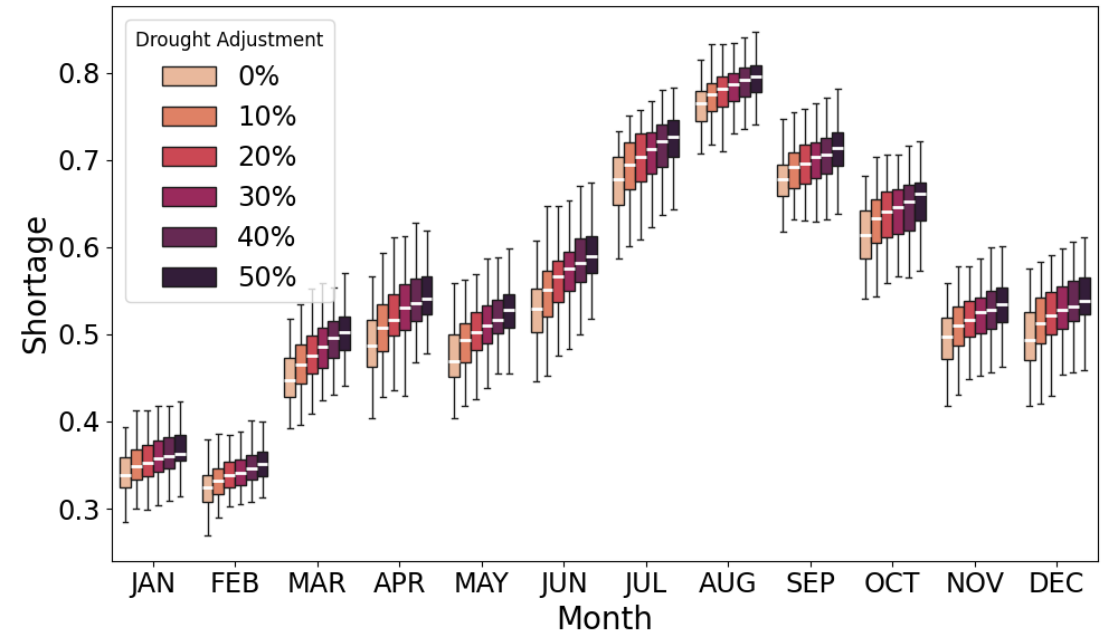
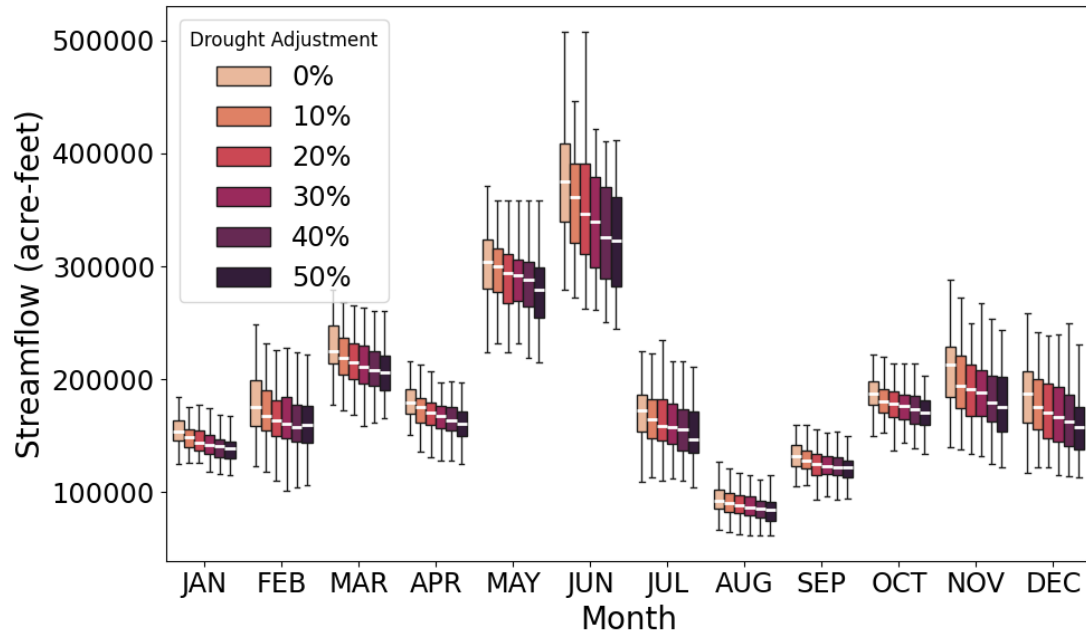
Naturalized flows



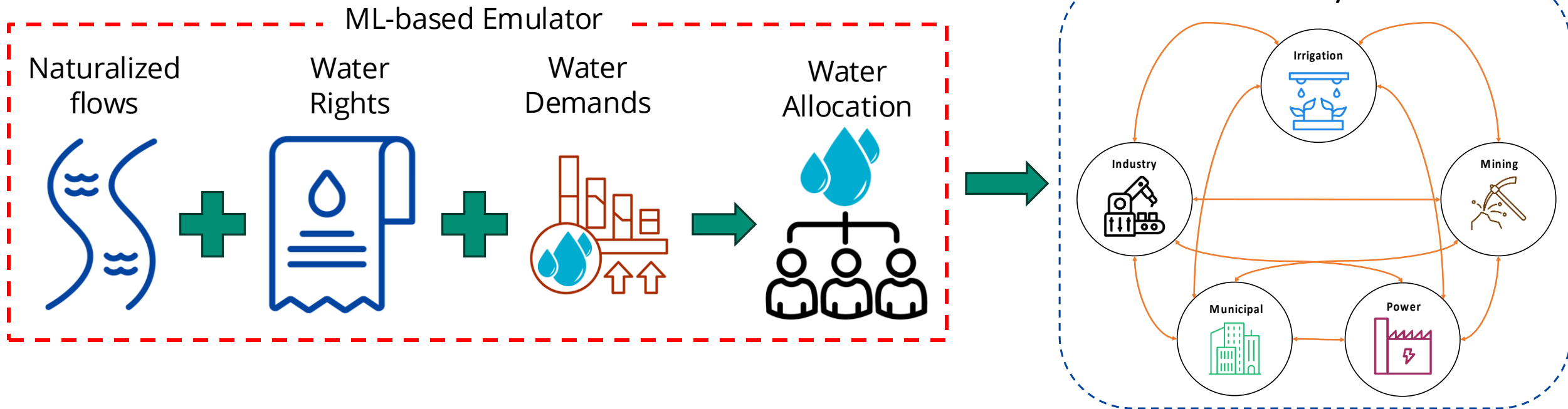
Water Allocation



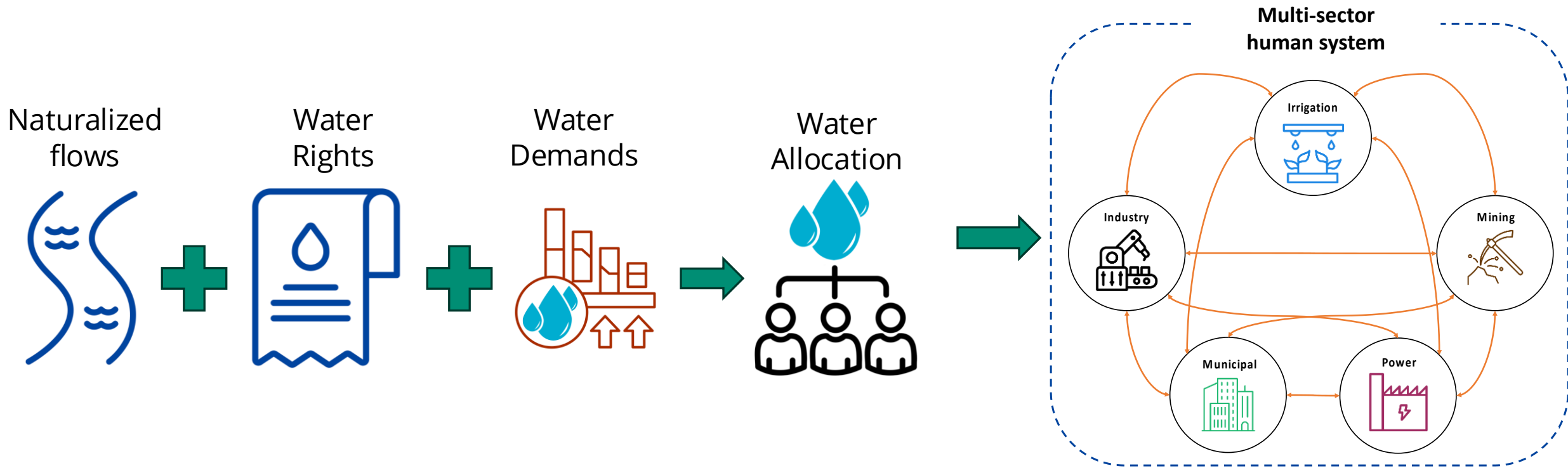
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In conclusion, water management is a coupled human–natural systems problem with cascading, multi-sector consequences.



- Water constraints influence site selection, expansion timelines, and industrial operational continuity.
- Water risk is also a market and governance issue (permits, buyer requirements, liability exposure).
- New modeling approaches enable rapid water stress testing, but decision support must better capture human–natural feedbacks and socio-economic context.